

2012 DSM EVALUATION REPORTS

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 22, 2013



ECONOLER

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EVALUATION OF 2012 DSM PROGRAMS

EXECUTIVE SUMMARY

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March 15, 2013



ECONOLER

ACRONYMS

ARet	Appliance Retirement
BER	Business Energy Rebates
BES	Business Energy Solutions
BNI	Business, Non-Profit and Institutional
CATI	Computer-Assisted Telephone Interviewing
CDI	Commercial Direct Install
CFL	Compact Fluorescent Lamp
CEE	Consortium for Energy Efficiency
C&S	Codes and Standards
DA	Delivery Agent
DHW	Domestic Hot Water
DSM	Demand-Side Management
DSMDS	Demand-Side Management Data System
EA	Energy Advisor
EEH	EnerGuide for Existing Houses
ENSC	Efficiency Nova Scotia Corporation
EP-DI	Efficient Products – Direct Install
ETS	Electric Thermal Storage
FR	Free-Ridership
HEA	Home Energy Assessment
HVAC	Heating, Ventilating and Air Conditioning
LED	Light Emitting Diode
LHLE	LED Holiday Light Exchange
LIHS	Low Income Homeowner Service
MEPS	Minimum Energy Performance Standards

MURB	Multi-Unit Residential Buildings
NC	New Construction
NRCan	Natural Resources Canada
NTGR	Net-to-Gross Ratio
PDWG	Program Development Working Group
PM	Program Manager
POP	Point of Purchase
QA	Quality Assurance
RDI	Residential Direct Install
SBES	Smart Business Energy Solutions
SLC	Smart Lighting Choices
UARB	Utility and Review Board

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INTRODUCTION

This document provides a summary of the evaluation of the 2012 electric demand-side management (DSM) programs in Nova Scotia. Econoler was mandated to conduct this evaluation for Efficiency Nova Scotia Corporation (ENSC). Established in 2010, ENSC is an independent organization in charge of helping Nova Scotians improve the energy efficiency of their homes and workplaces.

The evaluation revealed that ENSC's DSM program portfolio achieved a total of 158.867 GWh in net energy savings and 33.902 MW in net demand savings at the generator. Additionally, Codes and Standards were found to have achieved net energy savings of 16.353 GWh and net demand savings of 4.663 MW at the generator.

Econoler has obtained these results by conducting impact and process evaluations of the following programs or initiatives.

Table 1: Type(s) of Evaluation Conducted per Program

Program or Initiative	Type(s) of Evaluation	
	Process	Impact
Appliance Retirement (ARet)	x	x
Instant Savings	x	x
Home Energy Assessment (HEA)	x	x
Fuel Substitution	x	x
Low Income Homeowner Service (LIHS)	-	x
Performance Plus	x	x
Residential Direct Install (RDI)	x	x
Multi-Unit Residential Buildings (MURB)	x	x
Solar	-	x
LED Holiday Light Exchange (LHLE)	-	x
Business Energy Rebates (BER)	x	x
Custom Retrofit	x	x
Custom New Construction (NC)	-	x
Business Energy Solutions (BES)	-	x
Codes and Standards (C&S)	-	x

The current report aims at presenting the impact and process evaluation results of the 15 program components and initiatives offered in 2012 by ENSC. The following sections detail the evaluation methodology, the DSM portfolio performance, in terms of savings, and the recommendations to enhance the portfolio of programs. An in-depth analysis of individual program performance is also featured in this report.

1 EVALUATION OBJECTIVES & METHODOLOGY

1.1 EVALUATION OBJECTIVES

The objectives of the 2012 evaluation of ENSC's DSM programs involve:

- > assessing the effectiveness of program design and delivery;
- > determining the extent to which program implementation is proceeding as planned (i.e., that technologies have been installed and are working as expected);
- > determining the gross energy and demand savings;
- > determining the Net-To-Gross Ratio (NTGR); and
- > determining the net energy and demand savings.

1.2 METHODOLOGY

1.2.1 Process Evaluation

The 2012 process evaluation of ENSC's DSM programs relied on the analysis of program documentation, which included the ENSC website, the 2011 evaluation report (when applicable), the program manual and the tracking data. Once this key program information was reviewed, in-depth interviews were conducted with the Program Manager (PM) and program partners. Finally, surveys were conducted with program participants and, in the case of Performance Plus, also with builders.

1.2.2 In-Depth Interviews

The 2012 evaluation methodology included in-depth interviews with program staff as well as with different program partners. Between August and November 2012, Econoler conducted 111 in-depth interviews with various stakeholders. These included 23 interviews with PMs, 15 interviews with delivery agents, 5 interviews with energy advisors, 30 interviews with distributors, 19 interviews with manufacturers, 2 interviews with consultants and 17 interviews with retailers. A summary of the interviews completed for each program is presented in the following table.

Table 2: 2012 In-Depth Interviews

Program	In-Depth Interviews Completed in 2012						
	Program Managers	Delivery Agents	Energy Advisors	Distributors	Manufacturers	Consultants	Retailers
ARet	2	3	--	--	--	--	--
Instant Savings	2	1	--	--	--	--	17
HEA	2	5	2	--	--	--	--
Fuel Substitution	2	--	--	5	--	--	--
LIHS	1	--	--	--	--	--	--
Performance Plus	2	3	3	--	--	--	--
RDI	2	2	--	--	--	--	--
MURB	2	1	--	--	--	--	--
Solar	1	--	--	--	--	--	--
LHLE	--	--	--	--	--	--	--
BER	2	--	--	10	--	--	--
Custom Retrofit	2	--	--	--	--	2	--
NC	1	--	--	--	--	--	--
BES	2	--	--	--	--	--	--
C&S	--	--	--	15	19	--	--
Total	23	15	5	30	19	2	17

1.2.3 On-Site Visits

For the 2012 evaluations, Econoler visited a total of 325 participant sites, 20 retail stores and one recycling facility. These visits were conducted between October and December 2012 for all programs. The objective of the participant site visits was to collect data to establish or to validate some of the parameters used in the savings calculations, namely installation rates, hours of operation, interactive effects, free-ridership and other technical characteristics of the measures implemented. The objective of the 20 retail store visits conducted under the evaluation of Instant Savings was to provide the qualitative information required to depict the in-store experience of the client. "Mystery shopper" visits and observations allowed for an assessment of the effectiveness of the instant discounts awarded at the counter, the product promotional displays and the knowledge of products and the program on the part of employees. Finally, the objective of the recycling facility visit conducted under the evaluation of Appliance Retirement was to ensure that, once at the recycling facility, the retirement and recycling processes were conducted properly and that the metering activity was conducted in accordance with the protocol.

The complete results of the on-site work are provided in the individual program reports.

Table 3: 2012 On-Site Visits

Program	On-Site Visits Completed in 2012		
	Participant Sites	Retailer Stores	Recycler
Appliance Retirement (ARet)	3	--	1
Instant Savings	--	20	--
Home Energy Assessment (HEA)	2	--	--
Fuel Substitution	8	--	--
Low Income Homeowner Service (LIHS)	3	--	--
Performance Plus	2	--	--
Residential Direct Install (RDI)	100	--	--
Multi-Unit Residential Buildings (MURB)	31	--	--
Solar	5	--	--
LED Holiday Light Exchange (LHLE)	--	--	--
Business Energy Rebates (BER)	50	--	--
Custom Retrofit	31	--	--
Custom New Construction (NC)	10	--	--
Business Energy Solutions (BES)	80	--	--
Codes and Standards (C&S)	--	--	--
Total	325	20	1

1.2.4 Participant Surveys

A total of 1,042 interviews with participants and 57 interviews with builders (Table 4) were completed for this evaluation. Although the content of the surveys varied from one program to another, the survey instruments were used to capture information such as:

- > spillover and free-ridership;
- > program awareness;
- > participant motivations, concerns and barriers;
- > satisfaction with the program; and
- > recommendations for improvements.

The interviews were conducted between October and November 2012. An intercept survey was conducted in-store as part of the Instant Savings evaluation, while participants in remaining programs were surveyed using computer-assisted telephone interviewing (CATI) technology with contact information provided by ENSC.

Table 4: 2012 Telephone Surveys

Program	Surveys Completed in 2012	
	Participants	Builders
Appliance Retirement (ARet)	201	--
Instant Savings	164	--
Home Energy Assessment (HEA)	80	--
Fuel Substitution	75	--
Low Income Homeowner Service (LIHS)	--	---
Performance Plus	70	57
Residential Direct Install (RDI)	181	--
Multi-Unit Residential Buildings (MURB)	37	--
Solar	--	--
LED Holiday Light Exchange (LHLE)	--	--
Business Energy Rebates (BER)	56	--
Custom Retrofit	27	--
Custom New Construction (NC)	--	--
Business Energy Solutions (BES)	151	--
Codes and Standards (C&S)	--	--
Total	1,042	57

1.2.5 Impact Evaluation

The impact evaluations integrated findings from the literature review, tracking sheets, interviews with program partners, on-site visits and/or surveys, depending on the type of data collection activities considered necessary. Moreover, the HEA, LIHS and Performance Plus evaluations drew upon HOT2000¹ simulation calibration analyses using participant billing data. A billing analysis was also developed for Fuel Substitution.

On-site visits were conducted for all programs. In many cases, they were used to validate or to establish some key parameters of the gross impact evaluation, such as installation rates and hours of operation, and in other cases, they were mainly conducted for quality assurance. During the 2011 evaluations, on-site visits were also conducted, but in smaller numbers. When these on-site visits revealed possible discrepancies in the quantity of products installed or in the hours of operation

¹ HOT2000 is residential energy analysis software approved by Natural Resources Canada for calculating EnerGuide ratings. This software was developed by the Housing, Buildings, Communities and Simulation (HBCS) group of CanmetENERGY, a division of Natural Resources Canada.

For additional information: http://198.103.48.154/eng/software_tools/hot2000.html.

declared by the participant, the number of sites to be visited was increased for the 2012 evaluations to allow for establishing reliable installation rates and self-declaration ratios on the hours of operation.

The 2011 verification study suggested increasing direct measurement and billing analysis. Econoler applied this recommendation whenever possible. For Fuel Substitution, a billing analysis was performed with all participants to validate the annual electricity consumption used for heating. In the case of the HOT2000 simulation calibration analyses conducted for HEA, LIHS and Performance Plus and the time-of-use metering conducted for BES, the sample of projects was significantly increased in comparison to last year. All of these analyses allowed for more accurate estimates of program gross savings. However, for other programs, the program approaches and the short evaluation timeline made it impossible to include pre- and post-billing analysis or direct measurement in the impact evaluation. Gross savings in these instances are based on a thorough review of project files and engineering calculations or on solid data found in the literature. When available, Econoler always prioritized metering data over self-declaration estimates or theoretical values.

In order to estimate net savings impacts, interactive effects factors as well as NTGRs that incorporated levels of free-ridership and, in some cases, spillover, were applied to the gross savings impacts, where applicable.

The estimation of NTGRs for the 2012 evaluation of ENSC's programs relies on a self-report approach. A level of free-ridership was obtained for most programs evaluated either through surveys or in-depth interviews. The free-ridership evaluation methodology, which is similar to the one used in 2011, includes a series of questions that are transposed into a level of program attribution used to calculate the free-ridership level for each participant. Subsequently, a weighted average, based on each participant's savings, is used to estimate the global free-ridership level of the program.

Econoler's approach is consistent with evaluation, measurement and verification methods used in other jurisdictions such as California, New York, Oregon and Pennsylvania by using:

- > a 0-to-10 scoring system;
- > questions to jointly consider and rate the importance of the many factors likely to have influenced participant energy efficiency decision making. This question structure reflects the complex nature of the real-world decision making and helps ensure that all non-program influences are considered in the free-ridership assessment in addition to program influences.

The table below summarizes the free-ridership levels calculated during the 2011 and 2012 evaluations for each program.

Table 5: Free-Ridership Levels

Program		Free-Ridership Levels	
		2011	2012
Appliance Retirement (ARet)	Refrigerators	20%	17%
	Freezers	26%	16%
	Room AC Units	-- ^a	24%
Instant Savings	Regular CFLs	78%	59%
	LED Lamps	--	33%
	Clothes Washers	53%	78%
Home Energy Assessment (HEA)^b		31%	30%
Fuel Substitution		42%	32%
Low Income Homeowner Service (LIHS)		--	--
Performance Plus		32%	37%
Residential Direct Install (RDI)		--	19% ^c
Multi-Unit Residential Buildings (MURB)		17%	16%
Solar		--	--
LED Holiday Light Exchange (LHLE)		--	--
Business Energy Rebates (BER) – Mail-In Rebate		17.6%	18%
Business Energy Rebates (BER) – Instant Rebate^d	T8 lamps	19%	27%
	High-Performance Ballasts		24%
	LEDs	--	11%
Custom Retrofit		7%	9%
Custom New Construction (NC)		--	26%
Business Energy Solutions (BES) – SBES		12.8%	17%
Business Energy Solutions (BES) – CDI^e		15.4%	13%
Codes and Standards (C&S)		--	--
^a The free-ridership level for room AC units had not been calculated in 2011 and was assumed to be 0%.			
^b The 2011 free-ridership level refers to Energuide for Existing Houses.			
^c The free-ridership level calculated for RDI is for the non-low-income participants.			
^d The 2011 free-ridership level refers to Smart Lighting Choices (SLC).			
^e The 2011 free-ridership levels refer to Efficient Products – Direct Install (EP-DI).			

For programs where spillover effects can occur, the impact evaluation included the assessment of this distortion effect. Then, based on the free-ridership and spillover levels obtained, the NTGR was calculated using the following equation:

$$NTGR = 1 - \% \text{ free-ridership} + \% \text{ spillover}$$

The table below presents the NTGRs estimated through the 2012 evaluation of ENSC's programs.

Table 6: NTGRs Estimated for 2012

Program		NTGR
Appliance Retirement (ARet)		0.84
Instant Savings	Regular CFLs	0.70
	LED Lamps	0.87
	Clothes Washers	0.70
Home Energy Assessment (HEA)		0.70
Fuel Substitution		0.69
Low Income Homeowner Service (LIHS)		1.00
Performance Plus		0.76
Residential Direct Install (RDI)		0.91*
Multi-Unit Residential Buildings (MURB)		0.84
Solar		1.00
LED Holiday Light Exchange (LHLE)		1.00
Business Energy Rebates (BER) – Mail-in Rebate		0.82
Business Energy Rebates (BER) – Instant Rebate	T8 lamps	0.73
	Ballasts	0.76
	LEDs	0.89
Custom Retrofit		0.91
Custom New Construction (NC)		0.74
Business Energy Solutions (BES) - SBES		0.83
Business Energy Solutions (BES) - CDI		0.87
Codes and Standards (C&S)		1.00
*Average value taking into account the proportion of non-low-income and low-income participants.		

2 DSM PORTFOLIO PERFORMANCE

2.1 OVERVIEW

It is the opinion of Econoler that the portfolio of programs evaluated in 2012 was run efficiently and at a satisfactory level overall. In 2012, ENSC's program portfolio achieved a total of 158.867 GWh in net energy savings and 33.902 MW in net demand savings at the generator, which is an increase compared to 2011 (141.751 GWh and 28.864 MW).

Table 7: Program Performance as Net Energy and Demand Savings at the Generator

DSM PROGRAM	2011		2012	
	Energy GWh	Demand MW	Energy GWh	Demand MW
RESIDENTIAL				
ARet	7.175	1.144	6.795	0.999
Appliance Replacement	0.548	0.065	--	--
Instant Savings	13.802	1.388	10.767	1.895
HEA	4.805	1.543	7.184	2.370
Fuel Substitution	1.570	0.785	1.549	0.857
LIHS	7.636	1.632	2.209	1.026
Performance Plus	2.454	0.861	4.942	1.478
RDI	4.809	1.078	37.043	8.446
MURB	0.651	0.104	2.314	0.534
Residential Solar	--	--	0.107	0.000
LHLE	1.447	3.618	0.349	0.753
RESIDENTIAL SUBTOTAL	44.897	12.218	73.259	18.358
BNI				
BER	14.956	3.469	21.858	6.285
Custom Retrofit	32.930	3.764	28.941	3.490
NC	--	--	4.644	0.525
BES	48.968	9.413	30.152	5.244
Commercial Solar	--	--	0.013	0.000
BNI SUBTOTAL	96.854	16.646	85.608	15.544
PORTFOLIO TOTAL	141.751	28.864	158.867	33.902

Additionally, C&S was found to have achieved net energy savings of 16.353 GWh and net demand savings of 4.663 MW at the generator.

The achievement of such savings for 2012 was mainly attributable to the increased internal and external capacity, as well as strengthened marketing efforts. Notably, in 2012, ENSC managed to launch new programs following successful pilots. The program portfolio now covers a wider range of

energy efficiency measures. In addition, the introduction of new federal C&S in Nova Scotia in 2012 contributed to an increase in assessed savings.

The Evaluator also found major general improvements to the program portfolio since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving little time to follow up on all the process and impact recommendations before the new evaluation window, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve programs performance and management, such as the various process charts, evaluation plans and standardized program manuals.

Moreover, ENSC's actions in increasing program promotion and communication contributed significantly to program awareness in 2012, as it was an important way participants learned about the program. The marketing efforts deployed in 2012 also had a positive impact on the number of participants. Indeed, for many programs, there was an increase in the participation level in comparison to 2011.

Finally, noteworthy is that most participants and partners interviewed through the 2012 evaluation expressed very high levels of satisfaction with ENSC's programs.

2.2 DSM PROGRAM TARGETS AND RESULTS

In March 2012, revised (mid-course) program level savings targets were shared with ENSC's Program Development Working Group (PDWG). Although the mid-course targets presented to the PDWG included changes to individual program targets, the overall total energy and demand savings targets were identical to those approved by the Nova Scotia Utility and Review Board (UARB) for 2012. The following table presents the "as filed" and mid-course targets of each program category for comparison with the evaluated results.

Table 8: 2012 Savings Targets and Evaluated Results

DSM PROGRAM	"As Filed" Targets		Mid-Course Targets		Evaluated Results	
	GWh	MW	GWh	MW	GWh	MW
RESIDENTIAL						
Efficient Products ^a	17.4	4.0	16.2	2.7	17.911	3.647
Existing Houses ^b	14.1	9.7	29.5	7.9	50.406	13.233
New Houses (Performance Plus)	5.6	4.3	2.2	0.6	4.942	1.478
RESIDENTIAL SUBTOTAL	37.1	18.0	47.9	11.2	73.259	18.358
BNI						
Prescriptive Rebate ^c	21.5	4.5	14.9	2.9	21.871	6.285
Custom ^d	37.9	9.2	32.4	4.6	33.585	4.015
Small Business Direct Install (BES)	14.7	6.0	28.8	4.2	30.152	5.244
BNI SUBTOTAL	74.1	19.7	76.1	11.7	85.608	15.544
PORTFOLIO TOTAL	111.2	37.7	124.0	22.9	158.867	33.902
^a Including ARet, Instant Savings and LHLE ^b Including HEA, Fuel Substitution, LIHS, RDI, MURB and Residential Solar ^c Including BER and Commercial Solar ^d Including Custom Retrofit and NC						

The energy savings achieved by ENSC's portfolio of DSM programs were 28 percent higher than the 2012 program targets with a total of 158.867 GWh at the generator. The demand savings were also higher than established targets, totaling 33.902 MW. These results show that the majority of individual programs exceeded goals. Additionally, C&S achieved net energy savings of 16.353 GWh and net demand savings of 4.663 MW at the generator.

2.3 INDIVIDUAL IMPACT EVALUATION RESULTS

Table 9 illustrates the evaluated savings, the net savings targets revised in March 2012 and the savings tracked internally by ENSC for each program offered by ENSC in 2012. Specific observations regarding each program and initiative are also provided in the following section.

Table 9: 2012 Evaluated Results, Targets and Tracked Savings for Each Program (Energy and Demand Savings at the Generator)

DSM PROGRAM	Energy Savings (GWh)							Demand Savings (MW)						
	Evaluated					ENSC		Evaluated					ENSC	
	Initial Gross Savings	Installed/ Adjusted Gross Savings	Installed/ Adjusted Gross Savings with Inter. Effects	NTGR	Net Savings	Targets (Net Savings)	Tracked (Net Savings)	Initial Gross Savings	Installed/ Adjusted Gross Savings	Installed/ Adjusted Gross Savings with Inter. Effects	NTGR	Net Savings	Targets (Net Savings)	Tracked (Net Savings)
ARet	8.089	8.089	8.089	0.84	6.795	5.4	7.801	1.189	1.189	1.189	0.84	0.999	0.8	1.147
Instant Savings	17.620	15.238	13.254	0.81	10.767	10.8	10.167	3.101	2.682	2.333	0.81	1.895	1.9	1.011
HEA	10.277	10.277	10.262	0.70	7.184	4.2	6.424	3.399	3.399	3.161	0.70	2.370	1.3	2.136
Fuel Substitution	2.245	2.245	2.245	0.69	1.549	2.7	1.503	1.243	1.243	1.243	0.69	0.857	1.2	0.703
LIHS	2.277	2.277	2.209	1.00	2.209	1.1	2.202	1.079	1.079	1.047	1.00	1.026	0.5	1.044
Performance Plus	6.558	6.558	6.503	0.76	4.942	2.2	4.153	1.960	1.960	1.945	0.76	1.478	0.6	1.257
RDI	46.660	46.427	40.706	0.91	37.043	18.9	35.590	10.867	10.585	9.281	0.91	8.446	4.3	8.115
MURB	3.164	3.130	2.754	0.84	2.314	2.6	2.311	0.731	0.723	0.636	0.84	0.534	0.6	0.534
Residential Solar	0.107	0.107	0.107	1.00	0.107	-	0.075	0	0	0	1.00	0	-	0
LHLE	0.435	0.435	0.349	1.00	0.349	-*	0.374	0.939	0.939	0.753	1.00	0.753	-*	1.871
RES. SUBTOTAL	97.432	94.783	86.478	-	73.259	47.9	70.600	24.508	23.799	21.588	-	18.358	11.2	17.818
BER	26.804	27.295	25.191	0.86	21.858	14.9	20.819	7.873	7.912	7.315	0.86	6.285	2.9	6.133
Custom Retrofit	32.536	31.803	31.803	0.91	28.941	26.3	29.562	3.300	3.836	3.836	0.91	3.490	3.7	3.146
NC	6.381	6.276	6.276	0.74	4.644	6.1	6.034	0.840	0.710	0.710	0.74	0.525	0.9	0.781
BES	41.825	40.422	34.467	0.87	30.152	28.8	30.328	8.679	7.148	6.081	0.86	5.244	4.2	6.403
Commercial Solar	0.013	0.013	0.013	1.00	0.013	-	0.009	0.000	0.000	0.000	1.00	0.000	-	0.000
BNI SUBTOTAL	107.559	105.809	97.750	-	85.608	76.1	86.652	20.692	19.606	17.942	-	15.544	11.7	16.463
PORTFOLIO TOTAL	204.991	200.592	184.228	-	158.867	124.0	157.252	45.200	43.405	39.530	-	33.902	22.9	34.281
C&S	16.353	16.353	16.353	1.00	16.353	-	-	4.663	4.663	4.663	1.00	4.663	-	-
TOTAL OUTSIDE OF PORTFOLIO	16.353	16.353	16.353	-	16.353	-	-	4.663	4.663	4.663	-	4.663	-	-

^a The targets for LHLE are included in Instant Savings.

Appliance Retirement

The evaluated net savings of ARet fell short of those tracked by ENSC by 13 percent. This result is mainly due to the revision of the unitary savings values for each type of appliance. The revised unitary savings values for refrigerators and freezers were slightly lower than those estimated by ENSC due to the new average age, size, partial use factor and proportion of primary and secondary units calculated for the units retired in 2012. More specifically, the refrigerators and freezers retired were newer this year, which had the most significant impact on their unitary savings values. For room air conditioners, the unitary savings value calculated for this evaluation was higher than the one used for tracked savings since it took into account a replacement ratio.

Another factor that explains the differences between the tracked savings and the evaluation results is the NTGR. In the tracking sheet, ENSC used a NTGR of 0.79, based on the 2011 evaluation report. For this year's evaluation, the NTGR was established at 0.84. The increase in the NTGR is due to lower levels of free-ridership measured for refrigerators and freezers. As in 2011, an internal spillover level of 1 percent was also captured.

Instant Savings

The net evaluated energy savings of Instant Savings exceeded those tracked by ENSC by 6 percent although some unitary savings values were revised downward. The main element that explains this result is the difference between the NTGR measured for this evaluation and that used in the tracking sheet, which was based on the 2011 evaluation. For regular compact fluorescent lamps (CFLs), which contribute to more than 60 percent of gross savings, the NTGR went from 0.53 to 0.57. The free-ridership level measured this year through an intercept survey at the exit of the store right after the purchase was lower for regular CFLs. Moreover, the inclusion of the percentage of outdoor installations for CFLs and Light Emitting Diode (LED) lamps in the interactive effects calculation allowed for a more precise evaluation of savings and reduced the impact on the evaluated savings.

Home Energy Assessment

For HEA, both the energy and demand savings calculated for this evaluation are higher than the tracked savings, by 12 percent and 11 percent respectively. For the energy savings, this difference can be explained mainly by the adjustment made to the gross energy savings per EnerGuide point, from 817 kWh to 914 kWh. This adjustment came from a review of 506 project simulations and a calibration of the savings from a billing analysis of 172 participants. This approach used a much bigger sample size than that used in 2011 and is therefore more precise. Furthermore, since the energy savings per EnerGuide point was only calculated from the heating consumption reduction, solar domestic hot water (DHW) systems and DHW tank wraps were accounted as prescriptive measures, whereas ENSC considered those measures included in the savings per EnerGuide point.

With regard to net demand savings, the Evaluator made a small adjustment to ENSC's tracked savings by taking into account the unitary peak demand savings related to the installation of electric thermal storage (ETS) systems.

Fuel Substitution

The net energy savings calculated for Fuel Substitution are 3 percent higher than those calculated from the tracking sheet. This can be explained by the increase in the NTGR calculated for this evaluation in comparison to the one applied in the tracking sheet, which was based on the 2011 evaluation. The free-ridership level evaluated for the program in 2012 is lower than the one evaluated in 2011, probably due to the increase of marketing efforts and outreach activities. However, the unitary savings values for the two most popular products, wood and pellet stoves, were lowered after the billing analysis, which also had a considerable impact on the energy savings.

Low Income Homeowner Service

For LIHS, both the energy and demand savings calculated for this evaluation are practically identical to the tracked savings. On the one hand, an adjustment was made to the gross energy savings per EnerGuide point, which was increased from 817 kWh to 914 kWh. This adjustment came from the analysis conducted for the 2012 HEA evaluation. On the other hand, unitary savings for many prescriptive measures were reduced. In the end, these adjustments balanced each other and the evaluated savings ended up being very similar to the tracked savings.

Performance Plus

For Performance Plus, both the energy and demand savings calculated for this evaluation are higher than the tracked savings by 19 percent and 18 percent respectively. This difference can mainly be explained by the adjustment made to the gross energy savings per EnerGuide point, which was changed from 817 kWh to 914 kWh. This adjustment was based on the analysis conducted for the 2012 HEA evaluation. Furthermore, since the energy savings per EnerGuide point was only calculated from the heating consumption reduction, solar DHW systems were considered a prescriptive measure, whereas ENSC included this measure in the savings per EnerGuide point.

Residential Direct Install

The net savings values calculated for RDI are slightly higher than those calculated from the tracking sheet. This can be explained by the difference in some of the parameters used by ENSC and the Evaluator to estimate gross and net savings:

- > Econoler revised some of the unitary savings values used by ENSC in the tracking sheet. These adjustments resulted in a small increase of the initial gross savings.
- > Installation rates were added for all products installed through the program, except for programmable thermostats and electric kettles. Though these installation rates were very high,

they had an impact on the installed gross savings, since ENSC used installation rates of 100 percent in the tracking sheet.

- The NTGR measured during this evaluation is slightly higher than the one used by ENSC. In fact, ENSC estimated a NTGR of 0.83 for non-low-income participants, in comparison to the value of 0.84 measured by Econoler. This higher NTGR is mainly explained by the internal spillover effects of 3 percent that were calculated during this evaluation.

Multi-Unit Residential Buildings

The net evaluated savings were slightly higher than those tracked by ENSC for MURB. Some unitary savings values were revised during this evaluation. However, the main factors that explain the difference in savings are the review of the interactive effects for regular CFLs to take into account that part of them were installed outdoors and the fact that a free-ridership level of 16 percent was measured for this evaluation (compared to 17 percent in 2011).

Solar

The net energy savings calculated for Solar were 43 percent higher than those tracked by ENSC. This can be mainly explained by the fact that the NTGR estimated by the Evaluator was 1.0 while that assumed by ENSC was 0.70. Also, a small adjustment was made for space heating, but it was not significant compared to the gain in energy savings resulting from the change in NTGR.

LED Holiday Light Exchange

Although the unitary savings value was revised upward due to an increase in the average daily usage assumption for the LED holiday lights installed, the net evaluated energy savings fell short of the tracked savings by 7 percent because of the interactive effects factor considered by the Evaluator. For demand savings, the difference is more significant (-60 percent). The addition of a diversity factor explains this drop in savings.

Business Energy Rebates

For the mail-in rebate component of BER, the net energy and demand savings evaluated for 2012 were slightly lower than those tracked by ENSC, respectively by 7 percent and 3 percent. This could mainly be explained by the adjustments calculated from on-site visits and applied to the tracked gross savings. For the heating, ventilating and air conditioning (HVAC) measures, overall adjustment ratios of 0.863 and 1.037 were applied respectively on the energy and demand savings of all the projects implemented in this category. Additionally, diversity factors were taken into account to establish the peak demand savings. These revisions made to the tracked savings allowed for a more precise estimation of energy and demand savings.

For the instant rebate component, the net energy and demand savings evaluated were higher than the tracked savings, respectively by 13 percent and 6 percent. This result could be explained by the fact

that ENSC applied an NTGR of 0.75 on all the products purchased through the program. For the 2012 evaluation, NTGRs were calculated for the products contributing the most savings. The NTGR for the other products was assumed to be 1. Interactive effects of -15.5 percent were also applied to the gross savings calculated for indoor lighting products, but the conservative NTGR value used for tracked savings was sufficient to offset the reduction of savings caused by this interactive effects factor.

Custom Retrofit

The adjusted gross energy savings of Custom Retrofit were higher than those tracked by ENSC by approximately 0.05 percent. The Evaluator made some minor adjustments to ENSC's energy savings, due to issues found in interactive effect calculations under lighting retrofit projects or small discrepancies in energy efficiency equipment count observed during the on-site visits. The overall gross energy savings adjustment factor calculated for 2012 (0.977) turned out to be very similar to the one used for 2011. The 2012 net energy savings following the adjustment by Econoler were 2.1 percent lower than ENSC's figure because the free-ridership level set for 2012 was 2 percent higher than that of 2011. Nevertheless, the Evaluator believes that the free-ridership level of Custom Retrofit is under control and remains consistent with the special characteristics of the participants in such a custom program. In short, Econoler considers the 2012 energy savings adjustment factors to be minor and thereby the energy savings tracking process for Custom Retrofit quite efficient in 2012.

With regard to gross demand savings, the evaluated values were higher than those tracked by ENSC by approximately 13 percent. The main reason for this is that Econoler adjusted upward a number of diversity factors used for computing the peak demand savings of the sample projects, based on the equipment's operating conditions. The Evaluator considers that the diversity factors used by ENSC were sometimes too conservative and not tailored to the actual energy efficiency equipment operations. Finally, the difference between ENSC's and Econoler's net demand savings decreased to almost 11 percent because of the higher free-ridership percentage of 2012.

Custom New Construction

The net energy savings at the generator calculated by Econoler are approximately 22 percent lower than those tracked by ENSC. This difference is mainly due to the NTGR ratio established as part of this year's evaluation. The gross energy savings tracked by ENSC were adjusted by only 1.6 percent, which was mainly due to Econoler finding two small discrepancies between the energy savings figures presented in the feasibility studies and those tracked by ENSC.

The difference between net peak demand savings from Econoler and ENSC (almost 33 percent) is higher than for net energy savings because of the significant adjustments made by the Evaluator to the gross peak demand savings tracked under the program tracking sheet. In fact, it was found that the peak demand savings claimed for two projects were either inapplicable or not detailed enough by engineering calculations to allow for an accurate claim in 2012. However, Econoler adjusted upward

one of the projects' peak demand savings values since ENSC's estimate of the diversity factor was considered too conservative in light of the information available, which translated into an increase of the peak demand savings by more than 50 percent for this project.

As part of the gross savings evaluation, Econoler also slightly modified the line loss factors used by ENSC for all NC projects in accordance with up-to-date values from NSPI. It is, however, worth noting that this modification had no impact on the final evaluated savings results, Econoler's average line loss factors for energy and peak demand savings being respectively 0.07 percent and 0.06 percent lower than ENSC's.

Finally, the relatively high free-ridership percentage established following the in-depth interviews (conducted during the on-site visits) is probably due to a variety of factors. The review of the 2012 NC projects showed that a significant proportion of program participants had decided to implement energy efficiency measures not only to obtain ENSC's technical and financial support, but also to obtain a green building certification (e.g. LEED) or to comply with a corporate policy. Additionally, it should be noted that similar programs in other jurisdictions have shown a comparable level of free-ridership.

Business Energy Solutions

Overall, the net energy savings evaluated for BES fell short of those tracked by ENSC by 2 percent. This result can be explained by the adjustments applied in the Small Business Energy Solutions (SBES) gross savings calculation, namely the installation rates and the self-declaration ratio on the hours of operation. Moreover, for all components, ENSC used an interactive effects factor of -7.7 percent on lighting products, but this factor was established at -15.3 percent for this year's evaluation.

For demand savings, the difference between the tracked and the evaluation results mainly comes from the fact that, for SBES, Econoler applied a diversity factor of 80 percent on the gross demand savings.

Codes and Standards

For C&S, the evaluation allowed an estimation of the energy and demand savings for the introduction of new C&S on the Nova Scotian market on products targeted by *Amendment 11* to the Energy Efficiency Regulations², as a result of the increase of stringency and/or scope on existing minimum energy performance standards (MEPS).

Savings were calculated taking into account all product categories for which the necessary information on market size, non-compliance rates and unitary savings values were available. Since the Province did not implement the new MEPS for residential boilers (gas, oil and electric boilers) before the end of

² The *Amendment 11* to the Energy Efficiency Regulations was published on October 12, 2011 in the Canada Gazette, Part II and came into force six months after publication, on April 12, 2012.

2012, these three specific C&S were left out of the evaluation. Moreover, since it was not possible to obtain either a market analysis or any shipment data for digital television adapters, and assuming that the market size of these products is negligible, it was decided not to evaluate this C&S. Finally, single package vertical air conditioners and heat pumps, dry-type transformers and commercial self-contained refrigeration were also excluded of the evaluation because of a lack of reliable data available about the market size of these products and the difficulties to collect information through interviews with market experts. For all other products, the evaluation results revealed significant net savings values: 16.353 GWh and 4.663 MW.

2.4 OVERALL PORTFOLIO ANALYSIS

In addition to the performance of individual programs, it is worth looking at individual programs' contributions over the years from a more global perspective. Table 10 shows the evaluated contribution of each DSM program component to total portfolio savings in 2011 and 2012.

Table 10: Program Performance as Percentage of Total Portfolio Savings

DSM PROGRAM	2011		2012	
	Energy	Demand	Energy	Demand
RESIDENTIAL				
ARet	5.1%	4.0%	4.3%	2.9%
Appliance Replacement	0.4%	0.2%	--	--
Instant Savings	9.7%	4.8%	6.8%	5.6%
HEA	3.4%	5.3%	4.5%	7.0%
Fuel Substitution	1.1%	2.7%	1.0%	2.5%
LIHS	5.4%	5.7%	1.4%	3.0%
Performance Plus	1.7%	3.0%	3.1%	4.4%
RDI ^a	3.4%	3.7%	23.3%	24.9%
MURB	0.5%	0.4%	1.5%	1.6%
Residential Solar	--	--	0.1%	0.0%
LHLE	1.0%	12.5%	0.2%	2.2%
RESIDENTIAL SUBTOTAL	31.7%	42.3%	46.1%	54.2%
BNI				
BER ^b	10.5%	12.0%	13.8%	18.5%
Custom Retrofit	23.2%	13.0%	18.2%	10.3%
NC ^c	--	--	2.9%	1.5%
BES ^d	34.5%	32.6%	19.0%	15.5%
Commercial Solar	--	--	0.0%	0.0%
BNI SUBTOTAL	68.2%	57.6%	53.9%	45.8%
^a RDI was new in 2012. The percentage of savings presented for 2011 came from Low Income Renter, which is now part of RDI. ^b In 2012, NC was evaluated as a separate program. Before 2012, it was evaluated with Custom Retrofit. ^c BER includes the mail-in rebate component and the instant rebate component (previously known as Smart Lighting Choices). ^d BES includes SBES and CDI (previously known as Efficient Product – Direct Install).				

The Business, Non-Profit and Institutional (BNI) sector accounts for approximately half of total portfolio energy and demand savings. The residential sector represents the other half of ENSC's DSM program portfolio savings. In terms of energy savings, the residential sector's contribution to the program portfolio has increased in comparison to that found last year. Indeed, the number of participants associated with most of the residential programs increased in 2012, and these programs exceeded the net savings tracked by ENSC. Overall, all sectors demonstrated valuable results in 2012.

In 2011, ENSC conducted many pilot projects in order to explore new markets. Several pilots had great success and were integrated into existing or new programs in 2012. For example, Fuel Substitution and MURB, which were pilots in 2011, have been officially launched in 2012. In addition, RDI was created following the success of several direct install pilots offered to customers involved in HEA, LIHS and other direct install programs in the fall of 2011.

New pilot projects were also integrated into existing programs in 2012. Indeed, BES claimed energy savings through different pilot projects promoting LED technologies.

In 2012, ENSC has optimized its program portfolio by applying some changes. In particular, Energuide for Existing Houses (EEH) has been reconfigured to become HEA; it now focuses on building envelope measures, and the purchases of energy-efficient heating systems are now all rebated through Fuel Substitution. Efficient Products-Direct Install (EP-DI) and Smart Lighting Choices (SLC) have been respectively redirected into components of BES and BER. It should also be noted that Appliance Replacement was discontinued in 2012.

Since 2010, ENSC has gained experience and knowledge in a wider range of markets. Moreover, the program portfolio sought to diversify its sources for achieving savings by expanding the range of energy efficiency measures that it incentivized. ENSC successfully managed to maintain this diversification approach in 2012. Indeed, products and measures were added to certain programs in order to increase the variety offered to participants. This is the case for RDI, BER – Instant Rebate and Commercial Direct Install (CDI), which included LED technologies for the first time. Moreover, BER – Mail-In Rebate incorporated commercial kitchen equipment and agricultural equipment into the eligible measures, and SBES expanded its offer to heat pumps towards the end of 2012.

It is important to recognize that in previous years, portfolio performance relied heavily on the programs that promoted lighting products—more specifically, fluorescent technologies. Since 2011, ENSC has taken action to diversify its portfolio of programs with the addition of pilot programs and projects promoting new products or measures as a means to enhance its offerings.

The 2012 evaluation allowed the Evaluator to conclude that ENSC's DSM portfolio is quite complete. Indeed, besides existing programs, new programs were launched in 2012 to increase coverage of the residential market. RDI, MURB and Fuel Substitution carried this objective.

In addition to ENSC's overall program portfolio, the C&S initiative was evaluated for the first time this year and also contributed to important savings for the province.

3 OVERALL RECOMMENDATIONS

This section presents general recommendations for the program portfolio. These recommendations are generally considered good practices and can be applied to most ENSC programs. They are aimed specifically at enhancing program documentation and data management as well as program implementation and evaluation.

3.1 PROGRAM MANUAL

Program manuals feature key information on program process and tracking for internal use and are an essential reference tool for all program staff. In addition, program manuals are widely used by the Evaluator throughout the program process and impact evaluation activities. The program manual is intended to capture information about the program such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

For the 2012 evaluation, Econoler analyzed ENSC's program manuals. They are now presented in a standardized template which applies to all ENSC programs and includes the same table of contents with 10 sections. The 2012 version of the program manual is a considerable improvement over the 2011 format and followed one of the Evaluator's major recommendations. With this new format, most information is now covered in the program manual as well as its attached files and Appendices. For further improvements, Econoler has the following recommendations to supplement the tool where applicable:

Table 11: General Recommendations on ENSC Program Manuals

No.	Recommendations
OV-R1.	Continue to document key elements of the programs: With the new standardized format, the program manuals now include most of the information about the program. For further improvements, the Evaluator recommends continuing supplying it by documenting the elements such as the major changes in the Document Revision section, the major characteristics of the program, the rationale behind the incentive calculation and the pre-screening free-ridership approach where applicable.

No.	Recommendations
OV-R2.	Update the program manuals with the most recent information on eligible measures: Program manuals are widely used by the Evaluator throughout the program evaluation activities. In 2012, the Evaluator noticed that some program manuals did not contain the most up-to-date information on eligible measures or products. In some instances, the list of eligible products differed from the information found in the tracking sheet, or some eligibility criteria that are important for impact evaluation were not specified. Therefore, Econoler recommends continually updating the program manuals' content for evaluation purposes.
OV-R3.	Provide a quality assurance protocol for each program: The Evaluator noticed that LIHS has a Quality Assurance (QA) protocol, the objective of which is to ensure that the process, product and services delivered are meeting standards of quality expected by ENSC. This well-detailed document is a very good practice. ENSC plans on implementing QA for all programs in 2013. Evaluator strongly supports this approach and encourages ENSC to develop and document QA procedures for all ENSC's programs.
OV-R4.	Be consistent in program name formulation across all residential programs: ENSC is increasing focus on serving customers through a one-window service approach and is therefore planning to market all residential activities as services instead of programs. So far, this change has already been implemented for HEA, MURB and LIHS, which are now presented as services. The Evaluator recommends that consistency be maintained in the program names in internal and external documents (e.g. on the ENSC website). All activities should therefore be named only as a service or as a program, thus avoiding the confusion caused by two sets of names in the same portfolio. In a view to offer a one-window service approach, the program portfolio names should be planned carefully and globally, and not one program at a time. This latter approach would ensure that participants have all the necessary information to understand ENSC's offer, starting with the names of the different services. It would also prevent confusion among participants as to the difference between a service and a program, especially given that several programs already changed names a few times in the past.

3.2 DATA TRACKING

Data tracking and reporting are crucial for program management as well as for evaluation purposes. In 2010, ENSC implemented an online Demand-Side Management Data System (DSMDS), and has been working on its improvement since then. This centralized system allows the tracking of all projects for each program. While the DSMDS has been improved in 2012, it still has some limitations that prevent it from being fully functional for monitoring and evaluation purposes. The most important limitation observed was the fact that the DSMDS did not allow generating reporting sheets gathering all necessary information on the projects implemented through a program within a year. Thus, for the 2012 evaluation, Econoler used program tracking sheets provided by ENSC. Although, it should be noted that for some BNI programs, the tracking sheets consisted in an extract of the online DSMDS. While these extracts were the main data source used by the Evaluator, the DSMDS was also consulted to obtain and validate information in online documents for some projects.

Since the last evaluation in 2011, Econoler noticed major improvements to data tracking. Overall, the consistency and availability of the data recorded have increased. For many programs, ENSC implemented the main recommendations made by the evaluator, which include the adjustment of tracked savings on the basis of the most recent evaluation results, the use of unitary savings values for prescriptive measures and the incorporation of standardized entries using drop-down menus for many programs.

On the other hand, the Evaluator still faced some challenges arising from the data tracking when evaluating ENSC's 2012 programs. In many cases, tracked savings were computed in a way that made it difficult to validate savings, i.e. without clearly presenting the parameters used in the savings calculations and without automating the calculation of savings directly in the tracking sheets.

Therefore, Econoler makes the following general recommendations to improve tracking information consistency and to facilitate validation of the savings calculations for all programs. Knowing that ENSC is currently working on the DSMDS, these recommendations should help improve the DSMDS and, more particularly, the development of the reporting option for 2013. Econoler strongly supports ENSC's work on the DSMDS and is confident that most of the issues identified this year will be resolved in 2013 by the work done on the DSMDS.

Table 12: General Recommendations on Data Tracking

No.	Recommendations
OV-R5.	Improve the ease of use of the DSMDS: The DSMDS contained a lot of useful information, and its use by ENSC became more widespread over the last years. However, for this year's evaluation, it was still difficult for Econoler to use data directly in the DSMDS, and consequently they relied on tracking sheets provided by the PM. The main challenge for the DSMDS to be used for evaluation purposes is to generate reporting sheets that contain all relevant information on the projects implemented for a program within a year. In addition, the project folders for programs that require more technical details, such as Custom Retrofit and NC, should systematically be updated in the DSMDS when new information is available. ENSC is currently improving the DSMDS so that it could be used in 2013 for monitoring and evaluation purposes. A new business intelligence reporting tool is currently being implemented by ENSC and should improve reporting. Econoler therefore encourages ENSC to continue working on such improvements, including those targeting information extraction, so that the DSMDS can be used as the main source of information for 2013.
OV-R6.	Explicitly identify parameters used for savings calculations: Savings are computed differently for each program. Sometimes, only gross savings are provided, while in other instances net savings are provided without stating explicitly the parameters that were used to obtain the results. In order to thoroughly validate the savings generated by each program and to compare them with tracked savings, it is essential that all the parameters (e.g. unitary savings value, installation rate, NTGR, line loss factor, etc.) be detailed in separate and clearly identified fields.

3.3 EVALUATION PLAN

The evaluation plan identifies key variables that must be collected as part of program operations in order to make it possible to evaluate the program. In 2011, the Evaluator noticed that ENSC's programs did not have such documentation and therefore recommended to develop an evaluation plan in parallel with program design and development.

ENSC decided to adopt the evaluation plan template proposed by the Evaluator, which is now included as an Appendix of each program manual. The addition of the evaluation plan to the program documentation is a great improvement from last year and provided useful information for this year's evaluation. For additional improvements, the Evaluator has the following recommendations:

Table 13: General Recommendations on Evaluation Plan

No.	Recommendations
OV-R7.	Adapt the evaluation plan template to meet program needs: In the program base case, some programs, such as Fuel Substitution, have many measures to describe, from baseline to net savings. In other cases, such as Custom Retrofit, the base case section is not really appropriate or relevant, since savings cannot be forecasted or projected for performance- or custom-based programs. The table defining the base case should therefore be adapted to provide all the information needed to understand how savings are established by ENSC. The lines containing no information should be deleted.
OV-R8.	Update the base case content: The base case provides information on how the assumed gross savings have been established. Usually, these savings are calculated with an algorithm using a series of variables such as the hours of operation, wattage, base consumption, replacement ratio and installation rate. Such variables may evolve over time. The Evaluator noticed that some of the base cases included in the evaluation plans did not contain the most up-to-date information. Therefore, Econoler recommends continually updating the base case content for evaluation purposes.

3.4 MARKETING ACTIVITIES

In 2011, the Evaluator noticed that programs marketing and communication represented an area for improvement. Throughout the 2012 evaluation, Econoler has noted major improvements in program marketing and outreach activities. ENSC has been moving away from program-specific marketing to a more all-inclusive approach with increased focus on offering a full suite of energy-saving services and rebates. Integrated marketing plans for the residential and BNI sectors have been drawn up and are being implemented. There has been a focus on building tools, developing a customer-centric

approach in the residential sector and strengthening relationships with partners and industry associations in the business sector. In addition to the overall residential and commercial marketing strategies, programs also have specific approaches aimed at reaching the targeted market.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice, because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

To continue improving marketing activities in the future, the Evaluator has the following recommendations.

Table 14: General Recommendations on Marketing Activities

No.	Recommendations
OV-R9.	Provide partners and participants with simplified process charts: Most programs now have process charts that describe the participation process. This is a very good complement to program documentation. On this matter, the Evaluator recommends developing simplified participant process charts and posting them on the program website, which is comprehensive, clear and well-designed. Moreover, the partners should be given copies of their process chart. After all, since these charts are intended for participants and the partners, they must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version date should be indicated in each chart.
OV-R10.	Make the marketing plan's performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

4 INDIVIDUAL PROGRAM PERFORMANCE

This section provides a summary of the key findings and recommendations for each of the programs. Note that the numbering of the recommendations corresponds to the numbering presented in the individual reports.

4.1 RESIDENTIAL

4.1.1 Appliance Retirement

The 2012 evaluation of ARet demonstrated that the program is well designed and that it underwent a series of positive changes aimed at improving its design and implementation. Notably, the program has excluded dehumidifiers from the list of covered appliances, for cost-effectiveness reasons, and has included AIR MILES® reward points for every retired appliance in order to make the program more appealing. The reorganization of the program partners into two delivery agents (DAs) also had a positive impact on the retirement logistics, resulting in a significant increase in participants' satisfaction with the program's enrolment methods and the ease of scheduling a pickup time.

Furthermore, the Evaluator found major improvements to the program since the last evaluation window in 2011. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Moreover, additional efforts were made in program promotion and communication, as well as in informing participants about appliance disposal. This is a great improvement since the removal and recycling services provided as part of the program are the most important factor in the customer's decision to retire an appliance through the program.

ENSC's sustained efforts in program advertising contributed significantly to program awareness in 2012, as it was the main way participants learned about the program. Moreover, word of mouth was an important source of program awareness as well as a good indicator of program satisfaction. Indeed, the participants expressed very high satisfaction with the overall program, as did the partners.

The program achieved the retirement of 7,976 units for the year 2012, which represents a high level of participation. The evaluation revealed that ARet generated net energy savings of 6.795 GWh and demand savings of 0.999 MW at the generator in 2012, compared to 7.175 GWh and 1.144 MW in 2011. To calculate the net savings of ARet in 2012, Econoler reviewed the gross savings estimated by ENSC for refrigerators and freezers using results from the 2011 metering study and information on the appliance usage obtained from the 2012 participant survey. For room air conditioners, Econoler consulted other studies for similar programs and used information obtained from the participant survey to validate the hours of operation. Moreover, Econoler took into consideration the free-ridership and internal spillover measured through the participant survey.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 15: Recommendations for Appliance Retirement

No.	Recommendations
ARet-R1.	Continue marketing efforts and perform targeted marketing in rural communities: The ARet marketing campaign has improved since the last evaluation to include many different mediums and a brochure about appliance disposal. All partners interviewed indicated they were very satisfied with the current marketing and outreach activities and their outcome across the province since last year's evaluation. Moreover, survey results highlight the positive impact of ENSC advertising on customer awareness. The Evaluator recommends continuing marketing efforts and allowing efforts to reach rural communities in order to increase penetration in this market.
ARet-R2.	Explore the possibility of lowering the rebate: Participants' survey responses revealed that the money incentive is the third factor influencing the decision to retire an appliance through the program. The removal and recycling services, followed by the information or advice provided as part of the program, were most important. Although this could be viewed as an indication that the incentive rebates could be lowered, there are no other results in the present evaluation that confirm this. Therefore, for the next evaluation, Econoler recommends probing deeper into the possibility of lowering the rebate amount and the consequences that this might have on appliance retirement.
ARet-R3.	Collect information on the manufacture year of refrigerators and freezers, as well as the capacity of room air conditioners: Where available, the Evaluator recommends collecting the manufacture year of the refrigerators and freezers retired through the program in addition to the age of the appliance, as declared by the participant. These parameters are for the unitary savings calculation. For room air conditioners, the Evaluator recommends collecting the capacity of all units retired and including this information in the main tracking sheet. This would allow for a more precise estimate of the unitary savings value for this appliance.

No.	Recommendations
ARet-R4	Improve the metering of refrigerators and freezers at the recycling facility: For this year's evaluation, the results obtained from the metering activity conducted on refrigerators and freezers were not conclusive. Therefore, the unitary savings calculation was based on average annual consumptions obtained from the metering activity conducted for the 2011 impact evaluation. For the next evaluation window, Econoler recommends reviewing the metering protocol to measure the annual consumptions of a representative sample of refrigerators and freezers that will be retired through the program in 2013.

4.1.2 Instant Savings

The 2012 evaluation of Instant Savings demonstrated that the program works well overall and constitutes the right approach in a market transformation and resource acquisition perspective. Additions were made to the program to help improve its design and implementation. Notably, the amount of discounts on several products was raised, more products were made eligible and many efforts were deployed to improve program marketing and advertising. Indeed, the 2012 marketing strategy included improving point of purchase (POP) material, issuing a playbook, incorporating social media, launching a contest between participant stores to increase knowledge of salespeople with the program and improving retailer support and QA. Moreover, positive program elements, such as customer engagement events, were maintained in 2012 to continue providing customers with information about energy-efficient products and their benefits. LED giveaways were also integrated into these events.

Furthermore, the Evaluator found major improvements to the program since the last evaluation window in 2011. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management such as the process charts, the evaluation plan and a standardized program manual. Moreover, the tracking sheet now contains all necessary information for evaluation purposes.

ENSC's efforts in improving program marketing and advertising contributed to program awareness and to partner satisfaction in 2012. Indeed, a majority of CFL and LED buyers from the intercept survey knew about the program and the discounts prior to purchasing their lamps. Survey results showed that in-store signage proved to be successful at communicating with customers regarding the program and the discount. Retailers also provided positive feedback regarding the program marketing as they indicated being satisfied with the look of the promotional tools.

The DA and the retailers interviewed provided high satisfaction ratings with regard to the program in general and most of its aspects. They mentioned a challenge; though, that relies on involving store associates and personnel in the program. Efforts need to be made to help retailers see the benefits

they would obtain from taking part in the program. According to all partners, retailer involvement constitutes the main barrier to Instant Savings implementation.

Many retailers provided helpful feedback concerning the list of eligible products. Appliance retailers would like to see a change in the variety of refrigerators discounted under the program since CEE Tier 3 refrigerators constitute a very specific class of high-end product. As for other program products, some retailers suggested a greater focus on LED products in the future.

The evaluation revealed that Instant Savings generated net energy savings of 10.767 GWh and demand savings of 1.895 MW at the generator in 2012, compared to 13.802 GWh and 1.388 MW in 2011. To calculate the net savings of Instant Savings in 2012, Econoler reviewed the unitary savings values estimated by ENSC for each eligible product and included free-ridership and spillover, measured through market effects, for the three most popular products: regular CFLs, LED lamps and clothes washers.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 16: Recommendations for Instant Savings

No.	Recommendations
Instant-R1.	Document the AIR MILES® approach: The program manual does not provide enough information on the AIR MILES® approach, such as the number provided for each eligible product purchased, or justification from a 2011 pilot project. Overall, the AIR MILES® campaign needs to be better documented in the Instant Savings program manual. Among other things, an example of what information will be found in the AIR MILES® tracking sheet should be added as one of the program manual Appendices.
Instant-R2.	Generate greater involvement from the retailers: The DA mentioned an important concern during the evaluation process. They spoke of the difficulty to involve retailers in the program, both at the corporate and store levels. Indeed, a challenge persists in making retailers at the corporate level understand the relevance of program components such as POP and in-store customer engagement events. Since some corporate retailers do not always communicate well with their store associates, this challenge also affects participating stores. The retailers recognized this difficulty and its impact on the effectiveness of the campaigns. They reported the challenge that lies in communicating all the necessary information to their store personnel and in involving and engaging them, as indicated by the DA. The success of Instant Savings relies largely on the collaboration of retailers. ENSC already made a great effort to involve and engage retailers. Indeed, the communication and the relationship between the DA and the retailers are stronger than ever. Furthermore, initiatives such as the playbook and the contest were developed to create a sense of interest among store associates. The Evaluator recommends continuing strengthening the relationship with the corporate retailers while pursuing more concrete actions with the store associates. The latter are in direct contact with the clients and can become program promoters if they are well involved. By being informed of the benefits they can obtain from engaging in the program, they might be more likely to promote it.

No.	Recommendations
Instant-R3.	Focus on LED products going forward with the program: Some retailers recommended upgrading the lighting offer under Instant Savings. Indeed, they believe that LED lamps are the future, and that the demand for regular CFLs is slowly decreasing. Following this trend in the market, ENSC made efforts in this regard in 2012 by adding LED recessed downlight fixtures to the list of eligible products. The Evaluator recommends continuing this approach and centering the program lighting offer around LED products over the years to come. Given the relatively high free-ridership level measured for regular CFLs since the two last evaluations, Econoler also suggests planning the withdrawal of regular CFLs as an eligible product for 2014.
Instant-R4.	Modify the offer of appliances under the program to consider the most energy-efficient appliances available on the market: This recommendation targets the offer of refrigerators and clothes washers under Instant Savings. Firstly, interviews with retailers highlighted an issue regarding the energy-efficient refrigerators discounted under the program. Retailers pointed out that not many models of CEE Tier 3 refrigerators currently exist on the market, which constitutes a very specific class of high-end product. Moreover, many CEE Tier 3 refrigerators are larger in size. ENSC is already considering rebating smaller CEE Tier 2 refrigerators that are more energy-efficient than some of the larger CEE Tier 3 models. The Evaluator agrees with this approach and recommends adding to the program smaller models of CEE Tier 2 refrigerators with low annual energy consumptions to increase sales for this product and avoid encouraging the purchase of bigger refrigerators when it is not needed. As for clothes washers, many of the retailers interviewed mentioned carrying only CEE Tier 3 washers in their stores. Therefore, the program did not have a great impact on their sales since the rebate became an extra instead of being the main incentive to buy among customers. Discounting a selection of energy-efficient clothes washers limited to the highest energy-efficient models would allow for targeting the models that provide the most significant energy savings. Furthermore, this would help the program to have greater impact and publicity, and thus lower the free-ridership level for clothes washers, which is relatively high.

No.	Recommendations
Instant-R5.	Improve the content of the tracking sheet: Econoler's review of the tracking sheet showed that ENSC took into consideration the recommendations from last year's evaluation and the Evaluator concludes that the 2012 tracking sheet for Instant Savings is complete, consistent and easy to work with. In addition to the improvements already made to the tracking sheet, Econoler noticed two adjustments that could be made in the future to continue the improvements brought to the tracking sheet and facilitate program evaluation: > When possible, ask for the store identifier to be filled in. Having this information would facilitate the organization of field activities like the intercept surveys. However, the Evaluator understands that this could be difficult for some retailers, since they all use different approaches to collect retail store information. > Separate the technical information in two distinct columns to identify: 1) the product description, corresponding to a string of technical information on the product and 2) the wattage values separately. This would facilitate the calculations of the average wattage for each product category.

4.1.3 Home Energy Assessment

The 2012 evaluation of HEA demonstrated that the program underwent a series of changes that altered its design and implementation. In addition to the withdrawal of the federal government from the program, modifications were made to the former EEH program concerning the types of measures eligible for rebates. Indeed, all former measures related to mechanical heating systems were removed from the list of rebated measures and transferred into Fuel Substitution, as well as other programs such as Instant Savings and Solar. HEA now focuses on insulation measures related to the building envelope.

The Evaluator found major improvements to the program since the last evaluation window in 2011. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Moreover, additional efforts were made in program promotion and communication.

Furthermore, one of the recommendations from the 2011 evaluation report was to strengthen the relationship between the DAs and ENSC by notifying the DAs in advance of any major modifications to the program or consulting with them on potential measures to be included in the program. The interviews revealed that there is still improvement to be made in terms of communication.

A great majority of the partners reported the near absence of collaboration and support from Natural Resources Canada (NRCan) to the program after the training activities. Moreover, energy advisors (EAs) talked about the issues regarding the current management of the HOT2000 software by NRCan.

They reported that the software still contained several deficiencies and that NRCan should grant more human resources to finally fix this issue.

When asked about the program marketing and outreach activities, the majority of the program partners stated that they were happy with this year's improvement and proposed continuing aggressive ongoing marketing with a consistent message. For additional improvement, offering more information on the measures provided through the program still came out as one of the main recommendations suggested by program participants surveyed through this year's evaluation.

The program totalled 1,839 participants for the year 2012, which is an increase compared to last year (1,494 participants in 2011). The evaluation revealed that HEA generated net energy savings of 7.184 GWh and demand savings of 2.370 MW at the generator in 2012, compared to 4.805 GWh and 1.543 MW in 2011. Econoler estimated the gross savings of HEA in 2012 through a comparative analysis of information available in the tracking sheet, a billing calibration with 172 participants and the review and proper adjustment of prescriptive measure savings from the old EEH program. Moreover, Econoler took into consideration the free-ridership and internal spillover measured as part of the participant survey. It is to be noted though that no internal spillover was found in 2012.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 17: Recommendations for Home Energy Assessment

No.	Recommendations
HEA-R1.	Strengthen the relationship with the DAs: The interviews with the DAs revealed that there is still improvement to be made in terms of communication between ENSC and the DAs. These improvements include notifying the DAs in advance of any major modifications to the program or consulting with them on potential measures to be included in the program. On this matter, the PM agrees that any modification to the program along with its justification should be communicated to the DAs in advance, so they can be better prepared to support the program. The Evaluator strongly supports an open and constant communication channel as well as strong cooperation between ENSC and the DAs. Therefore, Econoler encourages any means of communication that would allow information to be better transferred between the two parties. The launch by ENSC in 2013 of a Trade Allies Internet portal is a step in the right direction towards better communication with the DAs.

No.	Recommendations
HEA-R2.	Consider the possibility of providing technical support for HOT2000: A great majority of the EAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies, and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee or employing an external expert to provide HOT2000 expertise to the EAs when needed. This expert would also be necessary for the HOT2000 simulation review presented in the following recommendation.
HEA-R3.	Perform a continuous HOT2000 simulation review process: The review of 25 HOT2000 simulations proved that there was a high variability in the quality provided by the EAs. Most of the errors found were recurrent and attributable to the same EAs. While some of these issues were trivial, others substantially changed the EnerGuide rating being simulated by the software. Therefore, the Evaluator considers that a small sampling, with a focus on negative and low EnerGuide rating projects, should be reviewed by ENSC each year. This would help find and address potential errors in the on-site data collection and building simulations. Positive and negative feedback could then be given to the EAs, with a view to continuously improving their work. This HOT2000 simulation review process could also allow ENSC to identify any needs for additional training among the EAs.

4.1.4 Fuel Substitution

The 2012 evaluation of Fuel Substitution found that the transition from a pilot to a component of the Existing Houses program was successful. Participants expressed high levels of satisfaction with the program overall, as well as with its specific aspects. Furthermore, the Evaluator found major improvements in Fuel Substitution since the last evaluation window in 2011. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management such as the various process charts, the evaluation plan and a standardized program manual. Moreover, great efforts were made in increasing upstream program promotion in order to influence decision making among homeowners who have not already decided to replace or substitute their equipment.

ENSC's actions in increasing program promotion and communication contributed to the program awareness in 2012, as it was an important means through which participants learned about the program. This finding could explain the drop in free-ridership to 32 percent in 2012, from 42 percent in

2011, where no upstream advertising was done. However, it should be noted that retail stores continue to be the main source of program awareness as they were in 2011, but to a lesser extent.

The program totalled 282 participants for the year 2012, which is similar to the previous year (296 participants in 2011). The evaluation revealed that Fuel Substitution generated net energy savings of 1.549 GWh and demand savings of 0.857 MW at the generator in 2012, compared to 1.570 GWh and 0.785 MW in 2011. To calculate the net savings of Fuel Substitution in 2012, Econoler reviewed the gross savings used in the tracking sheet by conducting a billing analysis and a literature review. Moreover, Econoler took into consideration the free-ridership and the spillover measured in the participant survey.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 18: Recommendations for Fuel Substitution

No.	Recommendations
Fuel-R1.	Continue marketing efforts and outreach activities: In 2011, the Evaluator recommended the addition of upstream advertising in program strategy. This recommendation has been successfully implemented since survey results indicated that one-third of customers learned about the program through ENSC advertising. The Evaluator recommends continuing marketing efforts and outreach activities as they contribute to lowering the free-ridership level by influencing decision making among homeowners who have not already decided to replace or substitute their equipment. They can also help increase the number of participants.
Fuel-R2.	Consider reintroducing a rebate on high quality, high efficiency ductless mini-split heat pumps: According to distributors, there is a need for ENSC to once again provide a rebate on ductless mini-split heat pumps to encourage the installation of quality ductless mini-split heat pumps. Furthermore, distributors would like to see only heat pumps that achieve a specific minimum level of efficiency being covered through the program. The program review has determined that the Tier 2 ENERGY STAR rating is increasingly becoming a prerequisite for ductless mini-split heat pump rebates, going beyond regular and Tier 1 ENERGY STAR-qualified ductless mini-split heat pumps. The possibility of offering a rebate meeting these criteria would most likely enhance the quality of ductless mini-split heat pumps sold in the Nova Scotian residential market.

No.	Recommendations
Fuel-R3.	Consider conducting calibrated simulations with participants who installed a wood or pellet stove: Wood and pellet stoves are by far the largest contributors of the achieved savings for Fuel Substitution. Together, they accounted for about 78 percent of the energy savings in 2012 and 90 percent of the energy savings in 2011. For this year's evaluation, Econoler revised only the average heating consumption for participants, which is one of the main parameters used in the unitary savings calculations of seven eligible products. This revision allowed for a more precise calculation of savings. However, for the two main products of the program, i.e. wood and pellet stoves, ENSC should consider reviewing the unitary savings values by conducting simulations with real participants and calibrating these simulations with their billing data. With these simulations, it would also be possible to review the demand savings value, based on the load profile.

4.1.5 Low Income Homeowner Service

The 2012 evaluation of LIHS demonstrated that the program is well designed and important to ENSC's program portfolio, considering that it targets customers who generally do not have the financial resources to undertake deep home energy retrofits on their own. The program totalled 811 participants in the year 2012, a slight increase over the 797 LIHS participants in 2011.

On-site visits revealed that the advisors made a great effort to complete a thorough investigation of the house energy components. However, the Evaluator noted that improvement could be made on the advisors' part to determine the exact insulation value of the house. The advisors did not always take the time to do so, either by assessing the building age and materials, or by investigating in many places to find small areas where insulation can be seen directly.

The HOT2000 simulations review showed the high variability in professionalism and training found among DAs. Some of these organizations presented very accurate files that displayed a very good understanding of the simulation process, as defined by NRCan guidelines. On the other hand, other DAs presented files that contained a number of recurrent omissions, incomplete information and calculation mistakes. In addition, almost every file assessed was missing at least a few of the required pictures. Some of these errors were significant and led to inaccurate EnerGuide rating calculations.

The evaluation revealed that LIHS generated net energy savings of 2.209 GWh and demand savings of 1.047 MW at the generator in 2012. In 2011, the Low Income report savings totaled 7.636 GWh and 1.632 MW. However, this included both LIHS and low income direct install participants (the latter are included in RDI and MURB programs in 2012). To calculate the net savings of LIHS in 2012, Econoler reviewed the gross savings estimated by ENSC and included interactive effects.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 19: Recommendations for Low Income Homeowner Service

No.	Recommendations
LIHS-R1.	Consider the possibility of providing technical support for HOT2000: A great majority of the EAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies, and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee or employing an external expert to provide HOT2000 expertise to the EAs when needed. This expert would also be necessary for the HOT2000 simulation review presented in the following recommendation.
LIHS-R2.	Perform a continuous HOT2000 simulation review process: The review of 20 HOT2000 simulations proved that there was a high variability in the quality provided by the EAs. Most of the errors found were recurrent and attributable to the same EAs. While some of these issues were trivial, others substantially changed the EnerGuide rating being simulated by the software. Therefore, the Evaluator considers that a small sampling, with a focus on negative and low EnerGuide rating projects, should be reviewed by ENSC each year. This would help find and address potential errors in the on-site data collection and building simulations. Positive and negative feedback could then be given to the EAs, with a view to continuously improving their work. This HOT2000 simulation review process could also allow ENSC to identify any needs for additional training among the EAs.

4.1.6 Performance Plus

The 2012 evaluation of Performance Plus demonstrated that the program underwent a series of changes that altered its design and implementation. Indeed, Performance Plus went from attributing distinctive incentives for every implemented prescriptive measure to attributing a global incentive determined by an overall EnerGuide rating provided during the final evaluation of the house.

Furthermore, the Evaluator found major improvements to the program since the last evaluation window in 2011. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management such as the various process charts, the evaluation plan and a standardized program manual. Moreover, additional efforts were made in the areas of program promotion and communication.

ENSC's actions in increasing program promotion and communication contributed significantly to program awareness in 2012, as this was the main way participants learned about the program. Moreover, word of mouth was an important source of program awareness, as well as a good indicator of program satisfaction.

Survey results revealed that satisfaction with the program and its various aspects is quite high among homeowners and builders. Both groups expressed recommendations to improve the program that mainly had to do with more information on the measures recommended as well as more marketing and advertising.

Program partners expressed concern regarding the program marketing and advertising. They feel that a large part of the marketing is left up to them. Most of the program partners agreed that people should be more informed about the assessment process, energy efficiency in general and the impact the implemented measures will have.

On-site visits were also conducted to assess the procedures and the ecoEnergy protocol that the EAs must follow during assessments. After the on-site visits, Econoler reviewed the HOT2000 simulations and EnerGuide reports developed by the two EAs. The Evaluator considers these tasks were done rather successfully by the two EAs, who were able to produce very precise EnerGuide ratings using the software.

The program totalled 1,024 participants for the year 2012, which is an increase compared to 2011 (701 participants). The evaluation revealed that Performance Plus generated net energy savings of 4.942 GWh and demand savings of 1.478 MW at the generator in 2012, compared to 2.454 GWh and 0.861 MW in 2011. To calculate the net savings of Performance Plus in 2012, Econoler reviewed the gross savings estimated by ENSC using two features, namely the savings per EnerGuide point increase estimated in the HEA evaluation and the savings generated in relation to the implementation of a series of prescriptive measures. In addition, free-ridership and spillover, through market effects, were measured during this evaluation by the means of participant and builder surveys.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 20: Recommendations for Performance Plus

No.	Recommendations
PP-R1.	Provide participants with more information on the measures recommended: Survey results revealed that participants wish to obtain more information on the measures recommended to them following the first review of house plans. Besides being mentioned as a recommendation to improve the program, the lack of information on the measures recommended was also brought up as the main reason why participants did not reach the EnerGuide rating they were aiming for. Program partners and builders also favor this approach and believe everyone could benefit from more information on the measures recommended during the participation process. Considering this, the Evaluator recommends providing participants with more information on the measures recommended and how these measures affect the EnerGuide rating. This information could be outlined in the HOT2000 report.
PP-R2.	Simplify the incentive table: The incentive table included in the program manual should be significantly simplified, since the incentives will be managed through ENSC as a single window and will be based on an EnerGuide rating only. Tables 8 and 9 of the current program manual are good examples of incentive summaries. For additional improvement, the “pay in full” note in Table 8 should be replaced by the amount required from both the homeowner and ENSC (\$300 each) when referring to the assessment cost.
PP-R3.	Provide more support to DAs in their marketing efforts to reach more homeowners and builders: A large part of the program marketing is handled by the DAs. More joint marketing efforts between the DAs and ENSC would allow reaching more homeowners and builders across Nova Scotia. This recommendation would address one of the main dissatisfactions identified by the program partners, which refers to the lack of support from ENSC in the marketing activities. Indeed, program partners feel the marketing is left up to them. They also believe people should be more informed about the assessment process and energy efficiency in general. The Evaluator thus recommends working in collaboration with the DAs to offer a better program delivery and inform more homeowners and builders about the program.

No.	Recommendations
PP-R4.	Consider the possibility of providing technical support for HOT2000: A great majority of the DAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee on HOT2000 or employing an external expert that could provide HOT2000 expertise to the DAs when needed.
PP-R5.	Investigate the baseline EnerGuide rating for new houses in Nova Scotia: Four studies were performed in 2011 with a view to fine-tuning the baseline EnerGuide value to be used for energy savings calculations. After reviewing these studies as part of the 2011 evaluation, the Evaluator elected to use 78 as the EnerGuide rating baseline value for calculating program gross savings and used the same baseline assumption for 2012. Considering the rapid penetration of high efficiency technology on the market and the relatively high level of free-ridership observed under Performance Plus, the Evaluator believes that ENSC should investigate the evolution of the EnerGuide rating baseline for 2013 and update this value if needed in their savings calculation.

4.1.7 Residential Direct Install

The evaluation of RDI revealed that the transition from a pilot to a component of the Existing Houses program in July 2012 was successful. Indeed, participants expressed a high level of satisfaction with this component, as well as with its various aspects. The Evaluator also commends ENSC on its diligence in implementing tools that will help improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual.

This year's evaluation revealed that the main ways non-low-income participants became aware of RDI were ENSC advertising, ENSC staff and the DAs, word of mouth as well as past participation in other ENSC programs. These results highlight the success of the marketing approach, which specifically relies on these media. Nevertheless, according to the DAs, the program marketing was one of the major barriers to program delivery. They felt that the program is more difficult to market, given that it is restricted to certain regions or demographics and that it is only available in certain areas at certain times. The DAs, therefore, both recommended ramping up outreach and marketing activities. This was also suggested by some non-low-income participants surveyed.

As for the DAs satisfaction with the program, they both reported being satisfied with Residential Direct Install and especially with their relationship with ENSC staff and the other DA. However, they found

that their participation as a program partner was complex because it required incorporating new parameters into a complex and widespread program within a short time frame, e.g. managing a large number of office and field staff while meeting weekly result targets.

The program totalled 28,397 participants for the year 2012, which is a very good result for a new program. The evaluation revealed that RDI generated net energy savings of 37.043 GWh and demand savings of 8.446 MW at the generator in 2012. To calculate the net savings of RDI in 2012, Econoler reviewed the gross savings estimated by ENSC and conducted 100 on-site visits to calculate installation rates for each category of product installed. Moreover, Econoler took into consideration the free-ridership and spillover levels associated with the non-low-income participants. These distortion effects were measured as part of the participant survey.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 21: Recommendations for Residential Direct Install

No.	Recommendations
RDI-R1.	Fine-tune the program marketing approach: The evaluation results indicated that RDI promotional efforts did yield positive results. Nevertheless, according to the DAs, the program marketing was one of the major barriers to program delivery. They felt that the program is more difficult to market, given that it is restricted to certain regions or demographics and that it is only available in certain areas at certain times. As part of the evaluation, DAs as well as some participants suggested improving marketing efforts and communication. Thus, ENSC should continue to conduct consultation with the DAs on this matter and fine-tune the program marketing approach.
RDI-R2.	Continue informing participants about energy-efficient products: The survey results showed that information or advice provided by the program advisor during the installation had an influence on the decision to install energy-efficient products. They also indicated that three quarters of the households remembered receiving information about energy-efficient products during the installer's visit and that this information encouraged many of them to change their behavior in terms of energy use at home. Thus, the Evaluator recommends continuing to include an educational perspective to the program by providing participants with information and advice on the energy-efficient products installed. This would also address the suggestion made by some participants to offer more information on the products installed and improve communication.

No.	Recommendations
RDI-R3.	Improve the content of the tracking sheet: Considering that the program was officially launched this year and has never been evaluated before, the tracking sheet was complete and sufficient for the first year of the program. In the future, Econoler recommends the following to facilitate program evaluation: > Add a unique identification number for each participant; > Identify the products installed in each residential unit; > Collect information on air conditioning; > Make sure that all the fields (e.g. rate code, heat type) are systematically filled out; > Set limitations for entries and develop a validation process.
RDI-R4.	Ensure that there is a real need for nightlights in the household before offering LED nightlights to participants: LED nightlights showed the lowest installation rate. Established at 95 percent, this was not considered as problematic, but the Evaluator noticed one main issue during the on-site visits that could be addressed in the future in order to avoid LED nightlight removal. In some cases, the participants declared that they had removed or given away their nightlights because they did not need them. All of these cases occurred when more than one LED nightlight was installed. In fact, for more than three quarters of the homes visited during this evaluation, two LED nightlights or more were installed. Thus, the Evaluator recommends that before offering a LED nightlight the installer ensure there is a real need for nightlights in the household and that the LED nightlights would replace old incandescent nightlights that are used on a regular basis.
RDI-R5.	Follow the penetration of regular CFLs in the next years: The survey results revealed that CFLs are the product that tends to increase the global free-ridership level of the program. Indeed, many participants declared that they would have installed CFLs without the program, which tends to indicate the acceptance of CFLs by Nova Scotian households. Moreover, the on-site visits demonstrated that most participants already had CFLs installed in their house before their participation. A socket study conducted in 2011 also indicated that households in Nova Scotia have an average of 36 sockets, of which an average of 16 contained CFLs. Overall, this is good news for ENSC as a promoter of energy-efficient products. However, given the penetration of regular CFLs in the market, Econoler recommends that ENSC follow this evolution in the next years to eventually stop offering the installation of free regular CFLs to non-low-income participants.

4.1.8 Multi-Unit Residential Buildings

The 2012 evaluation of MURB demonstrated that the transition from a pilot to a component of the Existing Houses program has been successful overall. The Evaluator found major improvements to the program since the last evaluation window in 2011. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management such as the various process charts, the evaluation plan and a standardized program manual.

Moreover, the marketing strategy of the program has been changed to include distinct approaches for tenants or condo owners who pay their own bills, and for property owners. For tenants or condo owners who pay their own bills, ENSC tried convincing them through several activities, including Facebook events, to install products to save energy and costs. In other cases, the DA directly contacts property owners who inform their tenants about the visits. Collaborating with landlords to perform installations provides easy access to units in which tenants are not responsible for paying the electricity bills.

In 2012, the DA identified on-site support received from superintendents as a barrier to the program's delivery. Without being problematic, on-site support can make all the difference in the number of installations completed. The DA suggested finding ways to tie the success of the installations to recognition or performance of building superintendents. Nevertheless, the DA was very satisfied with the overall program, as were the participants that were interviewed.

The survey results demonstrated the accuracy of the information found in the tracking sheet. Very few discrepancies were observed between survey results and the tracking sheet, as respondents were asked to confirm the products that had been installed through the program. Moreover, no removal phenomenon for a particular product was identified during the survey.

These survey results are in line with the information collected during on-site visits. In the vast majority of cases, the products installed through the program were still in place when the Evaluator conducted the visit. This resulted in very high installation rates, including an installation rate of 100 percent for regular CFLs, the product installed the most and contributes to more than 60 percent of the program savings.

For the impact evaluation, the unitary savings values were reviewed based on a literature review and the validation of the engineering calculations used by ENSC to estimate savings. Installation rates, interactive effects factors and free-ridership were also evaluated to establish the net savings generated by the program in 2012. Thus, the evaluation revealed that MURB generated net energy savings of 2.314 GWh and demand savings of 0.535 MW at the generator in 2012, compared to 0.654 GWh and 0.104 MW in 2011.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 22: Recommendations for Multi-Unit Residential Buildings

No.	Recommendations
MURB-R1.	Analyze the possibility of rewarding building superintendents' support: The new marketing strategy, which involves direct collaboration with landlords or landlords' representatives to perform installations, has significantly contributed to the success of the program. However, in that context, one of the barriers to program delivery is the on-site support received from superintendents, which can make all the difference in the number of installations completed. Therefore, the Evaluator recommends analyzing the possibility to tie the success of the installations to recognition or performance of building superintendents. For example, this could be done by launching a contest among landlords or landlords' representatives in order to reward collaboration.
MURB-R2.	Continue offering information about products installed and energy efficiency: There is a need for an energy efficiency program in the multi-unit renter market, as multi-unit renters are often less interested in energy efficiency and are less likely to install energy-efficient products in a home they do not own and where, in some cases, they are not responsible for paying the electricity bills. Moreover, the low level of free-ridership measured through the participant interviews reveals that most participants would not have installed any energy-efficient products in the absence of the program. These findings highlight the importance of educating this market about energy efficiency. Survey results showed that 70 percent of participants remembered receiving information about energy efficiency or energy savings as part of the program. This is a good result, on which ENSC should continue to build.
MURB-R3.	Collect quantity of products installed in the tracking sheet for each individual tenant unit: In 2012, the quantity of products installed in each individual unit was only collected on paper forms from mid-August. In the future, Econoler recommends keeping track of this information in the tracking sheet, using the unit number instead of the tenant name, since it is rarely possible to collect tenants' names and phone numbers due to tenant privacy issues and the high percentage of tenant turnover in the rental sector. These data would be useful for planning on-site visits with the landlords. The landlords can inform selected tenants of the upcoming visit and ask for their consent to enter their unit. Then, tenants could be visited for validating the installation of products, and a short survey could be completed to learn more about their satisfaction and free-ridership level.

No.	Recommendations
MURB-R4.	Improve the tracking sheet to facilitate field activities and provide a more precise evaluation of savings: Besides the fact that the information should be collected on a unit basis, the tracking sheet review also demonstrated that some improvements could be done to facilitate the field activities (participant survey and on-site visits) and the impact evaluation. First, the Evaluator recommends implementing a protocol to ensure that all the relevant information is collected and systematically recorded in the tracking sheet. In the 2012 tracking sheet, some fields, such as the landlord's name, phone number and rate code, contained a few blank entries. Secondly, the Evaluator identified additional information that could be collected in the future tracking sheet to allow for a more precise evaluation of savings. More particularly, Econoler recommends including the location (indoors or outdoors) of CFLs installed, as well as the energy source used for space heating and the use of air conditioning. Such information would be useful for evaluating the hours of operation and interactive effects for CFLs.

4.1.9 Solar

The 2012 evaluation revealed that Solar had generated net energy savings of 0.120 GWh at the generator. To calculate the net savings of Solar in 2012, Econoler not only reviewed the parameters used for estimating the unitary savings values of each type of equipment installed, but also completed a number of RETScreen simulations to validate whether the savings were acceptable for residential and commercial participants. Furthermore, five on-site visits were completed to validate solar system installation and the consistency between the information presented in the tracking sheet and that found on site.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 23: Recommendations for Solar

No.	Recommendations
Solar-R1.	Complete a RETScreen simulation for all the projects to improve the accuracy of the deemed savings: The RETScreen simulation tool is very easy to use and understand. With adequate input data (such as the number of occupants, the collector slope, the collector azimuth, etc.), the PM could quickly simulate each project and produce a precise savings estimate for each participant.
Solar-R2.	Consider requiring solar installers to complete a RETScreen simulation for all the projects: In relation with the preceding recommendation, participants might have difficulty finding all the required technical information about their solar system. Since solar installers have a better technical knowledge about their products and visit every house to install the equipment, they could collect all the necessary information to complete the RETScreen simulations. Therefore, they could be put in charge of providing the information to ENSC and even completing the RETScreen simulations themselves. Since the software is free and very simple to use, ENSC would only need to provide some simple instructions on information collection and inputting.
Solar-R3.	Include a participant survey to estimate free-ridership (FR) if participation level is high enough to justify doing so: Participants' responses to ENSC's screening question revealed that a certain level of FR could be expected for Solar. Since the participation level was low this year, no survey was conducted to collect the information required to determine a statistically sound FR level. In the future, if a greater number of participants and a more significant energy savings impact are expected, the evaluation should include quantification of an accurate FR based on a participant survey.

4.2 BUSINESS, NON-PROFIT AND INSTITUTIONAL

4.2.1 Business Energy Rebates

The 2012 evaluation of BER demonstrated that the program had undergone a series of changes, creating an intensified impact on the market. In fact, BER has grown in both range and scale, expanding from offering only mail-in rebates on a range of energy-efficient measures to instant rebates through electrical distributors within the province of Nova Scotia (formerly known as the Smart Lighting Choices program). It has also made significant progress towards horizontal diversification by incorporating commercial kitchen equipment and agricultural equipment into the eligible measures.

Furthermore, the Evaluator has observed major improvements to the program since the 2011 evaluation. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Additional efforts were also made in program promotion and communication, as well as in informing participants about expected savings.

ENSC's actions in increasing program promotion and communication contributed significantly to program awareness in 2012, making it the principal means by which participants learned about the program. Contact with contractors or distributors was also an important source of program awareness, highlighting the key role played by these actors in program promotion. Moreover, word of mouth was an important source of program awareness, as well as a good indicator of program satisfaction.

Many distributors noticed that program advertising activities had a good impact on end-user customers and on their business. For instance, they stated that their sales of lighting measures became much easier, especially those related to LED lighting. Apparently, BER achieved success in promoting LED lighting measures in the BNI sector, and the majority of participants and distributors expressed strong satisfaction with the overall program, as well as with its various aspects. Despite this success, some distributors noted that for T8 and ballast products, other BNI programs (namely BES and Custom Retrofit) offered higher lighting incentives than BER and reached a large portion of the BNI customers, which eroded the impact of the BER instant rebate on these products.

The evaluation revealed that BER generated net energy savings of 21.858 GWh and demand savings of 6.285 MW at the generator in 2012, compared to 14.956 GWh and 3.469 MW respectively in 2011. To calculate the net savings of BER in 2012, Econoler reviewed the gross savings estimated by ENSC, based on 50 on-site visits and a literature review, and took into consideration the free-ridership level for each rebate approach.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 24: Recommendations for Business Energy Rebates

No.	Recommendations
BER-R1.	Analyze product offering to reduce duplicate rebates and program overlapping in the market: Some eligible measures covered by the BER instant rebate approach are also covered by other BNI programs (BES and Custom Retrofit). When analyzing the savings associated with the instant rebate, Econoler found that 37 percent of the T8 lamps and 48 percent of the ballasts eligible for an instant rebate were already funded by another BNI program. This information was confirmed by some of the distributors interviewed during this evaluation. They indicated that most of their high-performance and reduced-wattage T8 lamps and high-performance ballasts were sold through other ENSC programs, mostly BES. These distributors explained that for these products, a large part of their sales volume came from a small number of contractors who worked on projects under other BNI programs. Although some products were double-funded, it is important to note that ENSC did not claim savings within the BER program for these items. The Evaluator was advised that ENSC already planned to remove the lamp and ballast rebates from the range of rebates accessible to the BES DAs and Custom project contractors. Still, the Evaluator considers that the products rebated through BER Instant Rebate should be limited to specific products with low market penetration since T8 lamps and HP ballasts are largely covered by the other two BNI programs offered by ENSC. Thus, Econoler recommends reviewing product offering of the BNI programs and limiting instant rebates to specific products with low market penetration, such as LED technologies. This would avoid double funding, dissatisfaction by stakeholders and program-overlapping in the market (i.e. offering different rebates under different forms for the same market).
BER-R2.	Improve the tracking sheet to facilitate effective validation of savings: Improvements to both mail-in and instant rebate tracking sheets could be made to facilitate analyzing energy and demand savings calculated for the program. Currently, all the values used in savings calculations are contained in one cell. Breaking down these values in different cells would allow the Evaluator to easily validate the savings calculations for each category of product and apply adjustments when necessary. Furthermore, both tracking sheets contain information presented in separate tabs. Consolidating all the information in one main database is another change that would facilitate the evaluation process.

No.	Recommendations
BER-R3.	Define different full load hours values according to building characteristics: Currently, for HVAC measures, ENSC uses two typical full load hours values to estimate energy savings in heating, depending on the heat pump capacity. Thus, these same values are applied on all types of building. However, the on-site visits demonstrated 1) that very few participants were able to enter a reliable value in the “Full load hours” field of the HVAC worksheet; and 2) that full load hours could vary significantly depending on the building’s characteristics, such as the building type and the temperature set point. Therefore, Econoler recommends developing a reference table with full load hours values defined according to different factors that might affect them like the building type (office building, retail stores, etc.) and the heating temperature set point of the building. This kind of information can be more easily and reliably collected using the worksheet than the full load hours themselves. A similar approach to recording the full load hours could be followed for cooling measures.
BER-R4.	Introduce tighter control on some product requirements: For lighting measures, one of the elements having a significant impact on the savings review is replacing non-eligible old lamps. To mitigate this issue in the future, the Evaluator recommends that participants be required to provide photographs of the lamps and/or fixtures they intend to replace, regarding lighting products with an eligibility criterion requiring the new product to replace a specific type of lamp or a minimum level of wattage. This recommendation is not intended to estimate savings based on the real wattage values of the replaced old lamps, but to ensure that this specific eligibility criterion is met and savings calculations are in compliance with the baseline.
BER-R5.	Move products from the instant rebate to the mail-in rebate: In relation to the preceding recommendation on validating the eligibility of old lamps, there could also be a similar issue with LED chandelier lamps and LED high bay fixtures. Therefore, Econoler recommends that these products be included in the mail-in rebate portion of the BER program so that ENSC has tighter control on eligibility criteria by requiring the photographs of the lamps and/or fixtures that the participant intends to replace. This recommendation also resonates with some distributors, who mentioned during the in-depth interviews that eligibility criteria on the products to be replaced were really difficult to validate in stores unless they collected the replaced old lamps, which would have required much time, space and organization.

No.	Recommendations
BER-R6.	Standardize savings calculations for lighting products with typical baseline values: A statistical analysis of the adjustment ratios calculated for each of the 14 lighting projects visited for this evaluation demonstrated that the error margin was too high, making it impossible to apply a common adjustment ratio on all the projects implemented in the category. This large error margin was due to the large variations between the adjustment ratios obtained from the on-site visits. Even if the sample size had been ten times bigger, the error margin would have remained very high because of the huge variations in the adjustments. These large variations between the adjustment ratios calculated for each project raised a question on the methodology used to estimate savings. A major source of errors certainly resided in the fact that savings were based on the real wattage values of the replaced old lamps declared by participants. Therefore, Econoler recommends standardizing the savings calculations for lighting products with typical baselines for every type of product installed. Such an approach to all eligible products would greatly simplify the savings calculations. And then, ENSC would only need to monitor the market trends and the new regulations introduced to adjust the baseline table, when necessary.
BER-R7.	Ensure that the participant provides the motor specifications sheet: For motor measures, the adjustments made to the savings calculations were generally a consequence of wrongly identified efficiency values on the worksheet. Therefore, the Evaluator recommends ensuring that the participant provides the motor specifications sheet (or a picture of the motor nameplate) to make it easier for ENSC to validate efficiency results at the savings calculation stage.

No.	Recommendations
BER-R8.	Develop a reference table with baseline and new wattage values for T5 and T8 high bay fixtures, LED technologies and induction technologies: The review of the displaced wattage values used for T5 and T8 high bay fixtures, LED technologies and induction technologies showed that the savings used in the tracking sheet might have been underestimated in some cases because of the relatively low ballast wattage values used for baseline fixtures. Moreover, for the new fixtures installed, ENSC often only uses the wattage of the lamp since most product specifications sheets do not list the wattage values of the whole fixture. For the 2012 evaluation, no adjustment was made since specific savings values were calculated for each product sold through the program and that savings values were calculated in one cell, making it impossible to apply any adjustment factor. To make savings evaluations more precise in the future, Econoler recommends developing a reference table with baseline lamp and ballast wattage values associated to each type of T5 and T8 high bay fixture, LED technologies and induction technologies sold through the instant rebate approach. These values would be based on typical replacement scenarios found in literature or established by well-informed market experts. For the wattage values of the new fixtures installed, Econoler recommends using typical ballast factor values instead of the information on each product specifications sheet, which is often unavailable.
BER-R9.	Include interactive effects in calculating the tracked savings of all the indoor lighting products sold through the instant rebate approach: For the lighting measures implemented through the mail-in rebate approach, interactive effects were already included in ENSC's gross savings calculations. For the instant rebate approach, interactive effects are only considered for LED strip lighting used in refrigeration applications. Therefore, the Evaluator had to adjust the tracked savings to take into account an interactive effects factor of -15.5 percent for all indoor lighting products. To make savings calculations more precise in the future, interactive effects should be systematically integrated into the savings calculations of all the indoor lighting products sold through the BER instant rebate.

4.2.2 Custom Retrofit

The 2012 evaluation of Custom Retrofit demonstrated that the program had undergone a series of positive changes that helped to improve and simplify its implementation and evaluation. Custom Retrofit was initially one of the two distinct components of a program named Custom, with one component targeting retrofit projects (Custom Retrofit) and the other targeting new constructions or major renovations to existing buildings (Custom New Construction). In 2012, Custom Retrofit and Custom New Construction were evaluated separately.

The Evaluator has noticed major improvements to the program since the last evaluation window in 2011. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Moreover, additional efforts were made in involving professionals in program promotion.

This year's evaluation revealed that the main source of awareness of Custom Retrofit was ENSC's marketing and outreach activities, as well as contractors or distributors. The validated importance of these actors in program awareness reflects the improvement made in enhancing program awareness and collaborating with contractors and design professionals to promote the program, as recommended by the Evaluator in the 2011 evaluation.

As was the case with the 2011 evaluation, the satisfaction with Custom Retrofit in 2012 was very strong with the majority of participants reporting being very satisfied with the program overall and most of its aspects. The two aspects less satisfactory were the wait times required to confirm eligibility and receive rebates. Despite the above, satisfaction was generally strong.

The program saw a total of 155 projects implemented for the year 2012, which was similar to that of 2011 (159 projects). The evaluation revealed that Custom Retrofit generated 28.941 GWh in net energy savings and 3.490 MW in demand savings at the generator in 2012, compared respectively to 30.323 GWh and 3.764 MW for the year of 2011. To calculate the net savings of Custom Retrofit in 2012, the Evaluator used an approach that involved conducting on-site visits of sample projects and an in-depth review of each sample project's technical documentation (e.g. feasibility study, metered data, energy billing, M&V reports, etc.). Then, the Evaluator calculated the gross energy and peak demand savings for all sample projects, based on the specific characteristics of each project type. The adjustment factors that resulted from this calculation were used to estimate the overall gross savings. Moreover, Econoler took into consideration the free-ridership and internal spillover, both measured on the basis of the participant survey.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 25: Recommendations for Custom Retrofit

No.	Recommendations
Custom-R1.	Consider diverting or assigning a proportion of the simple lighting retrofit projects to other prescriptive measure programs: When reviewing the project list of 2012, Econoler noticed a high percentage of simple projects, i.e. projects involving only one or a limited number of different energy efficiency measures. For instance, the projects including only lighting retrofit accounted for almost 60 percent of the projects claiming savings in 2012 and achieved more than 52 percent of these savings. Many of these projects are small or medium lighting retrofits that could have been supported by other BNI programs, such as BES. When possible, the Evaluator therefore recommends diverting and assigning other such upcoming simple projects to other BNI programs so that they could be tracked and managed in a more efficient and cost-effective way.
Custom-R2.	Improve tracking on implemented measures and savings: In several projects whose expected savings had been calculated in a feasibility study prepared by a third-party consultant, there was no clear statement on which measures were selected for implementation by the participant. Figure 3 of PDA Form 4 often provided some information about this, but for a number of projects the Figure 3 was not filled out or did not give the full details, which prevented knowing about the exact energy efficiency measures implemented. Consequently, the Evaluator had to investigate the status of project implementation during on-site visits, which might cause errors, especially when the person met during the visit knew little about the project or did not have an adequate understanding of all the technical aspects of the measures implemented. Thus, the Evaluator suggests that ENSC improve the tracking on the list of measures implemented and the savings related to each measure for every participating project.

No.	Recommendations
Custom-R3.	Improve the method for diversity factor calculations and document the assumptions used: When reviewing the project gross impacts, Econoler observed that diversity factors used by ENSC were generally obtained by dividing annual operation hours by the total of hours in one year (8760). This practice is very conservative and does not reflect the reality. Since an operating schedule is available for each project, it is possible to refine this calculation method by excluding the number of hours during which the facility is closed, or in some cases by taking into consideration that the equipment operates continuously during the peak demand hours.
Custom-R4.	Promote more active and extensive use of the M&V procedures: Standard Custom Retrofit projects must have an M&V plan compliant with the IPMVP (Section 6.7 of the program manual). For the majority of the 31 projects evaluated, the Evaluator did not observe any satisfactory M&V plans or reports during the in-depth reviews of the sample projects. Although M&V requires both the participant and ENSC to spend time and money, these additional resources would add key value to projects that yield such significant savings. As a major priority, M&V should thus be first and foremost conducted on large projects. In addition, M&V should be conducted on projects for which the savings to be realized depend heavily on equipment operating conditions, namely those involving industrial components such as compressors, variable speed drives and manufacturing equipment. As it was proposed in 2011, basic M&V procedures for any particular project should be defined at the earliest stage of project planning and execution (e.g. PDA signature) to ensure that baseline consumption data are metered (if required) before energy efficiency measures are implemented. This would greatly facilitate M&V activities and reduce their costs.

No.	Recommendations
Custom-R5.	Consider performing independent M&V on Custom Retrofit projects that are already carrying out M&V: The Evaluator believes that this recommendation from the 2011 report is still applicable. In fact, ENSC should consider performing independent M&V on projects where the implementation firm has already planned to conduct M&V within its project scope. It is possible that such M&V performed by implementation firms will not be in compliance with the IPMVP. It is also likely that such M&V will cover measures both eligible and ineligible for the Custom Retrofit program and that it is impossible to distinguish between them in the M&V results. In addition, assigning the sole responsibility of M&V to the firm that also implements the project may be risky. To reduce this risk, the Evaluator recommends that ENSC perform an independent M&V on such projects. A minimum threshold of energy savings (e.g. 500 MWh/year) could also be established to differentiate projects that automatically require independent M&V from those for which it is be optional.

4.2.3 Custom New Construction

The program saw a total of 8 projects implemented for the year of 2012, which is similar to the number of projects in 2011 (9). This year's evaluation also revealed that NC generated net energy savings of 4.644 GWh at the generator in 2012, compared to 2.607 GWh in 2011. Unlike 2011, NC claimed peak demand savings as part of this year's evaluation along with energy savings, for each of the projects included in the tracking sheet. Econoler's verification revealed that NC achieved net peak demand savings of 0.525 MW in 2012.

To calculate the gross energy and peak demand savings of NC in 2012, the Evaluator used an approach that involved conducting on-site visits of all projects and in-depth participant interviews during these on-site visits. This process allowed the Evaluator to calculate the gross impacts for all the 2012 projects by considering the specific characteristics of each project type. Moreover, Econoler took into consideration the free-ridership measured through the participant interviews to establish an appropriate NTGR for this year and thereby calculate the net energy and peak demand savings NC achieved in 2012.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 26: Recommendations for Custom New Construction

No.	Recommendations
NC-R1.	Ensure that program participants provide appropriate peak savings calculations: As was the case with the 2011 evaluation, the feasibility studies and building simulation reports made available by program participants in 2012 featured no or very limited information on potential demand savings to be achieved by their new construction projects. It was therefore very difficult for ENSC to track such savings and for Econoler to evaluate them. ENSC should also ensure that program participants provide not only estimated peak demand savings, but also sufficient information to establish an appropriate diversity factor for the project. Such information could include the simulated hourly peak load curve of the new building or at least the proportion of the demand savings achieved by the energy-efficient electrical systems (lighting, HVAC, etc.) along with their respective operation schedules. Finally, ENSC should also record in the program tracking sheet the peak demand savings of each project with some details on how they were calculated as well as the diversity factor used for each project.
NC-R2.	Improve tracking and monitoring of project status and savings: The Evaluator ran into a number of difficulties when investigating the status of each project as part of the 2012 in-depth assessment. The NC tracking sheet presented very limited information on the details and status of each project. Most of the project folders made available included only the project development agreement and the feasibility study with a few related documents, but no status or verification report from ENSC. Such a report would have allowed Econoler to understand how ENSC estimated the claimed savings (which were sometimes very different than those in the feasibility study) and what was actually constructed on site. Furthermore, two out of the 10 on-site visits performed revealed that the status of the construction process did not allow claiming any savings (even partially) in 2012. Therefore, Econoler recommends that ENSC improve tracking and monitoring of NC projects' status and, if possible, develop tools (e.g. status reports) to help internal and external users (e.g. the Evaluator) better understand the progress of each project.

No.	Recommendations
NC-R3.	Collect energy billing data from program participants: Once the new construction is complete, it would be a good practice for ENSC to start collecting the energy billing data of the new building from the program participant for at least four to six months after building commissioning. This information would allow making a comparison between the proposed consumption simulated by the consultant and the actual consumption. The results and analyses of such a comparison could help ENSC identify potential issues with building simulation accuracy as well as the gaps between the list of energy efficiency measures planned in the feasibility and those actually implemented on site, thus strengthening ENSC's quality control over NC projects.
NC-R4.	Conduct a literature review to validate whether the baseline design being used in NC reflects the state-of-the-art construction practices: In most of the feasibility studies reviewed by Econoler, the potential energy and peak demand savings were estimated with a baseline facility built to the 1997 MNECB as the basis for comparison. In a few cases, the original building design (also defined in the study) was more energy-efficient than the MNECB 1997 reference building. Moreover, eligible projects must achieve at least a 30-percent increase in energy efficiency over the MNECB, which suggests that the MNECB minimal requirements are not stringent enough. In light of this, the Evaluator believes the 1997 MNECB may not be the most suitable baseline for comparison in such a program. Similar new construction programs in other Canadian jurisdictions fine-tuned the 1997 MNECB baseline design to better reflect the state-of-the-art construction practices. Therefore, Econoler recommends that ENSC conduct a literature review of the other new construction programs in place elsewhere in Canada to optimize the baseline construction design to be used under NC for energy and demand savings calculations.

4.2.4 Business Energy Solutions

The 2012 evaluation of BES demonstrated that the program is well-designed and generates important electric savings. The program underwent structural changes in 2012. Indeed, BES is now comprised of two components: SBES and CDI. SBES carries the same objectives as its initial version implemented from 2008 to 2011. As for CDI, it pursues the same goals as those targeted by EP-DI in 2011. These changes allowed for the program to offer both lighting and non-lighting measures to eligible small businesses across Nova Scotia for a payment of as low as 20 percent of the installation and materials costs through SBES, and for no cost through CDI.

The evaluation revealed that ENSC is successful at communicating about the program, as it was the main way participants learned of it. It is noteworthy, though, that this was much more likely for CDI

participants. Contacts with contractors or vendors were also an important source of program awareness, especially for SBES participants, showing the importance of these actors in program promotion. Moreover, word of mouth was an important source of program awareness, more likely among SBES participants, as well as a good indicator of program satisfaction.

Both CDI and SBES achieved a high level of participant satisfaction, with a higher satisfaction level among SBES participants. The majority of participants were also satisfied with the length of time between their application for the program and the implementation of measures in their facilities. Participants offered recommendations to improve the program that went from increasing advertising and improving communication to providing a quicker participation process.

The program totalled 4,208 participants for the year 2012. SBES accounted for 1,239 of those participants (including participants from the Very Small Business and Retail LED pilots), while CDI covered 2,730 of them (including 84 participants from MURB). The remaining 239 participants took part in the LED Blitz pilot in December 2012.

The impact evaluation revealed that BES generated net energy savings of 30.152 GWh and demand savings of 5.244 MW at the generator in 2012. To calculate the net savings of BES in 2012, Econoler reviewed the gross savings estimated by ENSC and included interactive effects for lighting products. Moreover, Econoler took into consideration the free-ridership levels for each program component and spillover for SBES.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 27: Recommendations for Business Energy Solutions

No.	Recommendations
BES-R1.	Improve the tracking sheet to allow for a better validation of savings: Both SBES and CDI tracking sheets show some improvements on last year's version. In 2013, the information will be gathered in one main tracking sheet, using the SBES tracking sheet model. With that in mind, the Evaluator highlighted some potential adjustments that could be made to improve the content of the future tracking sheet and allow for a better validation of savings: > Specify the detailed characteristics of each type of lighting product installed, namely the number of lamps per fixture, the wattage of the lamps and the ballast factor; > Track the quantity of CFLs and LED lamps installed based on the type and wattage of the lamps replaced to facilitate the validation of the displaced wattage values used in the unitary savings calculations; > Calculate gross and net energy savings directly in the tracking sheet; > Make savings calculations automatic to ensure that the savings recorded in the tracking sheet correspond to those calculated using the parameters filled out for each measure (quantity, unitary wattage value, hours of operation, etc.); > Add a field to indicate the heating energy source, if air conditioning is used in the building and if the lighting products were installed inside or outside the building; this would allow for a more precise evaluation of interactive effects factor; and > Collect the specific length (in feet) of insulated pipe installed in each participating facility to calculate the savings accordingly and limit the length to the first 15 feet.
BES-R2.	Include a ballast factor in the unitary wattage calculation of hardwired CFLs, metal halide fixtures and high pressure sodium fixtures: The impact evaluation of SBES revealed some inconsistencies in the approach used to calculate the unitary wattage values of the following products: hardwired CFLs, metal halide fixtures and high pressure sodium fixtures. For these products, ENSC only considers a ballast factor for the old product that was replaced. For the new product installed, a ballast factor of 1 is applied, which is not appropriate. These types of products include a ballast that consumes a certain wattage. Therefore, Econoler recommends modifying the approach in the future to include a ballast factor in the unitary wattage calculation of hardwired CFLs, metal halide fixtures and high pressure sodium fixtures installed through the program.

No.	Recommendations
BES-R3.	Develop a validation process for product removals: Some inconsistencies related to product removal were noted in the CDI tracking sheet by the Evaluator. In some cases, an installer had to come back to replace lamps initially installed with another type of energy-efficient lamp, but no deductions were made to subtract the quantities of lamp that were removed. For this year's evaluation, Econoler made some spot checks in the tracking sheet and, when noticing that such situations occurred, adjusted the quantities of products installed accordingly. However, the Evaluator could not go through all the projects recorded in the tracking sheet. Therefore, it is essential for ENSC to develop a validation process to ensure the accuracy of the quantities of product entered in the tracking sheet and that deductions are made when some products are removed or replaced by other energy-efficient products.

4.2.5 Codes and Standards

Evaluating the energy impact of any regulations or policy will always be more challenging than calculating the impact of a DSM program with a list of participants and a number of products distributed. For C&S, the main challenge resides in the necessity of understanding the whole market of the targeted products. This does not only include finding the quantity of products sold in a specific market, but also requires a deep characterisation of that market (e.g. quantity per size, type, efficiency level, etc.). Depending on the product, this information can be hard to obtain and even impossible in some cases, as shown by the exclusion of some C&S from this evaluation.

Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Table 28: Recommendations for Codes and Standards

No.	Recommendations
CS-R1.	Collect all the studies conducted by NRCan on new MEPS implementation: Before implementing any new standards, NRCan normally conducts a market analysis and an energy impact analysis. These studies allow NRCan to validate the minimum efficiency requirements of their new standards and analyze its potential impact on the market. These studies generally include information on the market size by category, the non-compliance rate and the estimated unitary savings values. As demonstrated in this report, this information is absolutely necessary if ENSC wants to estimate the energy impact of each standard on the Nova Scotia market. Therefore, the Evaluator recommends that ENSC request all the studies conducted by NRCan on new MEPS to be implemented in the future and for which ENSC intends to evaluate its impact.

No.	Recommendations
CS-R2.	Prepare a list of contact names that could provide market information specific to Nova Scotia: The Evaluator recommends that, for future evaluations, once ENSC knows which MEPS will be implemented during the target period, ENSC start preparing a list of contact names that could be interviewed. The objective of these interviews is to collect market information on each product and to validate the information provided in the NRCan studies mentioned in the preceding recommendation. The list of contact names should be prepared for each product by including manufacturers, distributors and any associations which might be able to provide information specific to the Nova Scotia market. Since the information available from NRCan is quite often about the whole country at the national level and is not about any province in particular, province-specific information or data cannot be easily derived or generated. Therefore, it is extremely important to develop such a list.

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APPLIANCE RETIREMENT IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

February 28, 2013



ECONOLER

ACRONYMS

ARet	Appliance Retirement
CATI	Computer-Assisted Telephone Interviewing
CRA	Corporate Research Associates
DA	Delivery Agent
ENSC	Efficiency Nova Scotia Corporation
NTGR	Net-to-Gross Ratio
PM	Program Manager

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
EnerGuide rating	An EnerGuide rating shows a standard measure of the home's energy performance. It shows exactly how energy-efficient the home is.
Demand-to-energy ratio	A ratio obtained by dividing the target peak demand savings by the target energy savings of a given program for a given year.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.

Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Spillover (internal)	Percentage of savings attributable to participants who continue to implement the energy efficiency measures introduced by a program after participating in it once, without participating in the program a second time.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Appliance Retirement (ARet), which is a component of the Efficient Products program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM) and three delivery agents (DAs), four on-site visits as well as a telephone survey of 201 participants.

PROGRAM COMPONENT OVERVIEW

ARet began as a pilot in 2010 in the Halifax and Cape Breton Regional Municipalities. It was designed to encourage the retirement of old household appliances, such as refrigerators, freezers and room air conditioners. In 2011, Efficiency Nova Scotia Corporation (ENSC) expanded ARet to include all of Nova Scotia.

ARet persuades Nova Scotians to retire their old appliances by educating them on the cost of maintaining the appliance, providing a cash incentive (from \$10 to \$35 depending on the appliance), as well as offering a free pickup service from the home itself (not curbside).

Besides removing old appliances from the premises, ARet also offers an appliance recycling service. Appliances are shipped to a local recycling depot where over 95 percent of the constituent materials are recycled. Participants can register to have their appliance(s) picked up by contacting a call centre or by registering on the ENSC website.

In 2012, some changes were made to ARet, such as the exclusion of dehumidifiers from the list of covered appliances, for cost-effectiveness reasons, and the reorganization of the program partners into two delivery agents (DAs). ARCA Canada is responsible for appliance transportation and recycling, while Answer 365 operates the call centre that is used to book appointments through a system called Enerpath. ARet now uses AIR MILES® to offer reward points for every retired appliance.

The program aimed to achieve net electricity savings of 5.4 GWh and demand savings of 0.8 MW for the year 2012.

KEY FINDINGS

The 2012 evaluation of ARet demonstrated that the program is well designed and has an important level of participation. Indeed, the program achieved the retirement of 7,976 units for the year 2012. In terms of net energy savings, it generated 6.795 GWh at the generator, in comparison to 7.175 GWh in 2011, when dehumidifiers were still eligible in the program, and 2.14 GWh in 2010.

Awareness

To ensure program continuity in the years to come, program awareness constitutes an important aspect of the overall strategy. Similar to the survey results of 2011, this year's evaluation revealed that the main source of awareness of ARet was coming from ENSC's advertising. These results highlight the positive impact of the marketing efforts on customer awareness as well as on the high number of participants. Word of mouth, which is a strong indicator of overall customer satisfaction, was also an important source of program awareness.

As for the DAs, they all expressed high satisfaction with the improvement in current outreach and marketing activities and with their outcome across the province. As a suggestion for improvement, one partner recommended targeting rural communities to allow better penetration of this market. Moreover, the partners mentioned that an increase in retailer participation and municipality awareness of ARet could help program delivery.

In addition, the Evaluator noted an important improvement regarding last year's recommendation on the amount of information provided on appliance disposal, since this year's survey results revealed an increase in participants' awareness of the recycling component of the program. This result is particularly interesting since the removal and recycling services provided as part of the program is the most important factor in the customer's decision to retire an appliance through the program. As for the \$10 or \$35 incentive provided by ENSC, that is the third factor of influence, behind the removal and recycling services and the information or advice received through the program.

Satisfaction

Satisfaction with the program was very high among participants. Indeed, almost all participants (95%) expressed their satisfaction with the program. In particular, enrolling in the program was considered easy by nearly all participants, whether they enrolled online or over the phone. Similarly, the majority of participants found it extremely easy to schedule a pickup time for their appliance. Although the ease of scheduling a pickup was not an issue in the past, the survey results indicate improvement, which is very positive for the program. Finally, almost all participants (99%) reported that they would recommend ARet to a friend or family member, which is a strong indicator of satisfaction.

The program partners were also very satisfied regarding the program overall. All the interviewed partners had good things to say about program efficiency and stated that the on-course modifications required minor changes to their work. Noteworthy is that one DA indicated that working with AIR MILES was often challenging, as their ability to meet tight timelines was not always great.

Program Energy Savings

To calculate the net savings of ARet in 2012, Econoler reviewed the gross savings estimated by ENSC using results from a metering study conducted for the 2011 evaluation at the recycling facility and from other studies for similar programs. Moreover, Econoler took into consideration the appliance usage and the free-ridership and internal spillover measured through the participant survey. Through this approach, a free-ridership level of 17 percent was captured, while a spillover level of 1 percent was identified.

The next table presents the key distortion effects calculated through the program impact evaluation.

Table 1: Distortion Effects and Net-to-Gross Ratio

	2012
Free-Ridership Level	17%
Spillover Level	1%
Net-to-Gross Ratio	0.84

The evaluation revealed that ARet generated net energy savings of 6.795 GWh and demand savings of 0.999 MW at the generator in 2012.

Table 2: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	NTGR	Net Savings
Energy Savings			
Tracked Savings from ENSC	9.875 GWh	0.79	7.801 GWh
Evaluation Results	8.089 GWh	0.84	6.795 GWh
Demand Savings			
Tracked Savings from ENSC	1.452 MW	0.79	1.147 MW
Evaluation Results	1.189 MW	0.84	0.999 MW

The evaluated net savings fell short of those tracked by ENSC by 13 percent. This result is mainly due to the revision of the unitary savings values for each type of appliance. The revised unitary savings values for refrigerators and freezers were slightly lower than those estimated by ENSC due to the new average age, size, partial use factor and proportion of primary and secondary units calculated for the units retired in 2012. More specifically, the average age of refrigerators and freezers retired was younger this year, which had the most significant impact on their unitary savings values. For room air conditioners, the unitary savings value calculated for this evaluation was higher than the one used for tracked savings since it took into account a replacement ratio.

Another factor that explains the differences between the tracked savings and the evaluation results is the NTGR. In the tracking sheet, ENSC used a NTGR of 0.79, based on the 2011 evaluation report. For this year's evaluation, the NTGR was established at 0.84. The increase in the NTGR is due to lower levels of free-ridership measured for refrigerators and freezers. As in 2011, an internal spillover level of 1 percent was also captured.

RECOMMENDATIONS

Econoler finds that the program works well overall and at a satisfactory level. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator makes specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- ARet-R1. Continue marketing efforts and perform targeted marketing in rural communities:** The ARet marketing campaign has improved since the last evaluation to include many different mediums and a brochure about appliance disposal. All partners interviewed indicated they were very satisfied with the current marketing and outreach activities and their outcome across the province since last year's evaluation. Moreover, survey results highlight the positive impact of ENSC advertising on customer awareness. The Evaluator recommends continuing marketing efforts and allowing efforts to reach rural communities in order to increase penetration in this market.
- ARet-R2. Explore the possibility of lowering the rebate:** Participants' survey responses revealed that the money incentive is the third factor influencing the decision to retire an appliance through the program. The removal and recycling services, followed by the information or advice provided as part of the program, were most important. Although this could be viewed as an indication that the incentive rebates could be lowered, there are no other results in the present evaluation that confirm this. Therefore, for the next evaluation, Econoler recommends probing deeper into the possibility of lowering the rebate amount and the consequences that this might have on appliance retirement.
- ARet-R3. Collect information on the manufacture year of refrigerators and freezers, as well as the capacity of room air conditioners:** Where available, the Evaluator recommends collecting the manufacture year of the refrigerators and freezers retired through the program in addition to the age of the appliance, as declared by the participant. These parameters are for the unitary savings calculation. For room air conditioners, the Evaluator recommends collecting the capacity of all units retired and including this information in the main tracking sheet. This would allow for a more precise estimate of the unitary savings value for this appliance.

ARet-R4. Pursue the metering of refrigerators and freezers at the recycling facility: For this year's evaluation, the results obtained from the metering activity conducted on refrigerators and freezers were not conclusive. Therefore, the unitary savings calculation was based on average annual consumptions obtained from the metering activity conducted for the 2011 impact evaluation. For the next evaluation window, Econoler recommends reviewing the metering protocol and pursuing this activity to measure the annual consumptions of a representative sample of refrigerators and freezers that will be retired through the program in 2013.

1 COMPONENT DESCRIPTION

Appliance Retirement (ARet) began as a pilot in 2010 in the Halifax and Cape Breton Regional Municipalities. It was designed to encourage the retirement of household appliances, such as refrigerators, freezers and room air conditioners. In 2011, Efficiency Nova Scotia Corporation (ENSC) expanded ARet to include all of Nova Scotia.

ARet persuades Nova Scotians to retire their old appliances by educating them on the cost of maintaining the appliance, providing a cash incentive (from \$10 to \$35 depending on the appliance), as well as offering a free pick-up service from the home itself (not curbside).

Besides removing old appliances from the premises, ARet also offers an appliance recycling service. Appliances are shipped to a local recycling depot where over 95 percent of the constituent materials are recycled. Participants can register to have their appliance(s) picked up by contacting a call centre or by registering on the ENSC website.

In order to be eligible, all appliances must be plugged in, in working order and older than 10 years. In addition, refrigerators need to be standard size, between 10 and 25 cubic feet. To save on fuel and ensure that the trip is worthwhile for the pickup team, room air conditioners are only picked up in conjunction with the retirement of a fridge or freezer. To participate in the program, customers must own the appliance they wish to retire. In 2012, some changes have been made to the program, such as the exclusion of dehumidifiers from the list of covered appliances for cost-effectiveness reasons and the reorganization of the program partners into two delivery agents (DAs). ARCA Canada is responsible for appliance transportation and recycling, while Answer 365 operates the call centre that is used to book appointments through a system called Enerpath. ARet now uses AIR MILES® to offer reward points for every retired appliance.

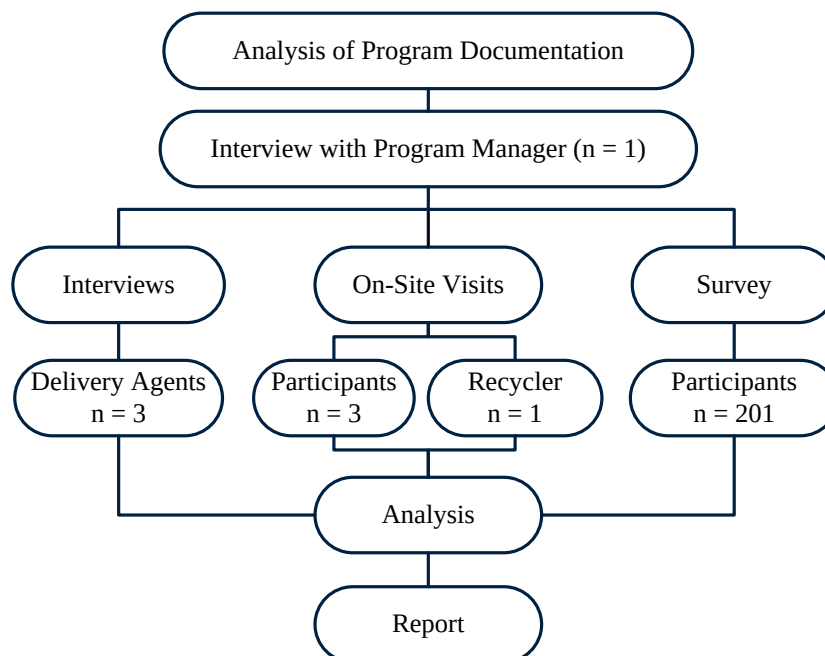
The program aims to achieve net electricity savings of 5.4 GWh and demand savings of 0.8 MW in 2012. Savings generated by ARet are accounted for under the Efficient Products program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for ARet. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was primarily obtained from the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews with the Program Manager (PM), in July 2012 and September 2012 respectively. These interviews were intended, among other things, to follow up on the 2011 evaluation recommendations regarding process issues, as well as to understand the main changes that were made to program delivery in 2012. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 Interviews with Delivery Agents

In October 2012, three interviews were conducted with the program DAs in order to understand, among other things, their involvement in the program, their participation process, as well as their perception of and satisfaction with the program.

The protocol used for the interviews with the DAs is presented in Appendix II for reference.

2.2.4 On-Site Visits

In November 2012, three on-site visits were conducted at households that had retired an appliance through the ARet program. They were conducted by Econoler's subcontractor, Equilibrium Engineering. These visits were used to gather information on the units retired (e.g., usage, primary or secondary unit, etc.) and the actions taken afterwards by homeowners. Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix III.

Additionally, the Evaluator conducted one visit at the recycling facility where the appliances retired through the program are taken. The main purpose of this visit was to ensure that, once at the recycling facility, the retirement and recycling processes were conducted properly and that the metering activity was conducted in accordance with the protocol.

2.2.5 Participant Survey

A telephone survey with a total of 201 program participants was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in October and November 2012 using computer-assisted telephone interviewing (CATI) technology. The average length of the survey was 12.5 minutes.

The participant survey was meant to generate feedback on the following aspects of ARet:

- > spillover and free-ridership;
- > program awareness;
- > participant motivations, concerns and barriers;

- > satisfaction with the program; and
- > recommendations for improvements.

The demographic profile of the survey respondents and the survey questionnaire are shown in Appendices IV and V respectively. The products covered by the survey were refrigerators, freezers and air conditioners. It is to be noted that overall percentages presented in the Participant Perspectives section may not equal 100% due to rounding.

The table below shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2011 and 2012 telephone surveys.

Table 3: Sample Size and Sampling Error

	2011			2012		
	Population	Sample Size (n)	Sampling Error at 90% Confidence Level	Population	Sample Size (n)	Sampling Error at 90% Confidence Level
Refrigerators	4,022	45	±12.1%	2,630	80	±9.1%
Freezers	2,505	40	±12.9%	4,788	81	±9.1%
Air Conditioners	n/a	n/a	n/a	121	40	±10.8%
Dehumidifiers	742	12	±23.5%	n/a	n/a	n/a
Total¹	6,498	90	±8.5%	7,008	201	±5.7%

¹ It is to be noted that categories of household appliances were not mutually exclusive. As a result, the total number of participants in the appliance groups was not equal to the total number of participants (both in terms of population and sampling).

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

In 2011, Econoler performed a comprehensive process evaluation of ARet. The 2010 evaluation report and recommendations, the program manual and website, the logic model and the program theory were among the program elements examined for the process evaluation. Moreover, the PM was interviewed along with program partners and participants. The 2011 approach generated a series of recommendations to improve program performance and management.

The 2012 process evaluation is a continuation of the 2011 evaluation and covers the following aspects:

- > follow-up of the 2011 evaluation recommendations regarding process issues;
- > new and/or updated program documentation including program modifications since the last evaluation;
- > program tracking sheet;
- > program partners' perspectives on process issues; and
- > program participants' perspectives on process issues.

Recommendations and follow-ups regarding the impact evaluation (energy or demand) will be addressed in the Impact Evaluation section of this report.

3.2 PROGRAM DOCUMENT ANALYSIS AND INTERVIEW WITH THE PROGRAM MANAGER

The following section describes the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interview with the PM. It also covers the follow-up on recommendations from last year in each applicable section.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory in which all the information about the program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program based on a template provided by the Evaluator.

In 2012, the Evaluator noted that ARet has a program memory in the form of a program manual and its various Appendices. The Evaluator is also pleased to report that ARet now has an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff, as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The program manual is intended to capture information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The ARet program manual is now presented in a standardized template which applies to all ENSC programs and includes the same table of contents with 10 sections. This is a considerable improvement from the 2011 format and follows one of the Evaluator's major recommendations.

With this new format, most recommendations regarding the program manual, such as documenting important assumptions or practices and providing the parameters used to estimate program objectives, are now covered in the program manual, as well as its attached files and Appendices.

The following table compares the program manual content of 2011 to the new version of 2012. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 4: Program Manual Content – ARet

Program Manual Content	2011	2012
Document revisions	✓	✓
Program description (including nature or type of program)	✓	✓
Program justification	⊘	✓
Program objectives	✓	✓
Incentives	✓	✓
Eligibility criteria	✓	✓
Program partners and their roles	⚠	✓
Program barriers	✓	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	⚠	✓
Details about the savings calculations and types of measure	⊘	✓
Annual budget	✓	✓
Cost-effectiveness test results	✓	✓
Market study or technical study supporting program elements or assumptions	⊘	✓
Marketing plan	⊘	✓
Evaluation plan	⊘	✓
Program theory	⚠	✓
Logic model	✓	✓
Program process flow chart	⊘	✓
Partner or participant process flow chart	✓	✓
Program forms	N/A	N/A
 Information included in the program manual  Information partially included in the program manual  No information		

Although the program manual is useful and well-designed, the Evaluator has a few minor recommendations for its improvement:

- > **Document the major characteristics of the program:** The AIR MILES[®] justification and allocation procedure is not explained in the program manual; neither is the booking procedure through the Enerpath tracking system for the call centre. The Evaluator recommends including this information in the program manual.
- > **Update the program manual to reflect both metering approaches:** The Description subsection in the Background Findings section should be updated to reflect the two different approaches for metering. The energy consumption of retired refrigerators and freezers is metered at the recycling facility, and an adjustment factor is applied to take into account door openings. For air conditioning units retired through the program, an on-site metering activity was initially planned, but due to the insufficient number of retired units, the savings will remain based on energy savings studies.
- > **Document major changes in the Document Revision section:** In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual, such as the exclusion of dehumidifiers from the program for cost-effectiveness reassessment reasons, the reorganization of the program DAs and the addition of AIR MILES[®] rewards. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program's logic model. Econoler is currently working with ENSC to make sure that each program's updated logic model reflects the current program strategy, and the performance indicators established based on the program theory. The programs' logic models will all be finalized and included in the programs' manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the Evaluator's recommended template for an evaluation plan, which is included as an Appendix of the ARet program manual. The PM provided positive feedback on this important tool that complements the program manual and makes it possible to evaluate the program. In this evaluation plan, the base-case details in Section 3 are particularly well done.

The addition of the evaluation plan to the program documentation is a great improvement from previous years. For additional improvements, the Evaluator has the following recommendations about the evaluation plan:

- > **Better describe the call centre's role in the Program Partners section:** The Evaluator recommends describing in a little more detail the role of the call centre in the Program Partners section, since they use an on-line platform to register the appointments for ARCA. By describing such roles, it will then be possible to identify researchable issues later on in the evaluation plan, such as their experience with this procedure and how user-friendly it is.
- > **Specify the exact number of units for each appliance in the Program Objective section:** In the Program Objective section, it would be relevant to include the targeted number of appliance units as a sub-objective in addition to the total program objective of 5.4 GWh, because each appliance has a specific unitary savings value applied to it. The targeted numbers would make it easier to compare the number of retired units anticipated by ENSC for each type of appliance and the actual number as revealed by evaluation results.
- > **Specify the period of the program targets, the tracking and the realization rate:** The Program Objectives section should indicate the program targets, the tracked results and the target realization rate for each period (e.g., by quarter), as well as for the whole timeframe (e.g., a year), as presented in the Evaluation Plan template proposed by the Evaluator, where each evaluation period is divided in columns. By providing data for a specific period of time, the realization rate, expressed as a percentage, will be the ratio between the program targets and the tracked results for this same period.

3.2.4 Program Charts

The program now has two process charts: one for the partners and the other for the participants. These charts are very informative for any new staff responsible for the program as well as for program partners and participants.

Econoler has the following recommendation on the program charts:

- > **Provide partners and participants with simplified process charts:** The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well designed. Moreover, the partners should be given copies of their process chart. After all, since these charts are intended for the partners and the participants, they must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version date should be indicated in each chart.

3.2.5 Marketing and Outreach Activities

Due to the restructuring of the residential sector, to avoid program silos and to provide a one-window approach for participants, an integrated marketing plan has been drawn up and is being implemented for this sector. Indeed, ENSC is moving away from program-specific marketing towards a more all-inclusive approach, which offers a full suite of energy saving services and rebates for customer. Over the last year, a focus was put on developing a customer-centric approach:

- > **Facebook:** Launched in September 2011, the Facebook page is being followed by over 28,000 people, which is a great accomplishment considering that there are fewer than 500,000 potential followers in Nova Scotia. It provides followers with energy saving tips and informs them about special offers, ways to meet with energy-efficiency representatives in person and energy-efficiency contests they can enter. It encourages followers to access all the energy-efficiency services to which they are eligible.
- > **New Website:** ENSC's new website will feature robust categorization (allowing the user to find specific content in a variety of ways), as well as a state-of-the-art predictive index. These combined features will make it easier for the user to locate specific services and for the website to suggest other appropriate services based on the user's needs and online behavioral pattern.
- > **Email Marketing:** Email addresses for e-newsletter communication are collected at various points of contact: home shows, retail in-store engagement events, program application forms and inbound calls.
- > **Customer Relationship Management:** The back-end of the residential services is being re-equipped to fit the customer-centric approach. The systems undergoing development will allow ENSC to call up customer history and provide thoughtful advice on future energy savings, whether through personal contact, direct mail, or online communication.

As for the program's current promotional activities, ARet is advertised online, through social media, truck wraps, radio, and newspapers. Since the program serves anyone who owns a qualifying appliance in Nova Scotia, the strategy is to reach potential participants through as many different mediums as possible. A common brochure also explains what happens to the appliances in terms of disposal, and it is also included in the Q&As section of the program website. This tool was developed in response to one of the Evaluator's 2011 evaluation report recommendations.

The program DAs have a lot of experience in marketing such programs throughout North America. They develop their own marketing plan, which the Evaluator considers as a market push approach, while all ENSC's activities described earlier are considered as a market pull approach.² Combining both market approaches (push and pull) in this program is a good practice.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice, because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

The Evaluator has the following recommendation on the marketing plan:

- > **Make the performance indicators more quantitative:** To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

3.3 TRACKING SHEET

Econoler reviewed the content of the ARet tracking sheet. It is to be noted that the tracking sheet reviewed by Econoler is an extract of the DA's online data management system. This specific form of the tracking sheet is not used by the PM for program monitoring.

The tracking sheet presents information about the participant and the retired appliances on two separate sheets. In the Appliance tab, each line corresponds to a retired appliance associated with a unique identification number. In this way, participants have as many rows as retired appliances, but the identification number makes it possible to associate the retired appliances with each participant.

Overall, the tracking sheet is clear and concise. It provides complete information on the participants, including their phone number, address, city and postal code, as well as all retired appliance details.

² A market push approach involves taking the product directly to the customer via whatever means, such as field promotion or direct selling, to ensure customers become aware of the program, while a market pull strategy involves inducing customers to seek out services in an active process, especially using advertising.

The date when the appliances were picked up is also indicated in the tracking sheet. Therefore, all participant information needed to conduct field activities (surveys and on-site visits) is present in the tracking sheet. In addition, the tracking sheet includes data relevant to the impact evaluation, such as the size and the age of the retired appliances.

The Evaluator also noticed some improvements in comparison with the 2011 tracking sheet. First, the age of the appliances was provided for 93 percent of the records, and all the retired appliances were over 10 years old, which is the age limit of the program. Second, a drop-down list of answers was integrated into the system for entering the appliance type, age and size. This addition makes it possible to standardize the entries and facilitates analysis. However, one of the recommendations made in 2011 to collect the capacity of room air conditioners was not implemented in the tracking sheet in 2012. This information would be useful for the unitary savings calculation.

Moreover, the tracking sheet contains information on the rebate amounts and whether AIR MILES[®] were given to participants following the retirement of their appliances. This information is available in the DA's online data management system and was included in the Participant tab as per the request of the Evaluator. This information was useful to the Evaluator for the participant survey and for validating the consistency of the incentives offered for the retired appliances.

Thus, the tracking sheet contains the essential information that the Evaluator needs to monitor the number of participants and the number of each type of appliance retired. However, the tracking sheet does not provide any information on the savings achieved through the program. Gross and net energy savings are calculated separately by the PM, using the number of each type of retired appliance provided in the tracking sheet and their unitary savings value established in the base cases. The number used by the PM of units retired was consistent with the information provided in the tracking sheet, and all the parameters used in the savings calculations were clearly indicated (unitary savings value, NTGR, line loss factor, etc.). For future validation purposes and to easily associate participants with the appliances retired during the evaluated period, it would be interesting to have this information grouped together on one main sheet. However, the Evaluator understands that this is difficult since the tracking sheet, with all the information on the participants and the appliances retired, is provided by the DA from the DA online data management system.

In light of these observations, the Evaluator has only one recommendation for further improving the tracking sheet in the future:

- **Collect information on the manufacture year of refrigerators and freezers, as well as the capacity of room air conditioners:** Where available, the Evaluator recommends collecting the manufacture year of the refrigerators and freezers retired through the program in addition to the age of the appliance, as declared by the participant. These parameters are for the unitary savings calculation. For room air conditioners, the Evaluator recommends collecting the capacity of all units retired and including this information in the main tracking sheet. This would allow for a more precise estimate of the unitary savings value for this appliance.

3.4 PARTNER PERSPECTIVES

3.4.1 Perception Related to Program Changes

A total of three people from the two organizations (DAs) involved in the program delivery were interviewed for the evaluation of ARet. The program partners were asked about their general satisfaction with the program and whether the recent changes made to the program have had an impact on their work.

Generally, the overall satisfaction level regarding the program is very high. Indeed, all the interviewed partners had good things to say about program efficiency and stated that the on-course modifications related to the tracking system and the types of appliance covered had required minor changes to their work.

On the other hand, the partners mentioned that an increase in retailer participation and municipality awareness about ARet could help program delivery. One DA also indicated that working with AIR MILES® was often challenging as their ability to meet tight timelines was not always great. There were also some complaints from program participants regarding the general services during removal operations, referring to slight damages made to customers' homes and delayed or missed pick-ups. On this matter, one DA said they could improve staff training related to the pick-up and de-commissioning of appliances.

3.4.2 Relationship with Partners

Furthermore, when questioned about their level of satisfaction with their relationship with ENSC staff, all DAs stated they were highly satisfied and pointed out it was a fantastic team to work with. All DAs also affirmed they were really satisfied with their relationship with each other. The only suggestion that was made was to strengthen communication between ARCA and the call centre in order to improve overall program efficiency. The call centre DA was also really satisfied with the Enerpath booking system.

3.4.3 Opinion on Marketing Strategy

All the partners interviewed indicated they were very satisfied with the current marketing and outreach activities and their outcome across the province. As a suggestion for additional improvements, one partner mentioned targeting rural communities to allow better penetration of this market.

3.5 PARTICIPANT PERSPECTIVES

3.5.1 Program Awareness and Enrolment

Survey respondents were asked how they became aware of the program. Results indicated that participants found out about ARet a number of different ways. Advertising from ENSC was the primary source of awareness (41%) including sponsor advertising in newspapers, on the radio or on television (30%), bill inserts (9%) and ENSC or other sponsor websites (3%). Word of mouth was also a common way participants heard about the program (35%).

Table 5: Sources of Program Awareness

Sources of Program Awareness*	2011	2012
<i>Sample Size</i>	90	201
TOTAL ADVERTISING	--	41%
Utility/sponsor advertising in newspapers, on the radio, on TV	46%	30%
Bill insert/mailling from utility/sponsor	21%	9%
ENSC/utility/sponsor website	2%	3%
Co-worker, family or friend	20%	35%
Internet – unspecified	7%	11%
Store flyers	6%	6%
Salesperson	2%	1%
Other participants	--	1%
Other	6%	8%
Don't know/Refused	1%	5%
*Multiple responses		

In terms of the method for enrolling in the program, the majority of participants (73%) signed up over the phone, while just over two in ten did so online (23%).

Table 6: Method of Enrolment in the Program

Method of Enrolment	2011	2012
<i>Sample Size</i>	90	201
Over the phone	86%	73%
Online	14%	23%
Both	--	1%
Don't know/Refused	--	2%

Participants were asked if they had encountered difficulties enrolling in the program and to rate the ease of enrolment on a scale of '1' to '5', where '5' is extremely easy. Enrolling for the program was considered easy by nearly all participants. This was the case for both those who enrolled online (82% stating 'extremely easy'), and those who enrolled over the phone (89%).

Table 7: Ease of Program Enrolment by Phone and Online

Level of Ease of Program Enrolment	2011		2012	
	Enrolled Online (#)	Enrolled Over the Phone (%)	Enrolled Online (%)	Enrolled Over the Phone (%)
<i>Sample Size*</i>	13	77	49	148
5 – Extremely easy	10	78%	82%	89%
4	3	16%	12%	8%
3	--	5%	2%	3%
2	--	1%	2%	1%
1 – Extremely difficult	--	--	2%	--
Average	4.8	4.7	4.7	4.8
*Don't know/Refused removed from calculations				

Similarly, the majority of participants found it extremely easy to schedule a time for pick-up of their appliance (84%). Although the ease of scheduling a pick-up time was not an issue in the past, the survey results indicate improvement, which is very positive for the program.

Table 8: Ease of Scheduling a Pick-Up Time

Level of Ease of Scheduling a Pick-up Time	2011	2012
<i>Sample Size</i>	90	201
5 – Extremely easy	70%	84%
4	20%	11%
3	7%	2%
2	2%	1%
1 – Extremely difficult	1%	1%
Average	4.6	4.7

3.5.2 Motivations and Barriers to Participation

There were a number of reasons participants chose to retire their appliances through the program. Four in ten people (41%) indicated that the unit was not working well, while three in ten (31%) participated because of the rebate or incentive being offered. Two in ten participants disposed of their appliance because of the option to have it picked up (19%) or because it was easy or convenient to turn in their appliance (18%). Meanwhile, just under two in ten (17%) wanted to reduce their energy or electricity costs.

Table 9: Why Participants Decided to Retire Their Appliances Through the Program

Reasons for Appliance Disposal*	2011	2012
	Overall (%)	Overall (%)
<i>Sample Size</i>	90	201
Old unit was not working well	43%	41%
Rebate/incentive	12%	31%
They would pick it up	12%	19%
Easy/convenient to turn it in	10%	18%
Reduce energy/electricity costs	21%	17%
Didn't need it anymore	32%	14%
Bought new appliance	13%	12%
Wanted to recycle	1%	8%
Better for the environment	2%	6%
Did not want to pay disposal fee at dump/recycling centre	1%	3%
Moving soon/just moved	1%	2%
Reduce maintenance costs/appliance needed repairs	--	2%
Remodeling/expanding	2%	1%
Cost too much to have it picked up	1%	1%
Trash collection would not accept	1%	--
Others	1%	4%
Don't know/Refused	2%	--
*Multiple responses		

Participants were asked if they know what happens to the appliance after it is picked up by the program. Two-thirds believed the appliance is recycled (65%), while one-quarter (24%) indicated that the hazardous material such as CFCs, refrigerants, and Freon are disposed of. Meanwhile, around one in ten believed the appliance is thrown out (13%) or sold for reuse (7%). A large majority of participants therefore know that appliances retired through the program are recycled.

Table 10: Appliance Disposal Beliefs

Appliance Disposal Beliefs*	2011	2012
<i>Sample Size</i>	<i>90</i>	<i>201</i>
Appliance is recycled	53%	65%
Hazardous materials (CFCs, refrigerants, Freon) within appliance are disposed of	20%	24%
Appliance is trashed	17%	13%
Appliance is sold for reuse	11%	7%
Others	6%	5%
Don't know/Refused	22%	18%
*Multiple responses		

Very few participants had concerns prior to taking part in the program. Indeed, just one percent of participants reported a concern, which was that they would not qualify for the rebate.

Thus, there does not seem to be any barriers to program participation as such. Survey results indicated that participants found it easy to participate. Even though the program manual indicates that scheduling a pick-up time is often a challenge, the survey showed very positive results on this matter. Indeed, the large majority of participants found it easy to schedule a time for pick-up of their appliance (see Section 3.5.1).

Table 11: Concerns Prior to Taking Part in the Program

Concerns	2011	2012
<i>Sample Size</i>	<i>90</i>	<i>201</i>
Yes	2%	1%
No	97%	98%
Don't know	1%	1%

3.5.3 Old Appliances

Refrigerators retired through the program were either primary or secondary refrigerators. That is, 53 percent of participants who retired a refrigerator noted that it was their primary refrigerator, while 48 percent retired their secondary or spare refrigerator.

Table 12: Use of Retired Refrigerators

Use of Retired Refrigerators*	2011	2012
<i>Sample Size</i>	45	80
Used as primary/main	42%	53%
Used as secondary/spare	57%	48%
*Base: Respondents who retired a refrigerator		

Most of those who retired a secondary refrigerator through the program had the refrigerator plugged in all of the time (54%) or most of the time (14%), while 14 percent of them were not using it. This latter value will be taken into consideration in the partial use factor presented in the Impact Evaluation section.

As for the participants who retired a freezer through the program, the majority had the appliance plugged in all of the time (81%).

Table 13: Amount of Time Appliance was Plugged In

Time Plugged In*	2011		2012	
	Refrigerators (%)	Freezers (%)	Refrigerators (%)	Freezers (%)
<i>Sample Size**</i>	26	39	37	80
All the time	62%	90%	54%	81%
Most of the time	12%	3%	14%	4%
Occasionally	19%	5%	19%	4%
Never	8%	3%	14%	11%
*Base: Respondents who turned in a secondary refrigerator or a freezer to the program				
**Don't know/Refused removed from calculations				

Most participants who retired an air conditioner through the program only ran the unit when necessary (78%).

Table 14: Air Conditioner Use

Air Conditioner Use*	2012
	Air Conditioners
<i>Sample Size**</i>	36
Only when necessary	78%
Generally running all the time	22%
*Base: Respondents who turned in an air conditioner to the program	
**Don't know/Refused removed from calculations	

Nearly all of the appliances were in working condition when participants decided to have them picked up through the program.

Table 15: Condition of Appliances

Appliance Was Working	2011		2012		
	Refrigerators (%)	Freezers (%)	Refrigerators (%)	Freezers (%)	Air Conditioners (%)
<i>Sample Size</i>	45	40	80	81	40
Yes	87%	93%	88%	95%	88%
Yes, but not that well	13%	8%	11%	2%	8%
No	--	--	1%	1%	3%
Refused	--	--	--	1%	3%

3.5.4 Appliance Replacement Behaviours

All participants were asked if they replaced the appliance after they turned it in to the program. Three-quarters of those who retired a refrigerator have since purchased another refrigerator (75%), while seven in ten (68%) who retired a freezer have done so as well and four in ten (38%) of those who retired an air conditioner also ended up acquiring a new unit.

It is to be noted that 44 percent of participants who retired a secondary refrigerator have since replaced it.

Table 16: Replacement of Appliances

Replacement	2011		2012		
	Refrigerators (%)	Freezers (%)	Refrigerators (%)	Freezers (%)	Air Conditioners (%)
<i>Sample Size</i>	45	40	80	81	40
Yes	53%	58%	75%	68%	38%
No	47%	43%	25%	32%	63%

The majority (77%) of participants who replaced the refrigerator they retired replaced it with a new model. However, 23 percent of respondents replaced their old refrigerator with a used model. The majority of those who replaced freezers or air conditioners that were retired through the program also reported that the replacement appliance was new.

Table 17: Replacement Appliance – New or Used

Replacement*	2011		2012		
	Refrigerators (%)	Freezers (%)	Refrigerators (%)	Freezers (%)	Air Conditioners (#)
<i>Sample Size**</i>	24	22	60	54	15
New	67%	82%	77%	89%	14
Used	33%	18%	23%	11%	1
*Base: Respondents who replaced appliances retired through the program					
**Don't know/Refused removed from calculations					

3.5.5 Importance of Secondary Appliance

Respondents who retired a secondary refrigerator or freezer through the program were asked how important it was to have a spare refrigerator or freezer for household food storage. The results exhibited divergent opinions for each appliance type. A secondary refrigerator was considered moderately important (mean of 2.9 out of 5), while a freezer was considered very important (mean of 4.0 out of 5).

Nevertheless, these results, combined with the fact that about half of the respondents replaced their appliance retired through the program (see Section 3.5.4), indicate the importance of secondary appliances for consumers. It could also explain consumer reluctance to get rid of a working appliance.

Table 18: Importance of Secondary Refrigerator and Freezer

Importance of Secondary Appliance**	2011		2012*	
	Refrigerators	Freezers	Refrigerator	Freezer
<i>Sample Size***</i>	24	40	32	80
5 - Extremely important	8%	50%	25%	57%
4	8%	18%	6%	11%
3	21%	13%	25%	13%
2	17%	5%	22%	6%
1 - Not at all important	46%	15%	22%	13%
Average	2.2	3.8	2.9	4.0
*Note: scale change in 2012 **Base: Respondents with secondary refrigerators or who retired a freezer ***Don't know/Refused removed from calculations				

3.5.6 Appliances Remaining in Home

Those who had a refrigerator retired through the program generally have just one refrigerator remaining (69%), while three in ten (28%) have two refrigerators remaining. In terms of those who had a freezer retired through the program, two in ten participants (22%) no longer have a freezer in their household, while seven in ten (70%) have one freezer remaining. Finally, for those who had an air conditioner retired through the program, four in ten (43%) have one air conditioner remaining, while approximately one-half (53%) reported no air conditioners remaining in their home.

Table 19: Appliances Remaining in Home after Program

Appliances Remaining	2011		2012		
	Refrigerators (%)	Freezers (%)	Refrigerators (%)	Freezers (%)	Air Conditioners (%)
<i>Sample Size</i>	45	40	80	81	40
0	--	33%	--	22%	53%
1	73%	58%	69%	70%	43%
2	18%	5%	28%	6%	3%
3 or more	6%	5%	3%	--	3%
Refused/DK	2%	--	1%	1%	--

Participants with refrigerators remaining in their home were asked about the age of these appliances. Overall, these refrigerators were generally quite new, with the majority of both the first and second refrigerators being between zero and five years old (71% and 67% respectively). Fifteen percent of the respondents reported having a refrigerator that is more than 10 years old.

Table 20: Age of Remaining Refrigerators

Age of Remaining Refrigerators*	2011			2012		
	First Refrigerator (%)	Second Refrigerator (#)	Third Refrigerator (#)	First Refrigerator (%)	Second Refrigerator (%)	Third Refrigerator (#)
<i>Sample size</i>	44	11	3	79	24	2
0 to 5 years old	55%	7	1	71%	67%	2
6 to 10 years old	20%	1	--	13%	13%	--
11 to 15 years old	16%	1	1	13%	8%	--
16 to 20 years old	--	1	--	1%	--	--
More than 20 years old	7%	--	--	1%	--	--
Refused/DK	2%	1	1	1%	13%	--
*Base: Respondents with refrigerators remaining in home after program						

Participants with a freezer remaining in their home generally have freezers that are less than 5 years old (90%).

Table 21: Age of Remaining Freezers

Age of Remaining Freezers*	2011			2012		
	First Freezer (%)	Second Freezer (#)	Third Freezer (#)	First Freezer (%)	Second Freezer (#)	Third Freezer (#)
<i>Sample Size</i>	27	4	2	62	5	--
0 to 5 years old	81%	3	1	90%	1	--
6 to 10 years old	15%	1	--	8%	1	--
11 to 15 years old	4%	--	--	--	--	--
16 to 20 years old	--	--	--	--	1	--
More than 20 years old	--	--	1	2%	2	--
*Base: Respondents with freezers remaining in home after program						

Most air conditioners that are remaining in respondents' homes are five years old or less.

Table 22: Age of Remaining Air Conditioners

Age of Remaining Air Conditioners*	2012		
	First Air Conditioner (#)	Second Air Conditioner (#)	Third Air Conditioner (#)
<i>Sample Size</i>	19	2	1
0 to 5 years old	16	1	--
6 to 10 years old	2	1	1
11 to 15 years old	1	--	--
16 to 20 years old	--	--	--
More than 20 years old	--	--	--
Don't know/Refused	--	--	--
*Base: Respondents with air conditioners remaining in home after program			

3.5.7 Program Influence

Participants were asked to rate the importance of various factors in their decision to retire an appliance through the program on a scale of '1' to '10', where '10' is extremely important. The removal and recycling services provided as part of the program were most important by those who had a refrigerator, freezer or air conditioner (mean score of 8.4 to 9.1). The information or advice received through the program was also considered rather important (mean score of 7.1 to 7.6), as was the \$10 or \$35 incentive provided by ENSC (mean score of 6.6 to 6.9). For those who participate in the AIR MILES® program, the option to receive AIR MILES® was considered moderately important (mean score of 4.8 to 5.6).

The ranking of the money incentive provided by ENSC indicates that the rebate amount may be lowered in the future. However, there are no other results collected through the present evaluation that support this indication. The Evaluator believes that the appropriate level of incentive could be explored in more detail in the next evaluation.

Table 23: Importance of Program in Influencing Decision to Retire Appliances

Importance of Program in Influencing Decision to Retire Appliances	2012					
	Refrigerators		Freezers		Air Conditioners	
	Sample Size	Average**	Sample Size	Average**	Sample Size	Average**
Average where 0 is "not at all important" and 10 is "extremely important"						
Removal and recycling services provided for free as part of the program	58	8.5	68	9.1	33	8.4
Information or advice received through the program	56	7.6	67	7.1	32	7.3
The \$10/\$35 incentive provided by ENSC	58	6.9	67	6.9	33	6.6
The AIR MILES® Reward Miles*	42	5.6	58	5.4	9	4.8
*Base: Respondents who participate in the AIR MILES® program						
**Don't know/Refused removed from calculations						

3.5.8 Program Impact

The majority of participants (72%) reported that their interest in energy efficiency has improved since participating in the program. Participants noted a moderate level of improvement in terms of their knowledge of energy efficiency (53%), their knowledge of appliances (45%) and reduction in total energy costs (40%).

Table 24: Level of Improvement

Level of Improvement	2012	
	<i>Sample Size*</i>	<i>Improved**</i>
Interest in energy efficiency	195	72%
Your knowledge of energy efficiency improved	197	53%
Your knowledge of appliances improved	197	45%
Reduction in total energy costs improved	153	40%
*Don't know/Refused removed from calculations		
**Percentage of respondents who gave a rating of 5 or 4 on a scale where 5 = 'Considerable improvement' and 1 = 'No improvement'		

The vast majority (93%) of participants did not experience any negative consequences as a result of having their appliance retired through the program. Of those that felt there were drawbacks, one percent mentioned the loss of food storage space.

Table 25: Program Drawbacks

Drawbacks	2011	2012
<i>Sample Size</i>	90	201
No drawbacks	80%	93%
Loss of food storage space	--	1%
Others	1%	4%
Don't know/Refused	19%	2%

3.5.9 Satisfaction with the Program

The vast majority of participants indicated a high level of overall satisfaction with this program. Indeed, 95 percent of participants offered a rating of '5' or '4', where '5' is extremely satisfied; and no participant indicated they were dissatisfied with the program.

Table 26: Overall Satisfaction with Program

Satisfaction with Program	2011	2012
<i>Sample Size</i>	90	201
5 - Extremely satisfied	79%	85%
4	17%	10%
3	3%	4%
2	--	--
1 - Extremely dissatisfied	1%	--
Don't know	--	--
Average	4.7	4.8
*Don't know/Refused removed from calculations **Percentage of respondents who gave a rating of 5 or 4 on a scale where 5 = "Extremely satisfied" and 1 = "Extremely dissatisfied"		

Nearly all participants would recommend the program to a family member or friend. This is a strong indicator of satisfaction.

Table 27: Recommend Program

Would Recommend Program	2011	2012
<i>Sample Size</i>	90	201
Yes	98%	99%
No/Refused	2%	1%

3.5.10 Participant Recommendations for Improvements

In terms of providing recommendations to improve the program, just over three-quarters (78%) of participants were unable to offer any recommendations. A small number of participants would like to see better advertising of the program (7%), a wider variety of products accepted (5%), improved scheduling (2%), or more information on the products/measures (1%).

Table 28: Recommendations for Improving Program in Future

Recommendations*	2011	2012
<i>Sample Size</i>	90	201
Better advertising/publicity/advertise the program more or in a better way	13%	7%
Accept a wider variety of products	4%	5%
Improve scheduling/shorten wait for pick-up	7%	2%
Offer more information on the products/measures recommended	1%	1%
Better communication	2%	--
Others	4%	8%
No improvements needed	--	--
No recommendations	71%	78%
*Multiple responses		

The small number of respondents who would like to see a wider variety of products accepted through the program (n=7) mentioned stoves, washers and dryers.

Table 29: Products/Measures that Participants Would Like to See Eligible in the Program

Products/Measures that Participants Would Like to See Eligible in the Program*	2012 (#)
<i>Sample Size**</i>	7
Stoves	4
Washers	2
Dryers	2
Other	1
Don't Know	2
*Multiple responses	
**Base: Respondents who said 'accept a wider variety of products' in S7	

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation is aimed at determining the gross and net savings of the program for 2012. Both energy and demand savings were considered in this evaluation. To do so, Econoler reviewed the following parameters:

- > unitary savings values used for each type of appliance;
- > demand-to-energy ratio;
- > interactive effects;
- > free-ridership; and
- > internal spillover.

The review of the unitary savings calculations was mainly based on metering data. In addition, a literature review was conducted to collect key parameters and estimate the annual consumption of air conditioner units. Finally, the participant survey was used to estimate free-ridership and evaluate if the program had generated spillover.

4.1.1 On-Site Visit Sampling and Protocol

Four on-site visits were conducted under the 2012 evaluation of ARet: one at the recycling facility and three at households that had retired old appliances in 2012.

For the participating households, the sampling was based on the tracking sheet provided in September 2012, which contained the list of participants and information about the appliances retired. As of September 2012, the tracking sheet contained 4,500 participants who retired 5,119 appliances. Our analysis revealed that refrigerators were the most frequently retired appliances (63%), followed by freezers (35%) and room air conditioners (2%).

It was also noted that some participants retired multiple types of appliance (336 participants retired two or more types of appliances) and that a few participants retired a large quantity of units (80 participants retired more than three units per visit).

Therefore, the selection was made to include:

- > One participant who retired more than three units;
- > One participant who retired at least two different types of appliance;
- > One participant selected randomly, regardless of the number and type of appliance retired.

The sampling was made to ensure that all types of appliances had been covered. Due to logistics, the selection was limited to the region of Halifax.

For each site visited, the Evaluator interviewed the homeowner to collect information on the appliances retired and the actions taken afterwards.

4.2 GROSS SAVINGS

For the 2011 evaluation of ARet, Econoler established average unitary savings values for each type of appliance. For refrigerators and freezers, the unitary savings values were based on the energy consumption data obtained from a metering activity at the recycling facility. These unitary savings values took into account the proportion of primary and secondary units, the proportion of units replaced and not replaced, the replacement type (with new or used units), partial use factors and lab-to-on-site factors. For room air conditioners, the consumption data obtained from the metering activity were not conclusive. They appeared to have been distorted due to the room conditions in the recycling facility that were not representative of those found in homes when room air conditioners are in function, typically during the summer. Therefore, Econoler estimated the unitary savings value for room air conditioners using the evaluation results from a similar program: the OPA's Every Kilowatt Counts program.³

For this year's evaluation, ENSC conducted another metering activity to measure the annual consumption of refrigerators and freezers retired in 2012. However, when analyzing the data at the end of the year, ENSC realized that some problems were encountered during the metering process. The data obtained from the metering activity were not conclusive and so could not be used for this evaluation. Therefore, Econoler used the average annual consumption per cubic foot established with the metering data of the 2011 evaluation, and revised the unitary savings values of refrigerators and freezers based on the size and age of the refrigerators and freezers retired in 2012, as well as the results obtained from the participant survey.

In 2011, the energy consumption of 38 refrigerators and 46 freezers was metered over 26 hours. The sample sizes were determined to reach a margin of error of 10 percent with a confidence level of 90 percent, based on the variance in the EnerGuide ratings of the appliances retired through the program in 2011.

The metering protocol used in 2011 was based on the New York Technical Resource Manual for Multifamily Replacement Refrigerators⁴ (as suggested in the 2010 Savings Verification Study report). This protocol served as a basis for ENSC to develop its own metering protocol. The New York metering protocol recommends conducting the metering tests for a minimum two-hour period, which is enough to cover three cycles. Under the ENSC protocol, the units were metered during 26 hours, which provides better accuracy.

³ The Cadmus Group, *Evaluation of Ontario Power Authority's 2008 Every Kilowatt Counts Power Savings Event, Keep Cool Pilot and Rewards for Recycling Programs*, Final Report, prepared for the Ontario Power Authority, July 9, 2009.

⁴ New York Department of Public Service, *Technical Resource Manual for Multifamily Replacement Refrigerators*, September 29, 2010.

For room air conditioners, Econoler had recommended in the 2011 evaluation report to conduct on-site metering during the summer in homes that operate old room air conditioners and have manifested the desire to retire their old appliances. This activity was launched in July 2012. However, the number of participants who retired their old room air conditioners during this period was very low. As a result, a negligible number of units was metered, so Econoler decided to use a similar methodology as last year to establish the unitary savings value associated with the retirement of old room air conditioners.

The following sections present the calculation details for revising the unitary savings value of each type of appliance retired through the program.

4.2.1 Refrigerators

For this year's evaluation, Econoler reviewed each parameter used in the unitary savings calculations of the refrigerators retired through the program, i.e.:

- > average consumption of refrigerators retired through the program (based on the 2011 metering data, as well as the size and age of the refrigerators retired through the program in 2012);
- > occupant adjustment factor;
- > replacement ratio; and
- > partial use factor for secondary refrigerators.

Average Consumption of Retired Refrigerators

Econoler revised the annual consumption of the refrigerators retired through the program using the data from the 2011 metering activity. In total, the annual energy consumption of 38 refrigerators was tested during this activity.

In order to estimate an average consumption representative of the refrigerators retired through the program, the annual energy consumption measured for refrigerators was analyzed by cubic foot and age of the refrigerators retired through the program in 2012. Below are the details of this analysis:

Table 30: Average Metered Consumption Values for Retired Refrigerators

Age of the Refrigerator	Average Annual Consumption per Cubic Foot	Proportion of Refrigerators in the 2012 Tracking Sheet
10 to 19 Years Old	58.9 kWh/cu. ft.	54%
20 to 29 Years Old	75.6 kWh/cu. ft.	33%
30 Years Old and More	86.0 kWh/cu. ft.	13%
Average Annual Consumption	67.9 kWh/cu. ft.	

Based on the age of the retired refrigerators monitored in the 2012 tracking sheet, these average values were weighted to establish an average consumption value of 67.9 kWh per cubic foot.

The average size of the retired refrigerators monitored in the tracking sheet corresponds to 14.1 cubic feet. Based on this average value, Econoler calculated the average annual consumption for retired refrigerators.

$$\text{Average Annual Consumption} = 67.9 \frac{\text{kWh}}{\text{cu. ft.}} \times 14.1 \text{ cu. ft.} = 957 \text{ kWh}$$

This average annual consumption of 957 kWh per year will be used for the unitary savings calculation of refrigerators retired through the program.

The average annual consumption of retired refrigerators is based on metering data which already takes into account the degradation of the appliances over time. Hence, no degradation factor needs to be applied.

Occupant Adjustment Factor

In the 2011 evaluation, the conditions under which the appliances were measured at the recycling facility are quite similar to that found in Nova Scotia's households, with a room temperature set at 25°C. The major difference between metering conditions and on-site conditions was due to the fact that the metering was conducted without accounting for door openings. Since the energy consumption of an appliance increases with door openings, Econoler used an adjustment of 1.12 to account for the average number of people per participating household, i.e. 2.5.⁵ This adjustment was based on the occupant adjustment factor proposed in the New York metering protocol⁶ on which the metering study was based.

For this year's evaluation, the same occupant adjustment factor will be used. The 2012 participant survey indicated that the average number of people in the participating households remains equal to 2.5.

Replacement Ratio

In the last evaluation, the unitary savings calculation took into account the replacement of refrigerators retired through the program. For the proportion of refrigerators that were replaced by a new unit after their retirement, the unitary savings value corresponded to the difference between the consumption of the retired and the new refrigerators.

For this year's evaluation, Econoler did not take into account any replacement ratio. This decision is based on the concept that if the program had not been in place, participants who decided to replace

⁵ According to the participant survey, the average number of people per participating household is approximately 2.5, which is consistent with the results of the 2011 socket study.

⁶ New York Department of Public Service, *Technical Resource Manual for Multifamily Replacement Refrigerators*, September 29, 2010.

their old refrigerator would have given it away or stored it in a place where it could be reused. Instead, the program recycles each appliance and prevents any further usage. Therefore, Econoler believes it more appropriate to only consider the total energy consumption of the appliance retired in this year's savings calculation, even if it was replaced by the participant. This concept was also advocated by the Cadmus Group in the impact evaluation report of the 2010 Great Refrigerator Roundup Program.⁷

Partial Use Factors

For secondary refrigerators, Econoler established partial use factors to account for the fact that not all refrigerators are plugged in year-round. Secondary refrigerators are likely to be unplugged for a portion of the year and, since they were eligible for the program, partial use factors were developed to adjust the unitary savings calculations to this reality.

The participant survey was used to estimate the amount of time during which participants had their secondary refrigerators plugged in year-round prior to retirement. To do so, Econoler used the following plug-in patterns:

- > all the time – the refrigerator was plugged in for the entire year;
- > most of the time – the refrigerator was plugged in for nine months of the year;
- > occasionally – the refrigerator was plugged in for four months of the year;
- > never – the refrigerator was never plugged in during the year.

The partial use factor for secondary refrigerators was calculated using the equation below.

$$\% = \left(\frac{12}{12} \times \% \text{ All the time} \right) + \left(\frac{9}{12} \times \% \text{ Most of the time} \right) + \left(\frac{4}{12} \times \% \text{ Occasionally} \right) + \left(\frac{0}{12} \times \% \text{ Never} \right)$$

For primary refrigerators considered to be the main unit in the house, it is assumed that they were used all the time. The table below displays the partial use factors calculated for each category of refrigerators.

Table 31: Partial Use Factor for Retired Refrigerators⁸

Refrigerator Category	Primary	Secondary*
All the Time	100%	54.1%
Most of the Time	-	13.5%
Occasionally	-	18.9%
Never	-	13.5%
Partial Use Factor	1.00	0.71
*Survey results presented in the Process Evaluation section were rounded to the nearest unit. For the impact evaluation, the decimal numbers were taken into account so that the total equals 100%.		

⁷ The Cadmus Group, *2010 Great Refrigerator Roundup Program – Impact Evaluation*, Final Report, prepared for the Ontario Power Authority, August 31, 2011.

⁸ From participant survey, Table 13, Section 3.5.3.

Unitary Savings Value Calculation

Econoler calculated the unitary savings value related to both refrigerator categories (primary and secondary). The table below presents the variables that were used to revise the unitary savings value. Starting with the average annual consumption value estimated for the retired refrigerators, the calculation accounts for the occupant adjustment factor and partial use factor.

Table 32: Unitary Savings Values for Retired Refrigerators

Refrigerator Category	Primary	Secondary
Average Consumption per Retired Unit	957 kWh/year	
Occupant Adjustment Factor	1.12	
Partial Use Factor	1.00	0.71
Unitary Savings Value per Category	1,072 kWh/year	756 kWh/year
Proportion (%) ⁹	52.5%	47.5%
Average Unitary Savings Value	922 kWh/year	

Using the proportion of each category resulting from the participant survey, the average unitary savings value for refrigerators is estimated to be 922 kWh per year. This represents a small decrease in comparison to the unitary savings value of 1,182 kWh per year used by ENSC in the tracking sheet. This value was based on the 2011 evaluation results, without considering any replacement ratio.

4.2.2 Freezers

Based on the same approach, Econoler revised the unitary savings value used for the freezers retired through the program. To do so, the following parameters were taken into consideration:

- > average consumption of freezers retired through the program (based on the 2011 metering data, as well as the size and age of the freezers retired through the program in 2012);
- > occupant adjustment factor;
- > replacement ratio; and
- > partial use factor.

Average Consumption of Retired Freezers

To revise the annual consumption of the freezers retired through the program, Econoler used the data from the 2011 metering activity. In order to estimate an average consumption representative of the freezers retired through the program, the annual energy consumption measured for the 46 freezers

⁹ From participant survey, Table 12, Section 3.5.3. The survey results presented in this section were rounded to the nearest unit. For the impact evaluation, the decimal numbers were taken into account so that the total equals 100%.

was analyzed per cubic foot and manufacture year. The table below presents the details of this analysis:

Table 33: Average Metered Consumption Values for Retired Freezers

Age of the Freezer	Average Annual Consumption per Cubic Foot	Proportion of Freezers in the 2012 Tracking Sheet
10 to 19 Years Old	55.2 kWh/cu. ft.	39%
20 to 29 Years Old	84.1 kWh/cu. ft.	36%
30 Years Old and More	86.2 kWh/cu. ft.	25%
Average Annual Consumption	73.4 kWh/cu. ft.	

Based on the manufacture year of the retired freezers monitored in the 2012 tracking sheet, these average values were weighted to establish an average consumption value of 73.4 kWh per cubic foot.

The average size of the retired freezers monitored in the tracking sheet is 13.6 cubic feet. Based on this average value, Econoler estimated the average consumption of retired freezers to be 998 kWh per year.

$$\text{Average Annual Consumption} = 13.6 \frac{\text{kWh}}{\text{cu. ft.}} \times 73.4 \text{ cu. ft.} = 998 \text{ kWh}$$

This average annual consumption was used in the unitary savings calculations for the freezers retired through the program.

As with refrigerators, no degradation factor was applied to the average consumption value calculated for retired freezers. The metering data already take into account the degradation of these appliances over time.

Occupant Adjustment Factor

To take into account the major difference between metering conditions and on-site conditions, i.e. door openings, the same occupant adjustment factor of 1.12 used for the refrigerators was applied to the metered consumption of the retired freezers.

Replacement Ratio

All freezers retired through the program are considered to be secondary units. In the 2011 evaluation report, the participant survey was used to establish the replacement ratio of retired freezers and adjust their unitary savings value accordingly.

However, for this year's evaluation, no replacement ratio is considered for the same reasons as mentioned earlier for the refrigerators.

Partial Use Factors

Secondary freezers are likely to be unplugged for a portion of the year. Therefore, partial use factors were developed to adjust the unitary savings calculations in accordance with the fact that not all freezers are operating year-round.

The participant survey was used to estimate the amount of time during which participants had their freezers plugged in throughout the year prior to retirement, using the following plug-in patterns:

- > all the time – the freezer was plugged in for the entire year;
- > most of the time – the freezer was plugged in for nine months of the year;
- > occasionally – the freezer was plugged in for four months of the year;
- > never – the freezer was never plugged in during the year.

Using the equation below, the partial use factors were calculated for secondary freezers.

$$\% = \left(\frac{12}{12} \times \% \text{ All the time} \right) + \left(\frac{9}{12} \times \% \text{ Most of the time} \right) + \left(\frac{4}{12} \times \% \text{ Occasionally} \right) + \left(\frac{0}{12} \times \% \text{ Never} \right)$$

The table below displays the partial use factor calculated for secondary freezers.

Table 34: Partial Use Factor for Retired Freezers¹⁰

Freezer Category	Secondary*
All the Time	81.3%
Most of the Time	3.7%
Occasionally	3.7%
Never	11.3%
Partial Use Factor	0.85
*Survey results presented in the Process Evaluation section were rounded to the nearest unit. For the impact evaluation, the decimal numbers were taken into account so that the total equals 100%.	

¹⁰ From participant survey, Table 13, Section 3.5.3.

Unitary Savings Value Calculation

The table below presents the variables that were used to calculate the unitary savings value for freezers. Starting with the average annual consumption value estimated for the retired freezers, the calculation accounts for the occupant adjustment factor and partial use factor.

Table 35: Unitary Savings Values for Retired Freezers

Freezer Category	Secondary
Average Consumption per Retired Unit	998 kWh/year
Occupant Adjustment Factor	1.12
Partial Use Factor	0.85
Average Unitary Savings Value	950 kWh/year

Therefore, the average unitary savings value for freezers is estimated to be 950 kWh per year. This represents a small decrease in comparison to the tracked unitary savings value of 1,068 kWh per year. This value was based on the 2011 evaluation results, without considering any replacement ratio.

4.2.3 Room Air Conditioner Units

Based on the 2011 evaluation, ENSC used a unitary savings value of 197 kWh per year for the room air conditioners retired through the program. This value was reviewed during this evaluation. Since on-site metering was conducted at a limited number of participating houses, the energy consumption data collected were not sufficient to draw conclusions. Therefore, Econoler relied on the literature and results obtained from the participant survey to review the unitary savings value of room air conditioners.

Based on the evaluation of the OPA's 2008 Every Kilowatt Counts program,¹¹ Econoler calculated the average annual consumption of retired room air conditioner units using a capacity of 8,000 Btu/h, an annual usage of 310.6 hours and an EER value estimated at 6.69 Btu/W-h. The capacity and the annual hours of operation were based on the data collected during on-site metering conducted in 18 Ontarian houses operating older room air conditioners. To establish the energy efficiency ratio (EER) of the recycled units, the OPA's evaluation team calculated the average EER of 15 room air conditioners recycled through the program using the ratios determined through laboratory testing.

Using these parameters, the calculations resulted in an average annual consumption of 371 kWh for old room air conditioners retired:

¹¹ The Cadmus Group, Evaluation of the Ontario Power Authority's 2008 Every Kilowatt Counts Power Savings Event, Keep Cool Pilot and Rewards for Recycling Programs, Final Report, Prepared for the Ontario Power Authority, July 9, 2009.

$$\text{Consumption of Old AC unit} = \frac{8,000 \text{ Btu/hr}}{6.69 \frac{\text{Btu}}{\text{W} \cdot \text{hr}} \times \frac{1,000 \text{ W}}{\text{kW}}} \times 310.6 \frac{\text{hr}}{\text{year}} = 371 \text{ kWh}$$

The annual usage of 310.6 hours per year is consistent with the information collected during the participant survey. Indeed, most participants indicated that they only operated their room air conditioners during approximately two months in the summer. During these months, their air conditioner unit was generally running only when it was necessary, according to the outdoor temperature. An analysis of the cooling degree days for the region of Halifax showed that over the July and August period, cooling was necessary for 36 days out of 62. Considering that people are home around 14 hours per day and that room air conditioners have a duty cycle, the hours of operation of 310.6 hours per year seem acceptable for Nova Scotia also.

Econoler considers using an average capacity of 8,000 Btu/h for the room air conditioner units retired through the program adequate, since that average comes from on-site data collected for a similar program in Ontario. As an improvement for the next evaluation, Econoler recommends collecting the capacity of the room air conditioner units retired in the tracking sheet.

As is the case for refrigerators and freezers, Econoler did not take into account any replacement ratio for this year's evaluation. Since no replacement ratio was applied, the unitary savings value of room air conditioners corresponds to 371 kWh per year.

4.2.1 On-Site Visit Results

The three on-site visits conducted at participating households during this evaluation demonstrated the smooth operation of the program. All the information on the retired appliances collected in the tracking sheet was confirmed by the homeowners. Moreover, the visit conducted at the recycling facility allowed the Evaluator to validate the retirement and recycling processes of the appliances retired through the program.

4.2.2 Demand-to-Energy Ratio

Econoler calculated the demand savings for ARet based on a demand-to-energy ratio of 0.147 MW/GWh. This ratio was obtained from the adjusted 2012 program targets, by dividing the target peak demand savings by the target energy savings.

4.2.3 Revised Gross Savings

Gross energy savings for the program were recalculated by the Evaluator to include the revised unitary savings values estimated for all types of appliances retired through the program. These adjusted unitary savings values take into account the proportion of primary and secondary units, the occupant adjustment factor and the partial use factor. The revised demand savings were obtained using the demand-to-energy ratio of 0.147 MW/GWh.

Gross energy and demand savings resulting from the retirement of old appliances though ARet are presented in the table below. Overall, total gross energy and demand savings amount to 7.354 GWh and 1.081 MW at the meter. At the generator, energy and demand savings are estimated to be 8.089 GWh and 1.189 MW using a line loss factor of 1.100 estimated for the residential sector, considering the fact that 99 percent of participants have a residential rate code. This line loss factor value was provided by Nova Scotia Power.

Table 36: Evaluation Results – Gross Energy and Demand Savings

	Refrigerators	Freezers	Room AC Units	Total
Number of Units				
Units Retired – From Tracking Sheet	5,092	2,744	140	7,976
Energy Savings				
Unitary Savings (kWh)	922	950	371	-
Total Gross Energy Savings – at Meter (GWh)	4.695	2.607	0.052	7.354
Line Loss Factor	1.100	1.100	1.100	-
Total Gross Energy Savings – at Generator (GWh)	5.164	2.867	0.057	8.089
Demand Savings				
Demand-to-Energy Ratio	0.147	0.147	0.147	-
Total Gross Demand Savings – at Meter (MW)	0.690	0.383	0.008	1.081
Line Loss Factor	1.100	1.100	1.100	-
Total Gross Demand Savings – at Generator (MW)	0.759	0.422	0.008	1.189

4.3 INTERACTIVE EFFECTS

In a residence, interactive effects occur when the installation of an energy-efficient product has an impact on the energy consumption of other elements such as heating and cooling devices. In the case of ARet, retirement of old appliances causes an increase in the heating load during winter and a decrease in the cooling load during summer since the compressor of the old appliance released heat. Interactive effects still occur when the retired appliance is replaced by a more energy-efficient one since the new appliance still releases heat, but it releases less heat than the less efficient unit it replaces.

In Nova Scotia, the heating load period lasts around eight months, while the cooling load period is relatively short. Hence, the interactive effects due to the retirement or replacement of an old appliance are expected to be negative, influencing downward the savings generated by such retirement or replacement. However, a number of factors can affect the interactive effects of the program:

- > As part of this evaluation, the focus is on electricity savings. In Nova Scotia, only 33 percent of households use electricity as their primary heating source.¹² Hence, the negative interactive effects on the heating load only affect a small proportion of participating households.
- > In Nova Scotia, 18 percent of households have air conditioning.¹³ Thus, it is also a small proportion of households for which positive interactive effects occur during the cooling period. Moreover, this cooling period lasts only two months.¹⁴
- > Several appliances, such as refrigerators and freezers, retired through the program are built-in or leaned against an exterior wall, which reduces their interactive effects.

Considering all of these factors, Econoler concludes that the interactive effects of the appliances retired through ARet are insignificant and so sets the interactive effects factor to zero percent.

4.4 NET-TO-GROSS RATIO

The net-to-gross ratio (NTGR) assessment is based on a self-report approach which relies on a series of questions designed to measure the influence of the program on customers' decision to participate in the program. This section presents the methodology used to transform information obtained through the participant survey into a NTGR. For ARet, the NTGR includes the assessment of two distortion effects: free-ridership and spillover. Once each effect is quantified, the NTGR is calculated based on the equation below.

$$NTGR = 1 - \% \text{ free-ridership} + \% \text{ spillover}$$

4.4.1 Free-Ridership

The free-ridership level was measured using the participant survey. The questionnaire included a number of questions that attempted to assess the following variables:

- > if participants had already considered disposing of their appliance before learning about the program;
- > what alternate ways participants would have considered to dispose of their old appliance if the program had not been available;
- > the level of importance of different factors on their decision to dispose of their old appliances; and
- > the probability that participants would have retired their old appliance, but at a later date if the program had not been available.

¹² From the socket study conducted by CRA with 1,004 households in Nova Scotia.

¹³ Statistics Canada (CANSIM), Households having air conditioning, Nova Scotia, 2009.

¹⁴ RETScreen, Climatic Data for Halifax International Airport.

Questions were asked separately for refrigerators, freezers and room air conditioners. Each question was transposed into a level of program attribution which was used to calculate the level of free-ridership for each participant. The algorithm behind this calculation is presented in Appendix VI.

As presented in the table below, a free-ridership level was estimated for each type of appliance and then transposed into an average free-ridership level based on the proportion of gross energy savings generated by each type of appliance in 2012.

Table 37: Free-Ridership Calculation

	Refrigerators	Freezers	Room AC Unit
Free-Ridership Level per Type	17%	16%	24%
Proportion of Gross Savings	64%	35%	1%
Average Free-Ridership Level	17%		

The average level of free-ridership obtained for ARet is 17 percent. This distortion effect can be applied directly to the total gross savings of the program since it already considers the weight of each appliance in terms of energy savings.

In 2011, the average level of free-ridership was estimated at 22 percent. Reductions were observed for the free-ridership levels of both refrigerators and freezers, estimated respectively at 20 percent and 26 percent in 2011. The free-ridership level for room air conditioners was evaluated for the first time in 2012. It represents the highest free-ridership level of the three categories of appliances.

4.4.2 Internal Spillover

The internal spillover effects were measured through the participant survey. For ARet, internal spillover can occur when participants decide to retire or replace other appliances on their own following their previous participation in the program and due to its influence.

During the telephone survey, participants were asked if they had retired additional appliances following their previous participation in the program. A question was used to verify the eligibility of the additional retirements by asking how they disposed of the old appliances.

Subsequently, another question was asked to verify the influence of the program on participants' decisions to dispose of additional appliances without receiving a rebate. Depending on the level of influence obtained during the survey, a portion of the savings related to the additional retirements was attributed to the program.

The level of internal spillover was calculated for each participant according to the equation below. The energy savings (kWh) associated with the additional retirements were estimated using the adjusted unitary savings value reviewed in this evaluation for each type of appliance.

$$\%SO = \frac{kWh \text{ associated with the additional retirement} \times \text{attribution level}}{kWh \text{ associated with the appliances retired through the program}}$$

From the 201 participants surveyed, two declared having retired an additional appliance following their previous participation in the program. These participants estimated that the program had had an average influence of 100 percent on their action. The total savings resulting from these additional retirements multiplied by the attribution level amounted to 2,243 kWh. Once divided by the energy savings generated by the participants who had answered the survey, it corresponded to an internal spillover level of 1 percent.

4.4.3 NTGR Calculation

Using the free-ridership and spillover levels established above, the NTGR value for the program is shown below.

$$NTGR = 1 - \% \text{ free-ridership} + \% \text{ spillover} = 1 - 17\% + 1\% = 0.84$$

4.5 NET SAVINGS

The net energy savings are estimated by adding the interactive effects and the NTGR to the gross savings, based on the equation below.

$$\text{Net Energy Savings} = \text{Gross Energy Savings} \times (1 + \text{Interactive Effects Factor}) \times NTGR$$

Overall, total net energy and demand savings amount to 6.177 GWh and 0.908 MW at the meter, and 6.795 GWh and 0.999 MW at the generator.

Table 38: Evaluation Results – Net Energy and Demand Savings

	Refrigerators	Freezers	Room AC Units	Total
Energy Savings				
Total Gross Energy Savings – at Meter (GWh)	4.695	2.607	0.052	7.354
Interactive Effects Factor	0%	0%	0%	-
NTGR	0.84	0.84	0.84	-
Total Net Energy Savings – at Meter (GWh)	3.944	2.190	0.044	6.177
Line Loss Factor	1.100	1.100	1.100	
Total Net Energy Savings – at Generator (GWh)	4.338	2.409	0.048	6.795
Demand Savings				
Total Gross Demand Savings – at Meter (MW)	0.690	0.383	0.008	1.081
Interactive Effects Factor	0%	0%	0%	-
NTGR	0.84	0.84	0.84	-
Total Net Demand Savings – at Meter (MW)	0.580	0.322	0.006	0.908
Line Loss Factor	1.100	1.100	1.100	
Total Net Demand Savings – at Generator (MW)	0.638	0.354	0.007	0.999

The demand and energy savings resulting from this evaluation were compared to the savings from the 2012 tracking sheet in the table below.

Table 39: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	NTGR	Net Savings
Energy Savings			
Tracked Savings from ENSC	9.875 GWh	0.79	7.801 GWh
Evaluation Results	8.089 GWh	0.84	6.795 GWh
Demand Savings			
Tracked Savings from ENSC	1.452 MW	0.79	1.147 MW
Evaluation Results	1.189 MW	0.84	0.999 MW

The evaluated net savings fell short of those tracked by ENSC by 13 percent. This result is mainly due to the revision of the unitary savings values for each type of appliance. The revised unitary savings values for refrigerators and freezers were slightly lower than those used by ENSC due to the new average age, size, partial use factor and proportion of primary and secondary units calculated for the units retired in 2012. More specifically, the refrigerators and freezers retired were younger this year, which had the most significant impact on their unitary savings values. For room air conditioners, the unitary savings value calculated for this evaluation was higher than the one used for tracked savings since the replacement ratio was dropped from this year's evaluation.

Another factor that explains the differences between the tracked savings and the evaluation results is the NTGR. In the tracking sheet, ENSC used a NTGR of 0.79, based on the 2011 evaluation report. For this year's evaluation, the NTGR was established at 0.84. The increase in the NTGR is due to lower levels of free-ridership measured for refrigerators and freezers. As in 2011, an internal spillover level of 1 percent was also captured.

For the next evaluation, Econoler recommends pursuing metering activities to update the average annual consumptions estimated for the refrigerators and freezers retired during the year based on their age and size. Thus, it remains important to collect such information in the tracking sheet.

For room air conditioners, due to the small number of units retired (only 140 units in 2012), Econoler considers it preferable to use data from the literature instead of on-site metering results. Therefore, the evaluation results from the OPA's Every Kilowatt Counts program could be used again in the future to establish the unitary savings value for room air conditioners. Although, it is recommended to collect the capacity of the room air conditioners retired through the program to improve the precision of the savings calculation. Even if this category of appliance does not represent an important number of retired units and had the highest free-ridership level of all three categories, the Evaluator still thinks that room air conditioners have their place in the program. ENSC, however, must keep offering a rebate for the retirement of this appliance only if another appliance, such as a refrigerator or freezer, is also picked up during the same visit.

CONCLUSION

The 2012 evaluation of ARet demonstrated that the program is well designed and that it underwent a series of positive changes aimed at improving its design and implementation. Notably, the program has excluded dehumidifiers from the list of covered appliances, for cost-effectiveness reasons, and has included AIR MILES® reward points for every retired appliance in order to make the program more appealing. The reorganization of the program partners into two delivery agents (DAs) also had a positive impact on the retirement logistics, resulting in a significant increase in participants' satisfaction with the program's enrolment methods and the ease of scheduling a pickup time.

Furthermore, the Evaluator found major improvements to the program since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving little time to follow up on all the process and impact recommendations before the new evaluation window, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Moreover, additional efforts were made in program promotion and communication, as well as in informing participants about appliance disposal. This is a great improvement since the removal and recycling services provided as part of the program are the most important factor in the customer's decision to retire an appliance through the program.

ENSC's sustained efforts in program advertising contributed significantly to program awareness in 2012, as it was the main way participants learned about the program. Moreover, word of mouth was an important source of program awareness as well as a good indicator of program satisfaction. Indeed, the participants expressed very high satisfaction with the overall program, as did the partners.

The program achieved the retirement of 7,976 units for the year 2012, which represents a high level of participation. The evaluation revealed that ARet generated net energy savings of 6.795 GWh and demand savings of 0.999 MW at the generator in 2012, compared to 7.175 GWh and 1.144 MW in 2011. To calculate the net savings of ARet in 2012, Econoler reviewed the gross savings estimated by ENSC for refrigerators and freezers using results from the 2011 metering study and information on the appliance usage obtained from the 2012 participant survey. For room air conditioners, Econoler consulted other studies for similar programs and used information obtained from the participant survey to validate the hours of operation. Moreover, Econoler took into consideration the free-ridership and internal spillover measured through the participant survey.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Continue marketing efforts and perform targeted marketing in rural communities: The ARet marketing campaign has improved since the last evaluation to include many different mediums and a brochure about appliance disposal. All partners interviewed indicated they were very satisfied with the current marketing and outreach activities and their outcome across the province since last year's evaluation. Moreover, survey results highlight the positive impact of ENSC advertising on customer awareness. The Evaluator recommends continuing marketing efforts and allowing efforts to reach rural communities in order to increase penetration in this market.
	2. Explore the possibility of lowering the rebate: Participants' survey responses revealed that the money incentive is the third factor influencing the decision to retire an appliance through the program. The removal and recycling services, followed by the information or advice provided as part of the program, were most important. Although this could be viewed as an indication that the incentive rebates could be lowered, there are no other results in the present evaluation that confirm this. Therefore, for the next evaluation, Econoler recommends probing deeper into the possibility of lowering the rebate amount and the consequences that this might have on appliance retirement.
	3. Collect information on the manufacture year of refrigerators and freezers, as well as the capacity of room air conditioners*: Where available, the Evaluator recommends collecting the manufacture year of the refrigerators and freezers retired through the program in addition to the age of the appliance, as declared by the participant. These parameters are for the unitary savings calculation. For room air conditioners, the Evaluator recommends collecting the capacity of all units retired and including this information in the main tracking sheet. This would allow for a more precise estimate of the unitary savings value for this appliance. *See Section 3.3 Tracking Sheet, Section 4.2.3 Room Air conditioner Units and Section 4.5 Net Savings for more details.

Executive Summary	4. Pursue the metering of refrigerators and freezers at the recycling facility*: For this year's evaluation, the results obtained from the metering activity conducted on refrigerators and freezers were not conclusive. Therefore, the unitary savings calculation was based on average annual consumptions obtained from the metering activity conducted for the 2011 impact evaluation. For the next evaluation window, Econoler recommends reviewing the metering protocol and pursuing this activity to measure the annual consumptions of a representative sample of refrigerators and freezers that will be retired through the program in 2013. *See Section 4.5 Net Savings for more details.
Program Manual	5. Document the major characteristics of the program: The AIR MILES® justification and allocation procedure is not explained in the program manual; neither is the booking procedure through the Enerpath tracking system for the call centre. The Evaluator recommends including this information in the program manual. 6. Update the program manual to reflect both metering approaches: The Description subsection in the Background Findings section should be updated to reflect the two different approaches for metering. The energy consumption of retired refrigerators and freezers is metered at the recycling facility, and an adjustment factor is applied to take into account door openings. For air conditioning units retired through the program, an on-site metering activity was initially planned, but due to the insufficient number of retired units, the savings will remain based on energy savings studies. 7. Document major changes in the Document Revision section: In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual, such as the exclusion of dehumidifiers from the program for cost-effectiveness reassessment reasons, the reorganization of the program DAs and the addition of AIR MILES® rewards. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.

Evaluation Plan	8. Better describe the call centre's role in the Program Partners section: The Evaluator recommends describing in a little more detail the role of the call centre in the Program Partners section, since they use an on-line platform to register the appointments for ARCA. By describing such roles, it will then be possible to identify researchable issues later on in the evaluation plan, such as their experience with this procedure and how user-friendly it is. 9. Specify the exact number of units for each appliance in the Program Objective section: In the Program Objective section, it would be relevant to include the targeted number of appliance units as a sub-objective in addition to the total program objective of 5.4 GWh, because each appliance has a specific unitary savings value applied to it. The targeted numbers would make it easier to compare the number of retired units anticipated by ENSC for each type of appliance and the actual number as revealed by evaluation results. 10. Specify the period of the program targets, the tracking and the realization rate: The Program Objectives section should indicate the program targets, the tracked results and the target realization rate for each period (e.g., by quarter), as well as for the whole timeframe (e.g., a year), as presented in the Evaluation Plan template proposed by the Evaluator, where each evaluation period is divided in columns. By providing data for a specific period of time, the realization rate, expressed as a percentage, will be the ratio between the program targets and the tracked results for this same period.
Program Charts	11. Provide partners and participants with simplified process charts: The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well designed. Moreover, the partners should be given copies of their process chart. After all, since these charts are intended for the partners and the participants, they must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version date should be indicated in each chart.

Marketing and Outreach Activities	12. Make the performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

APPENDIX II – INTERVIEW GUIDE WITH DELIVERY AGENTS

PROGRAM NAME: APPLIANCE RETIREMENT PROGRAM

How to complete this form

This is a Word document that integrates some form features. To enter your answers, simply position your cursor on the shaded sections and begin typing. Since this is a form, you cannot write anywhere else in the document. For the boxes, just click on the one next to your answer. Click again to uncheck it.

Please complete this form within the next 48 hours, [save the file](#) and send it back to us at glavigne@econoler.ca.

Thank you!

Part I: General Questions

Please indicate your company name.

Q1a. How would you describe your role(s) as an ENSC energy efficiency program partner?

Q1b. How long have you held that role/those roles (specify months or years)?

Q2a. How would you qualify your participation process in this program?

- ☐ Simple
☐ Complex

Q2b. If you checked “Complex,” please indicate which parts of your involvement or participation process have been the most complex.

Q3. On a scale from 1 to 10, where 1 is very poor and 10 is excellent, please rate your satisfaction in regard to the:

Aspects of the program	Score 1 = very poor 10 = excellent NA = Not applicable	Reason If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Program marketing and outreach activities		
Relationship with ENSC staff		
Relationship with Call Centre		

Part II: Questions Specific to the Appliance Retirement Program

Q4a. Regarding program on-course modifications, (tracking system, appliance covered by the program, etc.) do you feel they:

- ☐ Are easily adapted into the way you work
- ☐ Require minor changes in the way you work
- ☐ Require major changes in the way you work
- ☐ Not applicable/No program on-course modifications

Q4b. If you answered “Require major changes in the way you work,” would you say those major changes have caused problems in the way the program is managed or delivered?

- ☐ Yes
- ☐ No

Q4c. If you answered “Yes,” what have those problems been?

Q5. In your opinion, what are the main barriers to the delivery of the program, in order of importance?

Q6a. Approximately how many complaints have you received from participants thus far in 2012?

Number of complaints:

Q6b. What was the complaint/were the complaints about?

Q7a. Did you receive any complaints from other program partners?

- ☐ Yes : If yes, from which partners? (Please do not mention names, just the party's role)
- ☐ No

Q7b. What was the complaint/were the complaints about?**Q8. What suggestions do you have to improve program performance?****Q9. More precisely, what suggestions do you have concerning program marketing and outreach activities?**

Thank you very much for your time and co-operation.

Your answers will be treated in strict confidence—no names will ever be mentioned in the evaluation report. Our hope is that these results will contribute to improving program performance. You may be contacted by phone if we need to clarify your answers.

Date	
Your name	
Area code and phone number	
Email	

APPENDIX III – ON-SITE VISIT PROTOCOL

1 General Information

Date of visit: _____
 ATONum: _____
 Participant name: _____
 Telephone: _____
 Address: _____
 Type of household: _____

2 Appliance information

Validate tracking sheet information with participant:

Appliance	Number of Units Retired		Pick Up Date	
	From Tracking Sheet	On-Site Validation	From Tracking Sheet	On-Site Validation
Refrigerators (RF):				
Stand-Alone Freezers (FZ):				
Room Air Conditioner Units (AC):				

Notes:

2.1 Refrigerators (if applicable)

Replacement Information (*Participant declaration and on-site observations*)

Number of primary refrigerators retired:

Number replaced with a **new** refrigerator:

- *ENERGY STAR or not?*
- *Smaller, Bigger or Same Size?*
- *Capacity [in cubic feet]*

Number replaced with a **used** refrigerator:

- *Smaller, Bigger or Same Size?*
- *Capacity [in cubic feet]*

Number of secondary refrigerators retired:

Number replaced with a **new** refrigerator:

- *ENERGY STAR or not?*
- *Smaller, Bigger or Same Size?*
- *Capacity [in cubic feet]*

Number replaced with a **used** refrigerator:

- *Smaller, Bigger or Same Size?*
- *Capacity [in cubic feet]*

Number **not** replaced at all:

Secondary Refrigerator Usage (*Participant declaration*)

Amount of time plugged in:	All the Time	Most of the Time	Occasionally	Never
For a secondary refrigerator replaced:				
For a secondary refrigerator not replaced:				

2.2 Freezers (if applicable)

Replacement Information (*Participant declaration and on-site observations*)

Number of stand-alone freezers retired:

Number replaced with a **new** freezer:

- *ENERGY STAR or not?*
- *Smaller, Bigger or Same Size?*
- *Capacity [in cubic feet]*

Number replaced with a **used** freezer:

- *Smaller, Bigger or Same Size?*
- *Capacity [in cubic feet]*

Number **not** replaced at all:

Secondary Freezer Usage (*Participant declaration*)

Amount of time plugged in:	All the Time	Most of the Time	Occasionally	Never
For a secondary freezer replaced:				
For a secondary freezer not replaced:				

2.3 Room Air Conditioner Units (if applicable)

Replacement Information (*Participant declaration and on-site observations*)

Number of AC units retired:

Number replaced with a **new** AC unit:

- *ENERGY STAR or not?*
- *Smaller, Bigger or Same Size?*
- *Capacity [in Btu/h]*

Number replaced with a **used** AC unit:

- *Smaller, Bigger or Same Size?*
- *Capacity [in Btu/h]*

Number **not** replaced at all:

Room AC Unit Usage (*Participant declaration*)

Number of months per year plugged in:

Average number of hours per day in operation:

APPENDIX IV – DEMOGRAPHICS

The profile of the program participants interviewed for the survey is presented in the following tables.

The majority of respondents resided in single-family detached houses.

Table 40: Type of Home

Type of home	2011	2012
<i>Sample Size</i>	<i>90</i>	<i>201</i>
Single-family detached house	87%	87%
Apartment building that has fewer than 5 stories	2%	3%
Single-family attached house (townhouse, row house, or duplex)	1%	3%
Semi-detached house	6%	2%
Mobile home or house trailer	2%	2%
Apartment building that has 5 or more stories	1%	--
Apartment building with 2-4 units	--	--
Apartment building with 5 or more units	--	--
Others	--	1%
Don't know/Refused	1%	--

The majority of respondents owned their home (91%).

Table 41: Home Ownership

Home Ownership	2011	2012
<i>Sample Size</i>	<i>90</i>	<i>201</i>
Own/Buying	90%	91%
Rent/lease	8%	7%
Others	2%	1%
Don't know/Refused	--	--

Nearly three in ten respondents were in homes with 4 or more bedrooms (29%), while over half of them were in homes with three bedrooms (53%).

Table 42: Number of Bedrooms in Home

Number of Bedrooms	2011	2012
<i>Sample Size</i>	<i>90</i>	<i>201</i>
1	1%	2%
2	18%	13%
3	43%	53%
4 or more	36%	29%
Don't know/Refused	2%	2%

Four in ten respondents had a university degree (40%).

Table 43: Highest Level of Education

Level of Education	2011	2012
<i>Sample Size</i>	<i>90</i>	<i>201</i>
Less than high school graduate certificate	10%	10%
High school graduate certificate and/or some post-secondary education	28%	27%
Trade certificate/diploma	6%	5%
College certificate/diploma	14%	16%
University certificate/diploma	34%	40%
Don't know/Refused	8%	2%

The majority of respondents had 1 to 2 people in their household (65%).

Table 44: Household Size

Household Size	2011	2012
<i>Sample Size</i>	<i>90</i>	<i>201</i>
1	21%	15%
2	46%	50%
3	14%	12%
4	8%	16%
5	4%	5%
6 or more	6%	--
Don't know/Refused	1%	--

In terms of age, the majority of participants were 55 years of age or older (59%).

Table 45: Age of Respondent

Age of Respondent	2011	2012
<i>Sample Size</i>	90	201
18 to 24	0%	1%
25 to 34	8%	6%
35 to 44	11%	8%
45 to 54	20%	24%
55 to 64	38%	29%
65 or over	20%	30%
Don't know/Refused	3%	--

Nearly all the respondents paid their electricity bills themselves (94%).

Table 46: Method of Electricity Bill Payment

You Pay Electricity Bills	2011	2012
<i>Sample Size</i>	90	201
Yes	97%	94%
No	2%	5%
Don't know/Refused	1%	--

The vast majority of respondents were in homes where they resided year-round (99%).

Table 47: Residency in Home

Residency in Home	2011	2012
<i>Sample Size</i>	90	201
Year round residence	100%	99%
Seasonal/vacation home	--	1%
Don't know/ Refused	--	--

One-quarter of the respondents had a household income of \$80,000 or more (24%). Meanwhile, one in ten had a household income of less than \$25,000 (9%).

Table 48: Household Income

Household Income	2011	2012
<i>Sample Size</i>	90	201
\$14,999 or less	7%	2%
\$15,000 to \$24,999	8%	7%
\$25,000 to \$34,999	14%	15%
\$35,000 to \$49,999	13%	13%
\$50,000 to \$69,999	8%	12%
\$70,000 to \$79,999	4%	4%
\$80,000 or more	23%	24%
Don't know/Refused	22%	21%

Just over one-half of the respondents were female (54%), while under one-half were male (46%).

Table 49: Gender

Gender	2011	2012
<i>Sample Size</i>	90	201
Female	62%	54%
Male	38%	46%

APPENDIX V – PARTICIPANT SURVEY QUESTIONNAIRE

Participant Survey

ENSC 2012 Appliance Retirement Program

October 10, 2012

Screening Questions

Could I speak with [INSERT NAME]?

1. Yes [GO TO INTRODUCTION]
2. No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

INTRODUCTION

Hello, my name is _____ and I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you or your household recently participated in Efficiency Nova Scotia Corporation’s Appliance Retirement Program. We would appreciate your collaboration in answering questions related to your participation in this program.

We are calling customers who used the program to remove and recycle refrigerators, freezers or room air conditioner units in 2012. Are you the person who was most involved and familiar with deciding to have your old refrigerator, freezer or air conditioner unit picked up and recycled through the program?

[IF NO, ASK TO SPEAK TO THE APPROPRIATE PERSON: “May I please speak to the person who knows the most about having the appliance picked up?”]

[IF APPROPRIATE PERSON] We are trying to get feedback from customers about the Appliance Retirement program to make the program better. Your responses will be kept strictly confidential—that is, your name will not be associated with any of your responses. This survey will take about 15 minutes of your time. Is this a good time for you?

[IF REFUSED, ASK “Can we schedule a more convenient time for you to conduct this survey?”]

[SCHEDULED, IF NECESSARY, FOR: _____]

Verification and Recall (V Series)

V1. Our records indicate that your household participated in Efficiency Nova Scotia's Appliance Retirement Program, which removed and recycled

[INSERT NUMBER FROM VARIABLE "RF" IN THE SAMPLE] refrigerator(s),

[INSERT NUMBER FROM VARIABLE "FZ" IN THE SAMPLE] stand-alone freezer(s), (and)

[INSERT NUMBER FROM VARIABLE "AC" IN THE SAMPLE] room air conditioner unit(s)

from your home in 2012. Is this correct?

1. Yes [GO TO P1]
2. No, does not recall participating [PROBE: "Let me clarify. Someone would have come to your home and picked up your old appliance to recycle it. You would also have received a \$10 or \$35 rebate and the opportunity for Air Miles reward miles."] [IF PERSIST AS NO, THANK, TERMINATE AND RECORD]
3. No, different quantities (GO TO V2)
4. (Don't know) [PROBE: "Let me clarify. Someone would have come to your home and picked up your old appliance. You would also have received a \$10 or \$35 rebate and the opportunity for Air Miles reward miles."] IF PERSIST AS NO, THANK, TERMINATE AND RECORD.

V2. [ASK IF V1=3] Let me clarify, I am talking about the Efficiency Nova Scotia's Appliance Retirement program, which removed and recycled refrigerators, freezers or room air conditioner units from your home, paid you a \$10 or \$35 rebate for participating and gave you the opportunity for Air Miles reward miles. This was not a program that gave any rebates for purchases of new or replacement refrigerators, freezers or air conditioner units.

Thinking only about any appliances that were picked up through the Appliance Retirement program, which quantities are wrong? The [READ BELOW 1 = YES, 2 = NO, 98 = Don't Know]

- a. Number of refrigerators picked up
- b. Number of freezers picked up
- c. Number of air conditioner units picked up

- V3. [IF V2a. = YES] How many refrigerators were picked up through the Appliance Retirement program? [Record number, 98=Don't Know, 99= Refused] _____
- V4. [IF V2b. = YES] How many stand-alone freezers were picked up through the Appliance Retirement Program? [Record number, 98=Don't Know, 99=Refused]_____
- V5. [IF V2c. = YES] How many air conditioner units were picked up through the Appliance Retirement Program? [Record number, 98=Don't Know, 99=Refused]_____

Program Notoriety and Participation [P Series]

- P1. How did you find out about this program? [DON'T READ; ALLOW MULTIPLE RESPONSE BUT DO NOT PROBE FOR MULTIPLE]

Program Administrator Sources

1. (Bill insert/mailling from Efficiency Nova Scotia)
2. (Efficiency Nova Scotia website)
3. (Advertising in newspaper, radio, TV)
4. (Social Media –Facebook)
5. Contest "Nova Scotia's Worst Fridge"
6. Bus shelter advertisements

Retailer Sources

7. (Store flyer)
8. (Salesperson)

Other Sources

9. (Co-worker, family, or friend)
10. (Other participants)
11. (Internet—unspecified)
96. (Other [SPECIFY _____])
98. (Don't know)
99. (Refused)

P2. Why did you decide to get rid of the appliance(s) through Efficiency Nova Scotia's Appliance Retirement Program? PROBE: Anything else? [DO NOT READ – MULTIPLE RESPONSE]

Age/Need

1. (Old unit was not working well)
2. (Didn't need/use it any more)

Replacing unit

3. (Bought new appliance)

Housing change

4. (Remodeling/expanding)
5. (Moving soon/just moved)

Financial

6. (Reduce energy/electricity costs)
7. (Rebate/incentive)
8. (Cost too much to have it picked up)
9. (Did not want to pay disposal fee at dump/recycling center)
10. (Reduce maintenance costs/appliance needed repairs)

Logistical

11. (Easy/convenient to turn it in)
12. (They would pick it up)
13. (Trash collection would not accept)

Energy/Environment

14. (Better for the environment)
15. (Wanted to recycle)

Other

96. (Other [SPECIFY _____])
98. (Don't know)
99. (Refused)

- P3. Before participating, did you have any concerns about taking part in the program?
1. (Yes)
 2. (No)
 98. (Don't know)
 99. (Refused)
- P4. [IF P3 = 1] What were those concerns? PROBE: Anything else? [DO NOT READ. ACCEPT ALL RESPONSES]
1. (That I still needed my appliance)
 2. (That my appliance is still working/Don't want to get rid of a working appliance)
 3. (That there is no benefit to remove my appliance)
 4. (Rebates would be too low / insufficient)
 5. (The process will be too complicated)
 6. (The process would take too long)
 96. (Other [SPECIFY _____])
 98. (Don't know)
 99. (Refused)
- P5. What do you think happens to appliances after they are picked up by the program? PROBE: Anything else? [DON'T READ; MULTIPLE RESPONSE]
1. (They get recycled)
 2. (They get rid of the CFCs, refrigerants, freon)
 3. (They trash/get rid of it)
 4. (They sell it to be reused)
 96. (Other [SPECIFY _____])
 98. (Don't know)
 99. (Refused)

[IF RESPONDENT ASKS WHAT HAPPENS READ "After the program picks up an appliance, they take it to a facility and remove all environmentally hazardous materials, such as capacitors, mercury switches and refrigerants. Ninety-five percent of the unit is recycled including the metal, rubber, plastic and coolants."]

Program Satisfaction [S Series]

S1. Using a scale from 1 to 5 where 1 is “extremely dissatisfied” and 5 is “extremely satisfied” how would you rate your satisfaction with the program overall? [RECORD NUMBER, 98=Don’t know, 99 Refused] [DO NOT ACCEPT A RANGE]

[IF S1 = 1 OR 2]

S2. You indicated that you were not satisfied with the program overall. What was the SINGLE most important reason you were not satisfied with the program overall? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT ONE RESPONSE]

1. (Too difficult or long to sign up)
2. (My appliance(s) was/were not eligible)
3. (It was hard to schedule a pick-up time)
4. (The pick-up person was unpleasant)
5. (Incentive is too small)
6. (Too long before getting rebate)
96. (Other, specify_____)
98. (Don’t know) (GO TO S4)
99. (Refused) (GO TO S4)

[IF S1 = 1 OR 2]

S3. Were there any other reasons you were dissatisfied? [SAME LIST AS S2 ABOVE. DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]

97 No other reasons

S4. How did you initially sign up for the program? Did you sign up over the phone with a toll free number or did you sign up online?

1. (Over the phone)
2. (Signed up online)
3. (Both)
98. (Don’t know)
99. (Refused)

S5. Using a scale from 1 to 5 where 1 is “extremely difficult” and 5 is “extremely easy” how difficult or easy was it for you to...? [RANDOMIZE ORDER, ASKING A-B BASED ON SKIP PATTERNS]

- A. [IF S4=2 OR 3] Fill out the sign-up form and sign up online
- B. [IF S4=1 OR 3] Call the program and sign up over the phone
- C. Schedule the time for the pickup

- S6A. [IF S5A < 3] Please describe any difficulties you had in signing up online. [MULTIPLE RESPONSE – RECORD VERBATIM]
- S6B. [IF S5B < 3] Please describe any difficulties you had in signing up over the phone.
[MULTIPLE RESPONSE – RECORD VERBATIM]
- S6C. [IF S5C < 3] Please describe any difficulties you had in scheduling the pick-up of your appliance(s).
[MULTIPLE RESPONSE – RECORD VERBATIM]
- S7. Do you have any recommendations for improving the Appliance Retirement Program?
PROBE: Anything else?
1. (Accept a wider variety of products)
 2. (Improve scheduling/shorten wait for pick-up/Increase pick-ups)
 3. (Offer more information on the products/measures recommended)
 4. (Advertise the program more or in a better way)
 5. (Better/stronger incentives)
 6. (No recommendation)
 96. (Other [SPECIFY _____])
 97. (Don't know)
 98. (Refused)
- S8. [IF S7 =1] Which products or measures would you like to be eligible in the Appliance Retirement Program?
[MULTIPLE RESPONSE – RECORD VERBATIM]
96. (Record answer)
 97. (Don't know)
 98. (Refused)

Appliance Section

[PROGRAMMER: EACH RESPONDENT WILL BE ASKED ABOUT ONE APPLIANCE].

APPLIANCE	QUOTA
REFRIGERATOR (RF)	n=80
FREEZER (FZ)	n=80
AIR CONDITIONNER (AC)	n=40
TOTAL	n=200

Refrigerators [RF Series]

[IF V1 = 1 and RF = 0 OR IF V3=0 GO TO FZ1 (FREEZERS)]

[READ IF V1 = 1 AND RF = 1 OR IF V3=1], Now, I'd like you to think about the refrigerator you had removed through the program.

[READ IF V1 = 1 AND RF > 1 OR IF V3>1] I know you had more than one refrigerator removed through the program. For purposes of this survey, pick just one of the refrigerators removed and keep only that one refrigerator clearly in your mind as you answer the next few questions.

RF1. Was the refrigerator removed through the program the main one used in the home, a second refrigerator that was being used at least part of the time, or a refrigerator that was not being used at all?

IF CLARIFICATION NECESSARY: "A main or primary refrigerator would typically be located in the kitchen, plugged in or "on" all the time, and used for regular household purposes. A secondary or spare refrigerator is typically located somewhere other than in the kitchen and may be plugged in or "on" all or only part of the time." [NOTE: IF RESPONDENT RECENTLY BOUGHT A NEW REFRIGERATOR AND WAS JUST WAITING FOR THE PREVIOUSLY USED ONE TO BE PICKED UP BY THE PROGRAM, IT SHOULD BE CLASSIFIED AS "MAIN/PRIMARY"]

1. Used as Main/Primary
2. Used as a Spare/Secondary at date of pickup
3. Not being used

98. (Don't know) [PROBE: READ CLARIFICATION AND TRY TO CLASSIFY STATUS OF REFRIGERATOR]

99. (Refused)

RF2. Approximately how old was the refrigerator you had removed through the program? Was it [READ, CHECK ONE]:

1. 0 to 5 years old
2. 6 to 10 years old
3. 11 to 15 years old
4. 16 to 20 years old
5. More than 20 years old

98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?' RECORD]

99. (Refused)

- RF4. [IF RF1 = 3] Approximately how long had the refrigerator been unused when you decided to get rid of it? [RECORD]
1. Months [RECORD 1 to 11 months]
 2. Years [RECORD 1 to 50 years; round to the nearest year]
 98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE LENGTH OF TIME IT HAD BEEN UNUSED IN YOUR HOUSEHOLD?' RECORD]
 99. (Refused)
- RF5. Was the refrigerator in working condition when you decided to have it picked up by the program? [READ]
1. Yes
 2. Yes, but not that well
 3. No
 98. (Don't know)
 99. (Refused)
- RF6. [IF RF1=2 or 3] In the year prior to getting rid of the refrigerator, how often did you have the refrigerator plugged in? Was it plugged in [READ, CHECK ONLY ONE]:
1. All the time
 2. Most of time
 3. Occasionally
 4. Never [GO TO RF8]
 98. (Don't know) [GO TO RF8]
 99. (Refused) [GO TO RF8]
- RF7. [IF RF6< 4] How important for your household food and beverage storage needs is it to have a secondary refrigerator? Answer on a scale of 1 to 5, where 1 is 'not at all important' and 5 is 'extremely important.' [RECORD NUMBER, 98 don't know, 99 Refused]:
- RF8. Where in the house was the refrigerator most recently located? [RANDOMIZE AND READ 1-5, THEN 96 – CHECK ONLY ONE]
1. Basement
 2. Kitchen
 3. Garage
 4. Porch
 5. Laundry room
 96. Some other place [SPECIFY _____]
 98. (Don't know)
 99. (Refused)

Refrigerator Free-Ridership Section [RFR Series]

Please continue thinking about just that one refrigerator.

RFR1. Had you **already** considered disposing of the refrigerator **before** you heard about Efficiency Nova Scotia's Appliance Retirement Program? By dispose of, I mean getting the appliance out of your home by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center yourself.

- 1. Yes
- 2. No [GO TO RE1]
- 98. (Don't know)
- 99. (Refused)

RFR3. Now suppose that the Efficiency Nova Scotia Appliance Retirement Program that you used to dispose of this refrigerator had not been available. What would you have done with the refrigerator? [DO NOT READ; INDICATE ONE RESPONSE ONLY]

IF NEEDED: Your best estimate is okay.

- 1. (Sold it)
- 2. (Given it away for free)
- 3. (Taken it to a recycling center)
- 4. (Hired someone to take it for recycling)
- 5. (Taken it to a garbage dump or put out as trash)
- 6. (Hired hauler to take it away for junking or dumping)
- 7. (Had a retail store come and pick it up)
- 8. (Continued to use it)
- 9. (Store it unplugged)
- 10. (Postponed getting rid of it)
- 96. (Other, specify _____)
- 98. (Don't Know)
- 99. (Refused)

[ASK IF RFR3 = 10]

RFR4. You indicated that without the Program, you would have postponed getting rid of your refrigerator. How soon would you have disposed of your old refrigerator? Would you have disposed of it within a year of when the Program took it or more than a year later?

- 1. Within a year of when the program took it
- 2. More than a year later
- 98. Don't Know
- 99. Refused

RFR5. Efficiency Nova Scotia paid for the refrigerator to be removed from your home and recycled. The approximate value of this service is \$60. If you had not received these services for free from Efficiency Nova Scotia, how likely is it that you would have paid the full cost of recycling the refrigerator yourself? Please answer on a 10 point scale with a 0 meaning “Very Unlikely” and a 10 meaning “Very Likely”. Again, the approximate cost of removal and recycling would have been \$60. [DO NOT ACCEPT A RANGE]

___ Response

98. (Don’t know)

99. (Refused)

RFR6. Next, I’m going to ask you to rate the importance of the Appliance Retirement Program as well as other factors that might have influenced your decision to remove your refrigerator. Using a scale from 0 to 10, where 0 means “Not at all important” and 10 means “Extremely important”, please rate the importance of each of the following in your decision to remove your refrigerator.

Factor (READ AND RANDOMIZE)	Responses
a. The \$35 incentive provided by Efficiency Nova Scotia	___ Response ___98 Don’t Know ___99 Refused
b. Information or advice received from the program	___ Response ___98 Don’t Know ___99 Refused
c. Removal and recycling services provided for free as part of the program	___ Response ___98 Don’t Know ___99 Refused
IF AIRMILES=YES IN THE SAMPLE d. The Air Miles reward miles	___ Response ___98 Don’t Know ___99 Refused

RFR8. Now suppose that the program had provided you only the free removal and recycling services and *not* the \$35 incentive, how likely is it that you would have disposed of this refrigerator through the Appliance Retirement Program without the \$35 incentive? Please answer on a 10 point scale with 0 meaning “Very Unlikely” and 10 meaning “Very Likely”.

___ Response

98. (Don’t know)

99. (Refused)

Replacement Refrigerator (RE Series)

- RE1. Did you replace the refrigerator that you turned in through Efficiency Nova Scotia's Appliance Retirement Program?
- 1. Yes
 - 2. No [GO TO RRF1]
 - 98. (Don't know) [GO TO RRF1]
 - 99. (Refused) [GO TO RRF1]
- RE2. Was the replacement refrigerator new or used when you started using it as the replacement refrigerator?
- 1. New
 - 2. Used
 - 98. (Don't know)
 - 99. (Refused)

Remaining Refrigerators (RRF Series)

- RRF1. How many refrigerators are currently in use in your home since you removed a refrigerator through the program?
- [RECORD NUMBER]_____ [98 Don't know, 99 Refused] [IF 0 GO TO FZ1 (Freezer Series)].

IF 'DON'T KNOW' OR 'REFUSED' TO RRF1, SKIP TO FZ SERIES

- RRF2a through RRF2c. [FOR EACH REFRIGERATOR IN RRF1, ASK "Approximately how old is your refrigerator." [IF MORE THAN ONE REFRIGERATOR, ASK ABOUT UP TO THREE REFRIGERATORS INSERTING "first", "second," or "third" BEFORE "refrigerator" AS APPROPRIATE, BASED ON RRF1 RESPONSE.]
- 1. 0 to 5 years old
 - 2. 6 to 10 years old
 - 3. 11 to 15 years old
 - 4. 16 to 20 years old
 - 5. More than 20 years old
 - 98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE OF THIS REFRIGERATOR?' RECORD]
 - 99. (Refused)

Freezer [FZ Series]

[IF V1 = 1 AND FZ > 0 OR IF V4>0 (had freezer removed) ASK FZ SERIES, OTHERWISE SKIP TO AC1 (Air conditioner unit Series)]

[READ IF V1 = 1 AND FZ = 1 OR IF V4=1] Now, I'd like you to think about the stand-alone freezer you had removed through the program.

[READ IF V1 = 1 AND FZ > 1 OR IF V4>1] I know you had more than one stand-alone freezer removed through the program. For purposes of this survey, pick just one of the freezers removed and keep just that one freezer clearly in your mind as you answer the next few questions.

FZ1. In the year prior to getting rid of the freezer, how often did you have the freezer plugged in? Was it plugged in [READ, CHECK ONLY ONE]:

1. All the time
2. Most of time
3. Occasionally
4. Never
98. (Don't know)
99. (Refused)

FZ2. Approximately how old was the freezer you had removed through the program? Was it [READ, CHECK ONE]:

1. 0 to 5 years old
2. 6 to 10 years old
3. 11 to 15 years old
4. 16 to 20 years old
5. More than 20 years old
98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?' RECORD]
99. (Refused)

FZ3. Was the freezer in working condition when you decided to have it picked up by the program? [READ]

1. Yes
2. Yes, but not that well
3. No
98. (Don't know)
99. (Refused)

- FZ4. [IF FZ1 = 4 (Never used)] Approximately how long had the freezer been unused when you decided to get rid of it? [RECORD]
1. Months [RECORD 1 to 11 months]
 2. Years [RECORD 1 to 50 years; round to the nearest year]
 98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE LENGTH OF TIME THAT THE FREEZER HAD BEEN UNUSED?' RECORD]
 99. (Refused)
- FZ6. How important for your household food storage needs is it to have a stand-alone freezer? Answer on a scale of 1 to 5, where 1 is 'not at all important' and 5 is 'extremely important.' [RECORD NUMBER, 98 don't know, 99 Refused]:
- FZ7. Where in the house was the freezer located? [RANDOMIZE AND READ 1-5, THEN 96 – CHECK ONLY ONE]
1. Basement
 2. Kitchen
 3. Garage
 4. Porch
 5. Laundry room
 96. Some other place [SPECIFY _____]
 98. (Don't know)
 99. (Refused)

Freezer Free-Ridership [FFR Series]

Please continue thinking about just that one freezer.

- FFR1. Had you **already** considered disposing of the freezer **before** you heard about Efficiency Nova Scotia's Appliance Retirement Program? By dispose of, I mean getting the appliance out of your home by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center yourself.
1. Yes
 2. No [GO TO FE1]
 98. (Don't know)
 99. (Refused)

FFR3. Now suppose that the Efficiency Nova Scotia Appliance Retirement Program that you used to dispose of this freezer had not been available. What would you have done with the freezer?

[DO NOT READ; INDICATE ONE RESPONSE ONLY]

IF NEEDED: Your best estimate is okay.

1. (Sold it)
2. (Given it away for free)
3. (Taken it to a recycling center)
4. (Hired someone to take it for recycling)
5. (Taken it to a garbage dump or put out as trash)
6. (Hired hauler to take it away for junking or dumping)
7. (Had a retail store come and pick it up)
8. (Continued to use it)
9. (Store it unplugged)
10. (Postponed getting rid of it)
96. (Other, specify _____)
98. (Don't Know)
99. (Refused)

[ASK FFR4 IF FFR3 = 10]

FFR4. You indicated that without the Program, you would have postponed getting rid of your freezer. How soon would you have disposed of your old freezer? Would you have disposed of it within a year of when the Program took it or more than a year later?

1. Within a year of when the program took it
2. More than a year later
98. (Don't Know)
99. (Refused)

FFR5. Efficiency Nova Scotia paid for the freezer to be removed from your home and recycled. The approximate value of this service is \$60. If you had not received these services for free from Efficiency Nova Scotia, how likely is it that you would have paid the full cost of recycling the freezer yourself? Please answer on a 10 point scale with a 0 meaning "Very Unlikely" and a 10 meaning "Very Likely". Again, the approximate cost of removal and recycling would have been \$60. [DO NOT ACCEPT A RANGE]

___ Response

98. (Don't know)
99. (Refused)

FFR6. Next, I'm going to ask you to rate the importance of the Appliance Retirement Program as well as other factors that might have influenced your decision to remove your freezer. Using a scale from 0 to 10, where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of each of the following in your decision to remove your freezer.

Factor (READ AND RANDOMIZE)	Responses
a. The \$35 incentive provided by Efficiency Nova Scotia	___ Response ___98 Don't Know ___99 Refused
b. Information or advice received from the program	___ Response ___98 Don't Know ___99 Refused
c. Removal and recycling services provided for free as part of the program	___ Response ___98 Don't Know ___99 Refused
IF AIRMILES=YES IN THE SAMPLE d. The Air Miles reward miles	___ Response ___98 Don't Know ___99 Refused

RFR8. Now suppose that the program had provided you only the free removal and recycling services and *not* the \$35 incentive, how likely is it that you would have disposed of this freezer through the Appliance Retirement Program without the \$35 incentive? Please answer on a 10 point scale with 0 meaning "Very Unlikely" and 10 meaning "Very Likely".

- ___ Response
98. (Don't know)
99. (Refused)

Replacement Freezer Questions (FE Series)

FE1. Did you get another freezer to replace the one you turned in through Efficiency Nova Scotia's Appliance Retirement Program?

1. Yes
2. No [GO TO RFZ1]
98. (Don't know) [GO TO RFZ1]
99. (Refused) [GO TO RFZ1]

FE2. Was the replacement freezer new or used when you started using it as the replacement freezer?

1. New
2. Used
98. (Don't know)
99. (Refused)

Remaining Freezers [RFZ Series]

RFZ1. How many stand-alone freezers are currently in use in your home?

[RECORD NUMBER]_____ [RECORD NUMBER, 98 Don't know, 99 Refused] [IF 0 GO TO AC SERIES].

IF "DON'T KNOW" OR "REFUSED" IN RFZ1, GO TO AC SERIES

RFZ2a through RFZ2c. [FOR EACH FREEZER IN RFZ1, ASK "Approximately how old is your freezer." [IF MORE THAN ONE FREEZER, ASK ABOUT UP TO THREE FREEZERS INSERTING "first", "second," or "third" BEFORE "freezer" AS APPROPRIATE, BASED ON RFZ1 RESPONSE.]

1. 0 to 5 years old
2. 6 to 10 years old
3. 11 to 15 years old
4. 16 to 20 years old
5. More than 20 years old
98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE OF THIS FREEZER?']
99. (Refused)

Air Conditioner Units [AC Series]

[IF V1 = 1 AND AC > 0 OR IF V5>0 (had air conditioner unit removed) ASK AC SERIES, OTHERWISE SKIP TO SO SERIES

[READ IF V1 = 1 AND AC = 1 OR IF V5=1] Now, I'd like you to think about the air conditioner unit you had removed through the program.

[READ IF V1 = 1 AND AC > 1 OR IF V5>1] I know you had more than one air conditioner unit removed through the program. For purposes of this survey, pick just one of the air conditioner units s

removed and keep just that one air conditioner unit clearly in your mind as you answer the next few questions.

AC1. In the year prior to getting rid of the air conditioner unit, how often did you have the air conditioner unit plugged in? Was it plugged in [READ, CHECK ONLY ONE]:

- 1. All the time
- 2. Most of time
- 3. Occasionally
- 4. Never
- 98. (Don't know)
- 99. (Refused)

AC2. Approximately how old was the air conditioner unit you had removed through the program? Was it [READ, CHECK ONE]:

- 1. 0 to 5 years old
- 2. 6 to 10 years old
- 3. 11 to 15 years old
- 4. 16 to 20 years old
- 5. More than 20 years old
- 98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?' RECORD]
- 99. (Refused)

AC3. Was the air conditioner unit in working condition when you decided to have it picked up by the program? [READ]

- 1. Yes
- 2. Yes, but not that well
- 3. No
- 98. (Don't know)
- 99. (Refused)

AC4. [IF AC1 = 4 (NEVER USED)] Approximately how long had the air conditioner unit been unused when you decided to get rid of it?

- 1. Months [RECORD 1 TO 11 MONTHS]
- 2. Years [RECORD 1 TO 50 YEARS; ROUND TO THE NEAREST YEAR]
- 98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE LENGTH OF TIME THAT THE AIR CONDITIONER UNIT HAD BEEN UNUSED?' RECORD]
- 99. (Refused)

[IF AC1=4 GO TO AFR1-AIR CONDITIONER UNIT FREE-RIDER SERIES]

AC6. Where in the house was the air conditioner unit located? [READ 1-2, THEN 96– CHECK ONLY ONE]

- 1. Bedroom
- 2. Living room
- 96. Some other place [SPECIFY _____]
- 98. (Don't know)
- 99. (Refused)

AC7. In which months did you typically operate your air conditioner unit? [DO NOT READ, CHECK ALL THAT APPLY]

- 1. January
- 2. February
- 3. March
- 4. April
- 5. May
- 6. June
- 7. July
- 8. August
- 9. September
- 10. October
- 11. November
- 12. December
- 98. (Don't know)
- 99. (Refused)

AC8. During these months, was your air conditioner unit generally running all the time or did you only use it when necessary? [CHECK ONLY ONE]

- 1. Generally running all the time
- 2. Only when necessary
- 98. (Don't know)
- 99. (Refused)

[ASK AC8 = 2]

AC9. You told me that you used to turn on your air conditioner unit when it was necessary. On what basis did you decide to turn on you air conditioner unit? [DO NOT READ - ALLOW MULTIPLE BUT DO NOT ASK FOR]

1. (According to the temperature/When it was warm)
2. (When people are at home)
3. Luring night time)
4. (On weekends)
96. (Other, specify _____)
98. (Don't know)
99. (Refused)

Air Conditioner Unit Free-Ridership [AFR Series]

Please continue thinking about just that one air conditioner unit.

AFR1. Had you **already** considered disposing of the air conditioner unit **before** you heard about Efficiency Nova Scotia's Appliance Retirement Program? By dispose of, I mean getting the appliance out of your home by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center yourself.

1. Yes
2. No [GO TO ACU1]
98. (Don't know)
99. (Refused)

AFR3. Now suppose that the Efficiency Nova Scotia Appliance Retirement Program that you used to dispose of this air conditioner unit had not been available. What would you have done with the air conditioner unit? [DO NOT READ; INDICATE ONE RESPONSE ONLY]

IF NEEDED: Your best estimate is okay.

1. (Sold it)
2. (Given it away for free)
3. (Taken it to a recycling center)
4. (Hired someone to take it for recycling)
5. (Taken it to a garbage dump or put out as trash)
6. (Hired hauler to take it away for junking or dumping)
7. (Had a retail store come and pick it up)
8. (Continued to use it)
9. (Store it unplugged)
10. (Postponed getting rid of it)
96. (Other, specify _____)
98. (Don't Know)
99. (Refused)

[ASK AFR4 IF AFR3 = 10]

AFR4. You indicated that without the Program, you would have postponed getting rid of your air conditioner unit. How soon would you have disposed of your old air conditioner unit? Would you have disposed of it within a year of when the Program took it, or more than a year later?

- 1. Within a year of when the program took it
- 2. More than a year later
- 98. (Don't Know)
- 99. (Refused)

AFR5. Efficiency Nova Scotia paid for the air conditioner unit to be removed from your home and recycled. The approximate value of this service is \$60. If you had not received these services for free from Efficiency Nova Scotia, how likely is it that you would have paid the full cost of recycling the air conditioner unit yourself? Please answer on a 10 point scale with a 0 meaning "Very Unlikely" and a 10 meaning "Very Likely". Again, the approximate cost of removal and recycling would have been \$60. [DO NOT ACCEPT A RANGE]

___ Response

- 98. (Don't know)
- 99. (Refused)

AFR6. Next, I'm going to ask you to rate the importance of the Appliance Retirement Program as well as other factors that might have influenced your decision to remove your air conditioner unit. Using a scale from 0 to 10, where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of each of the following in your decision to remove your air conditioner unit.

Factor (READ AND RANDOMIZE)	Responses
a. The \$10 incentive provided by Efficiency Nova Scotia	___ Response ___98 Don't Know ___99 Refused
b. Information or advice received from the program	___ Response ___98 Don't Know ___99 Refused
c. Removal and recycling services provided for free as part of the program	___ Response ___98 Don't Know ___99 Refused
IF AIRMILES=YES IN THE SAMPLE d. The Air Miles reward miles	___ Response ___98 Don't Know ___99 Refused

AFR8. Now suppose that the program had provided you only the free removal and recycling services and *not* the \$10 incentive, how likely is it that you would have disposed of this air conditioner unit through the Appliance Retirement Program without the \$10 incentive? Please answer on a 10 point scale with 0 meaning “Very Unlikely” and 10 meaning “Very Likely”.

____ Response

98. (Don’t know)

99. (Refused)

Replacement Air Conditioner Unit Questions (ACU Series)

ACU1. Did you get another air conditioner unit to replace the one you turned in through Efficiency Nova Scotia’s Appliance Retirement Program?

1. Yes

2. No [GO TO ACZ1]

98. (Don’t know) [GO TO ACZ1]

99. (Refused) [GO TO ACZ1]

ACU2. Was the replacement air conditioner unit new or used when you started using it as the replacement air conditioner unit?

1. New

2. Used

98. (Don’t know)

99. (Refused)

Remaining Air Conditioner Unit [ACZ Series]

ACZ1. How many stand-alone air conditioner units are currently in use in your home?

[RECORD NUMBER]_____ [RECORD NUMBER, 98 Don’t know, 99 Refused] [IF 0 GO TO SO SERIES]

IF “DON’T KNOW” OR “REFUSED” IN ACZ1, GO TO SO SERIES

ACZ2a through ACZ2c. [FOR EACH AIR CONDITIONER UNIT IN ACZ1, ASK “Approximately how old is your air conditioner unit.” [IF MORE THAN ONE AIR CONDITIONER UNIT, ASK ABOUT UP TO THREE AIR CONDITIONER UNITS INSERTING “first”, “second,” or “third” BEFORE “air conditioner unit” AS APPROPRIATE, BASED ON ACZ1 RESPONSE.]

1. 0 to 5 years old
2. 6 to 10 years old
3. 11 to 15 years old
4. 16 to 20 years old
5. More than 20 years old
98. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE OF THIS AIR CONDITIONER UNIT?']
99. (Refused)

Spillover [SO Series]

SO1. Since participating in Efficiency Nova Scotia's Appliance Retirement Program, have you disposed of other appliances WITHOUT RECEIVING A REBATE?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[GO TO IM1 IF SO1=2 OR 98 OR 99]

SO2. What other appliance(s) have you disposed of WITHOUT RECEIVING A REBATE since participating in Efficiency Nova Scotia's Appliance retirement program? [READ IN ORDER – CODE ONE ONLY PER STATEMENT]

- a. Other refrigerator
- b. Other stand-alone freezer
- c. Other air conditioner unit

- 1 (Yes)
- 2 (No)
98. (Don't know)
99. (Refused)

[GO TO IM1 IF 2 OR 98 OR 99 TO ALL OF SO2a-d]

SO3. How did you dispose of [this/these] appliance(s)? Did you... [READ, CHECK ALL THAT APPLY]

1. Sell it/ them
2. Give it/them away for free
3. Take it/them to a recycling center or hired someone to take it/them for recycling
4. Take it/them to a garbage dump or put out as trash
5. Hire hauler to take it/them away
6. Have a retail store come and pick it/them up
96. Or did you do something else? [SPECIFY]_____
98. (Don't know)
99. (Refused)

SO4. How influential was your experience with the Appliance Retirement Program on your decision to dispose of this or these additional appliance(s) WITHOUT RECEIVING A REBATE? Please give your answer on a scale of 0 to 10, where 0 indicates that the program "had no influence at all on your decision to dispose of this or these additional appliance(s)" and 10 indicates that the program was "extremely influential to your decision to dispose of this or these additional appliance(s)." [RECORD RESPONSE 0-10, 98 = Don't know, 99 = REFUSED] [DO NOT ACCEPT A RANGE]

Impact of Measures [IM Series]

IM1. Please indicate how each of the following has changed since participating in the Appliance Retirement Program? On a scale of 1 to 5, where 1 means "no improvement" and 5 means a "considerable improvement", how much has [READ EACH ONE, RANDOMIZE] improved?

- a. The Reduction in total energy costs
- b. Your interest in Energy efficiency
- c. Your knowledge of Energy efficiency
- d. Your knowledge of Appliances
- 98 Don't know
- 99 Refused

IM2. What, if any, negative consequences have you experienced from removing your appliances through the Appliance Retirement Program? [DON'T READ, PROBE; MULTIPLE RESPONSE]

1. (No drawbacks)
2. (Loss of food storage space)
3. (Loss of other storage space)
4. (House no longer cool)
5. (Usable appliances are thrown away)
96. (Other SPECIFY _____)
98. (Don't know)
99. (Refused)

IM3. Would you recommend the Appliance Retirement Program to a family member or friend?

1. Yes
2. No
98. (Don't know)
99. (Refused)

IM4. [IF IM3 = 2 "NO"] Why not? PROBE: Any other reasons? [RECORD VERBATIM – 98=Don't know, 99=Refused]

Demographics [D Series]

These final questions are asked for statistical purposes only. The information collected is strictly confidential.

D1. What type of residence do you live in? [READ RESPONSES 1-7, THEN 96; SELECT ONE RESPONSE]

1. Detached single-family home
2. Semi-detached house
3. Mobile home or house trailer
4. Townhouse or duplex which share adjacent walls
5. Row house (Single story apartment building)
6. Apartment building that has fewer than five stories
7. Apartment building that has five or more stories
96. Or something else [SPECIFY: _____]
98. (Don't know)
99. (Refused)

- D2. How many bedrooms are in your home?_[88=DK; ENTER ZERO FOR A STUDIO APARTMENT WITH NO BEDROOMS]
- D3. Do you own or rent this home?
1. Own/buying
 2. Rent/lease
 3. Other (Describe) _____
- D4. Do you pay the electric bills for your home?
1. Yes
 2. No
 98. (Don't Know)
 99. (Refused)
- D5. Is your home occupied year round, or is it a seasonal home?
1. Year round residence
 2. Seasonal / vacation home
 96. (Other Specify _____)
 98. (Don't know)
 99. (Refused)
- D6. Including yourself, how many people live in this residence on a full-time basis?
- Number of people: _____
- [NOTE: DON'T ALLOW ZERO FOR A RESPONSE]
- D7. What is your age group? Are you... [READ LIST; SELECT ONE RESPONSE]
1. 18 to 24
 2. 25 to 34
 3. 35 to 44
 4. 45 to 54
 5. 55 to 64
 6. 65 or over
 99. (Refused)

D8. What is the highest grade of schooling completed by the head of your household? [DO NOT READ]

1. (Less than high school graduation certificate)
2. (High school graduation certificate and/or some post-secondary)
3. (Trades certificate or diploma)
4. (College certificate or diploma)
5. (University certificate or diploma)
98. (Don't know)
99. (Refused)

D9. Which of the following income categories best describes your total annual household income before taxes in 2011? Stop me when I reach the right category. [READ LIST; SELECT ONE RESPONSE]

1. Less than \$15,000
2. \$15,000 - \$24,999
3. \$25,000 - \$34,999
4. \$35,000 - \$49,999
5. \$50,000 - \$69,999
6. \$70,000 - \$79,999
8. \$80,000 or more
98. (Don't know)
99. (Refused)

D10. [DO NOT READ] Gender:

1. Male
2. Female

END: Those are all the questions I have for you. I thank you very much for your time and cooperation and have a nice day!

APPENDIX VI – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

FR1. Had you already considered disposing of your appliance before you heard about the program?	IF 2. No: FR1 = 0% OTHERWISE: GO TO FR3
FR3. If the program had not been available, what would you have done with your appliance? 1. (Sold it) 2. (Given it away for free) 3. (Taken it to a recycling center) 4. (Hired someone to take it for recycling) 5. (Taken it to a garbage dump or put out as trash) 6. (Hired hauler to take it away for junking or dumping) 7. (Had a retail store come and pick it up) 8. (Continued to use it) 9. (Store it unplugged) 10. (Postponed getting rid of it) 99. (Don't Know / Refused)	IF 1. : FR3 = 0% IF 2. : FR3 = 0% IF 3. : FR3 = 100% IF 4. : FR3 = 100% IF 5. : FR3 = 50% IF 6. : FR3 = 50% IF 7. : FR3 = 50% IF 8. : FR3 = 0% IF 9. : FR3 = 50% IF 10. : FR3 = 0% IF 99. : FR3 = 0%
PA1 Score:	FR1 or FR3
FR6. Level of influence (Scale 0 to 10) Factors a, b, c and d = Program factors	FR6_P = MAX(a; b; c; d)
PA2 Score:	(10 – FR6_P) x 10%
FR4. [Ask if FR3 = 10] How soon would you have disposed of your old appliance? 1. Within a year of when the program took it 2. More than a year later 99. (Don't Know / Refused)	IF 1. : FR4 = EMPTY IF 2. : FR4 = 0%
PA3 Score:	FR4
Final Free-Ridership	MEAN VALUE OF : (PA1 ; PA2 ; PA3)



INSTANT SAVINGS

IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 5, 2013



ECONOLER

ACRONYMS

CEE	Consortium for Energy Efficiency
CFL	Compact Fluorescent Lamp
CRA	Corporate Research Associates
DA	Delivery Agent
ENSC	Efficiency Nova Scotia Corporation
LED	Light Emitting Diode
LTE	Laboratory of Energy Technologies
NRCan	Natural Resources Canada
NTGR	Net-to-Gross Ratio
OPA	Ontario Power Authority
PM	Program Manager
POP	Point of Purchase

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Demand-to-energy ratio	A ratio obtained by dividing the target peak demand savings by the target energy savings of a given program for a given year.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Market effects	Percentage of savings attributable to spillover from a program beyond program participants, i.e., in terms of supply, not demand.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.

Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Instant Savings, which is a component of the Efficient Products program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM), one delivery agent (DA) and 17 retailer partners, 20 in-store visits of retailer stores, as well as on an in-store intercept survey of 164 participants (compact fluorescent lamp (CFL) and Light Emitting Diode (LED) buyers).

PROGRAM COMPONENT OVERVIEW

In 2012, Instant Savings worked in collaboration with 11 major retail chains and 38 independent retailers across Nova Scotia to offer customers in-store discounts on different energy-efficient products.

Discounts were offered on the following products:

- > multipacks of ENERGY STAR® CFLs;
- > any size packages of ENERGY STAR® specialty CFLs;
- > ENERGY STAR® LED lamps and recessed downlight fixtures;
- > dimmer switches;
- > indoor and outdoor motion sensors;
- > power bars with integrated timer;
- > load sensing power bars (smart strips);
- > heavy duty outdoor timers;
- > programmable thermostats for baseboard heaters;
- > CEE Tier 3 refrigerators; and
- > CEE Tier 3 clothes washers.

The spring and fall campaign periods for the year 2012 ran from April 16 to June 17 and from October 1 to November 30, respectively.

In 2012, the Instant Savings also included an AIR MILES® component, which rewarded participants with AIR MILES® when purchasing eligible products. The program held in-store customer engagement events as well, during which participants were given information about the program and other Efficiency Nova Scotia Corporation (ENSC) programs along with free LED lamps as part of ENSC representative giveaways.

Instant Savings is both a resource acquisition and a market transformation program. The program's long-term market transformation goal is not simply the partial adoption of CFLs and LEDs in Nova Scotia; it is the use of CFLs and LEDs in all available sockets. From a resource acquisition perspective, as long as customers install program CFLs and LEDs in sockets previously occupied by lower efficiency technologies in a cost effective manner, the goal has been achieved.

The program aimed to achieve net energy savings of 10.8 GWh (8.3 GWh for Instant Savings and 2.5 GWh for the AIR MILES® component) and demand savings of 1.9 MW (1.5 MW for Instant Savings and 0.4 MW for the AIR MILES® component) at the generator for the year 2012.

KEY FINDINGS

The 2012 evaluation of Instant Savings demonstrated that the program constitutes the right approach in a market transformation and resource acquisition perspective. In terms of net energy savings at the generator, the program generated 10.767 GWh (10.061 GWh for Instant Savings and 0.706 GWh for the AIR MILES® component) in comparison to 13.802 GWh in 2011.

Awareness and Marketing

In order for the program to keep being successful in the years to come, program awareness constitutes an important aspect of the program strategy. Survey results showed that nearly six in ten CFL or LED buyers had heard of Instant Savings when they purchased their eligible products. Furthermore, the majority of participants were aware of the discount prior to paying for their lamps. In-store signage proved to be successful at communicating with customers regarding the program and the discount. Indeed, the vast majority of participants who were aware of the discount saw in-store promotions such as stickers, shelf signs or posters. The mystery in-store visits confirmed that promotional display was improved in 2012, thus explaining its recognition by participants. The mystery shopper noticed that the rebates were clearly visible, that the promotional displays were fairly uniform from one chain retailer to another and that a wider variety of promotional tools were used by retailers. Moreover, customer engagement events were much better organized and provided customers with information on eligible products and rebates from the Instant Savings campaign or on other ENSC programs. ENSC's efforts in improving the program marketing material and awareness paid off as retailers also mentioned being satisfied with the look of the promotional tools and the positive impact of customer engagement events on customer awareness of energy-efficient products.

Though being satisfied with the marketing material, retailers reported the difficulty in involving store associates and personnel to ensure optimal program promotion. Corporate-level retailers described difficulty in communicating all the necessary information to their store personnel and in involving and engaging them. The program DA also noticed this issue. The latter believes that a challenge persists in making retailers understand the relevance of program components such as point of purchase (POP) display and in-store customer engagement events. According to all partners, retailer involvement constitutes the main barrier to Instant Savings implementation. The DA believes that initiatives such as the playbook and the contest need to continue in order to create a sense of involvement among retailers and turn them into program promoters and advocates.

The DA and the retailers also brought up another challenge associated to program implementation. Many retailers mentioned very tight timelines during the preparation process to the campaigns, especially for the spring campaign. The DA confirmed this situation but mentioned that efforts were

made to improve timelines for the fall campaign. Overall, retailers wish to be informed in advance of all program-related decisions that affect the way they work, such as program dates, eligible products and rebate amounts.

Most of the retailers mentioned being satisfied with the products promoted through the program. Many appliance retailers would like to see a change in the variety of energy-efficient appliances discounted under the program. Notably, not many models of CEE Tier 3 refrigerators currently exist on the market, which constitutes a very specific class of high-end product. Discounting other energy-efficient models, such as CEE Tier 2 refrigerators, would break this barrier and make this type of product more accessible to consumers. In addition, many of the retailers carry only CEE Tier 3 washers in their stores. Therefore, the program did not have a great impact on their sales since the rebate became an extra instead of being the main incentive to buy. As for other program products, some retailers recommended adding indoor and outdoor lighting fixtures, freezers and dishwashers to the list of eligible products. Two retailers also suggested a greater focus on LED products going forward with the program.

Satisfaction

In spite of the concerns mentioned above, the DA indicated being very satisfied with the program overall as well as with their relationship with the participating retailers and ENSC's team. Likewise, the retailers provided high satisfaction ratings with regard to the program in general and most of its aspects such as their relationship with the DA, program support and communication as well as discount processing, tracking and reporting.

Program Energy Savings

The impact evaluation is the result of three main activities: a review of unitary savings used to estimate gross savings, the CFL and LED-buyer intercept survey and retailer interviews. To calculate the gross and net savings, Econoler took into consideration the replacement ratio of regular CFLs, the interactive effects for lighting products as well as free-ridership and spillover through market effects for three important products: regular CFLs, LED lamps and clothes washers. The table below shows the net-to-gross ratio (NTGR) calculated from the free-ridership and spillover levels captured for these three products. For all other products, a NTGR of 1 was used since the population of buyers for these products was too small to reach a sufficient number of participants through an intercept survey.

Table 1: Distortion Effects and Net-to-Gross Ratio

Category of Product	Free-Ridership	Spillover	NTGR
Regular CFLs	59%	29%	0.70
Specialty CFLs	-	-	1.00
LED Lamps	33%	20%	0.87
CEE Tier 3 Clothes Washers	78%	48%	0.70
LED Distributed During In-Store Events	-	-	1.00
Products Sold through the AIR MILES® Campaigns	-	-	1.00
All Other Products	-	-	1.00

The evaluation revealed that Instant Savings generated net energy savings of 10.767 GWh and demand savings of 1.895 MW at the generator in 2012. These results include the savings from the products sold during both markdown campaign periods, from the LEDs distributed during in-store customer engagement events and from the products sold through the AIR MILES® campaigns.

Table 2: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	19.009 GWh	16.311 GWh	14.263 GWh	0.71	10.167 GWh
Evaluation Results	17.620 GWh	15.238 GWh	13.254 GWh	0.81*	10.767 GWh
Demand Savings					
Tracked Savings from ENSC	1.889 MW	1.621 MW	1.418 MW	0.71	1.011 MW
Evaluation Results	3.101 MW	2.682 MW	2.333 MW	0.81*	1.895 MW

**NTGRs were different for each category of product. The NTGRs presented in this table correspond to the rounded averages obtained by dividing the net savings by the installed gross savings (with interactive effects).*

These net evaluated energy savings exceeded those tracked by ENSC by 6 percent although some unitary savings values were revised downward. The main element that explains this result is the difference between the NTGR measured for this evaluation and that used in the tracking sheet, which was based on the 2011 evaluation. For regular CFLs, which contribute to more than 60 percent of gross savings, the NTGR went from 0.53 to 0.70. The free-ridership level measured this year through an intercept survey at the exit of the store right after the purchase was lower for regular CFLs. Moreover, the inclusion of the percentage of outdoor installations for CFLs and LED lamps in the interactive effects calculation allowed for a more precise evaluation of savings and reduced the impact on the evaluated savings.

RECOMMENDATIONS

Econoler finds that the program works well overall and at a satisfactory level. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

Instant-R1. Document the AIR MILES® approach: The program manual does not provide enough information on the AIR MILES® approach, such as the number provided for each eligible product purchased, or justification from a 2011 pilot project. Overall, the AIR MILES® campaign needs to be better documented in the Instant Savings program manual. Among other things, an example of what information will be found in the AIR MILES® tracking sheet should be added as one of the program manual Appendices.

Instant-R2. Generate greater involvement from the retailers: The DA mentioned an important concern during the evaluation process. They spoke of the difficulty to involve retailers in the program, both at the corporate and store levels. Indeed, a challenge persists in making retailers at the corporate level understand the relevance of program components such as POP and in-store customer engagement events. Since some corporate retailers do not always communicate well with their store associates, this challenge also affects participating stores. The retailers recognized this difficulty and its impact on the effectiveness of the campaigns. They reported the challenge that lies in communicating all the necessary information to their store personnel and in involving and engaging them, as indicated by the DA.

The success of Instant Savings relies largely on the collaboration of retailers. ENSC already made a great effort to involve and engage retailers. Indeed, the communication and the relationship between the DA and the retailers are stronger than ever. Furthermore, initiatives such as the playbook and the contest were developed to create a sense of interest among store associates. The Evaluator recommends continuing strengthening the relationship with the corporate retailers while pursuing more concrete actions with the store associates. The latter are in direct contact with the clients and can become program promoters if they are well involved. By being informed of the benefits they can obtain from engaging in the program, they might be more likely to promote it.

Instant-R3. Focus on LED products going forward with the program: Some retailers recommended upgrading the lighting offer under Instant Savings. Indeed, they believe that LED lamps are the future, and that the demand for regular CFLs is slowly decreasing. Following this trend in the market, ENSC made efforts in this regard in 2012 by adding LED recessed downlight fixtures to the list of eligible products. The Evaluator recommends continuing this approach and centering the program lighting

offer around LED products over the years to come. Given the relatively high free-ridership level measured for regular CFLs since the two last evaluations, Econoler also suggests planning the withdrawal of regular CFLs as an eligible product for 2014.

Instant-R4. Modify the offer of appliances under the program to consider the most energy-efficient appliances available on the market: This recommendation targets the offer of refrigerators and clothes washers under Instant Savings. Firstly, interviews with retailers highlighted an issue regarding the energy-efficient refrigerators discounted under the program. Retailers pointed out that not many models of CEE Tier 3 refrigerators currently exist on the market, which constitutes a very specific class of high-end product. Moreover, many CEE Tier 3 refrigerators are larger in size. ENSC is already considering rebating smaller CEE Tier 2 refrigerators that are more energy-efficient than some of the larger CEE Tier 3 models. The Evaluator agrees with this approach and recommends adding to the program smaller models of CEE Tier 2 refrigerators with low annual energy consumptions to increase sales for this product and avoid encouraging the purchase of bigger refrigerators when it is not needed.

As for clothes washers, many of the retailers interviewed mentioned carrying only CEE Tier 3 washers in their stores. Therefore, the program did not have a great impact on their sales since the rebate became an extra instead of being the main incentive to buy among customers. Discounting a selection of energy-efficient clothes washers limited to the highest energy-efficient models would allow for targeting the models that provide the most significant energy savings. Furthermore, this would help the program to have greater impact and publicity, and thus lower the free-ridership level for clothes washers, which is relatively high.

Instant-R5. Improve the content of the tracking sheet: Econoler's review of the tracking sheet showed that ENSC took into consideration the recommendations from last year's evaluation and the Evaluator concludes that the 2012 tracking sheet for Instant Savings is complete, consistent and easy to work with. In addition to the improvements already made to the tracking sheet, Econoler noticed two adjustments that could be made in the future to continue the improvements brought to the tracking sheet and facilitate program evaluation:

- > When possible, ask for the store identifier to be filled in. Having this information would facilitate the organization of field activities like the intercept surveys. However, the Evaluator understands that this could be difficult for some retailers, since they all use different approaches to collect retail store information.
- > Separate the technical information in two distinct columns to identify: 1) the product description, corresponding to a string of technical information on the product and 2) the wattage values separately. This would facilitate the calculations of the average wattage for each product category.

1 COMPONENT DESCRIPTION

Efficiency Nova Scotia Corporation (ENSC) Instant Savings offers customers instant discounts at the cash register at more than 200 participating retailers when purchasing eligible energy-efficient products. Instant Savings works in collaboration with a delivery agent (DA), Summerhill Group, 11 major retail chains and 38 independent retailers. In 2012, discounts on eligible products were offered during two, two-month campaigns that took place in the spring and the fall. The in-market campaigns ran from April 16 to June 17, 2012 and from October 1 to November 30, 2012. Instant Savings was formerly known in the market as “Plug Into Savings” and more recently as the “Retail Markdown Program.”

The program features the following efficient products with a distinct discount for each of them.

Table 3: List of Discounts per Product

\$3 on ENERGY STAR® Regular CFLs (multipacks of 2 or more)	Between \$5–\$7 on Power Bars with Integrated Timers (\$7 in the spring and \$5 in the fall)
\$4 on ENERGY STAR® Specialty CFLs (single or double packs)	\$10 on Load Sensing Power Bars (Smart Strips)
\$6 on ENERGY STAR® Specialty CFLs (multipacks of 3 or more)	\$10 on Heavy Duty Outdoor Timers (plug-in)
Up to \$15 on ENERGY STAR® LED Lamps (up to \$15 in the spring and up to \$10 in the fall)	\$10-\$30 on Programmable Thermostats for Electric Baseboard Heaters
\$15 on ENERGY STAR® LED Recessed Downlight Fixtures¹	\$100 on Select CEE TIER 3 Refrigerators
\$3 on Dimmer Switches (hard-wired)	\$100 on Select CEE TIER 3 Washers
\$3-4 on Indoor and Outdoor Motion Sensors (hard-wired)	

Most of the products discounted under the program in 2012 were also discounted in 2011 under the Retail Markdown Program. Some additions were made however, such as the load sensing power bars and the Light Emitting Diode (LED) recessed downlight fixtures. In addition, the amount of the discount for certain products was raised. For instance, the discount on ENERGY STAR® specialty CFLs was increased by a dollar. Furthermore, the discount on LED lamps tripled in the spring (\$15) and doubled in the fall (\$10) of 2012 compared to 2011.

¹ LED recessed downlight fixtures were promoted and discounted only during the fall campaign.

In 2012, the program was promoted through in-store signage, store flyers, radio remotes and advertisements, newspaper advertisements, information provided on the ENSC website and elsewhere online, through social media, associate training, associate contests and customer engagement events. These events, held in participating retail stores during the campaign periods, aimed to provide information about the program and its products, and involved LED lamp giveaways.

An AIR MILES[®] campaign was also held in some stores that chose to take part in this loyalty rewards program. Through this campaign, participants were rewarded with AIR MILES[®] reward points instead of instant discounts at the cash when purchasing some of the program products.

Instant Savings is both a resource acquisition and a market transformation program operating in a market that is partially transformed for regular Compact Fluorescent Lamps (CFLs). A socket study conducted in 2011 indicated that households in Nova Scotia have an average of 36 sockets, of which an average of 16 contained CFLs and two contained LED lamps.

The program's long-term market transformation goal is not simply the partial adoption of CFLs and LEDs in Nova Scotia; it is the use of CFLs and LEDs in all available sockets. From a resource acquisition perspective, as long as customers install program CFLs and LEDs in sockets previously occupied by lower efficiency technologies in a cost effective manner, the goal has been achieved.

The 2012 LED Research Study revealed that Nova Scotians are indeed less receptive to purchasing LEDs than CFLs, with price being the main barrier. This constitutes an important opportunity for Instant Savings, as it offers significant discounts on LED lamps and LED recessed downlights. The program also takes advantage of its customer engagement events and LED giveaways to educate customers on the benefits of LEDs and encourage them to purchase this product.

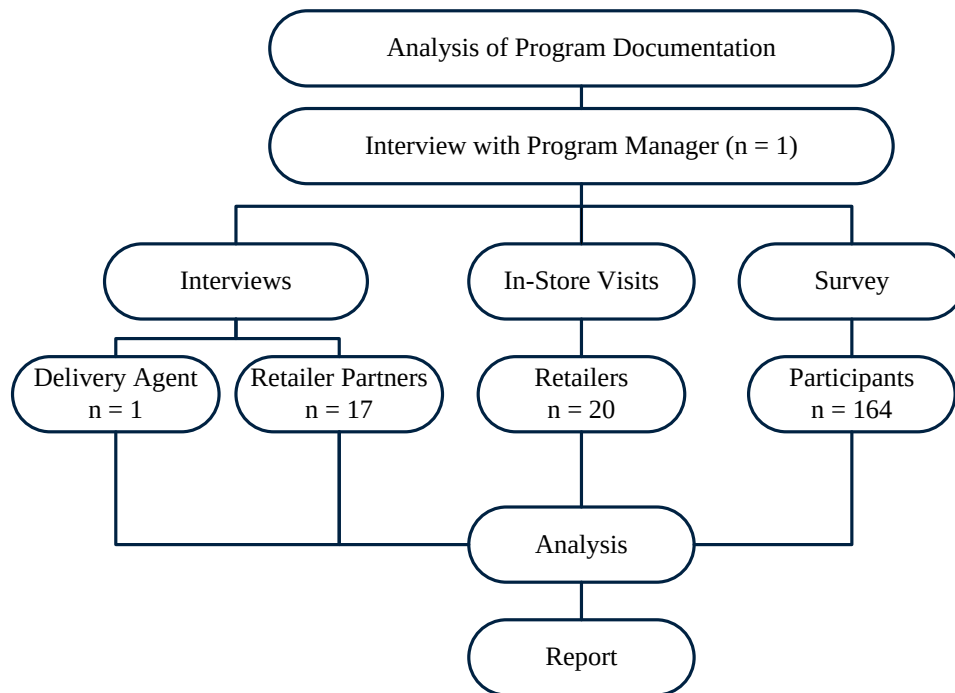
The program aims to achieve net electricity savings of 10.8 GWh (8.3 GWh for Instant Savings and 2.5 GWh for the AIR MILES[®] component) and demand savings of 1.9 MW (1.5 MW for Instant Savings and 0.4 MW for the AIR MILES[®] component) for 2012. Savings generated by Instant Savings (including AIR MILES[®]) are accounted for under the Efficient Products program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for Instant Savings. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was obtained primarily from the following four sources:

- > ENSC website;
- > Program Manual;
- > Program Promotional Material; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews respectively in July and in August 2012 with the Program Manager (PM). These interviews were intended, among other things, to follow-up on the 2011 evaluation recommendations regarding process issues, as well as to understand the main changes that occurred in program delivery in 2012. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 In-Depth Interviews with Program Partners

Interview with Delivery Agent

In October 2012, one interview was conducted with the program DA in order to understand, among other things, their involvement in the program, their participation process, as well as their perception of and satisfaction with the program.

The protocol used for the interview with the DA is presented in Appendix II for reference.

Interviews with Retailers

In October and November 2012, a total of 17 in-depth interviews were conducted with program retailers. Of the 17 retailers, eight were corporate retailers and nine were independent retailers. These interviews focused on three specific products: ENERGY STAR® CFLs, ENERGY STAR® LED lamps as well as CEE Tier 3 clothes washers. Free-ridership was measured for ENERGY STAR® LED lamps and CEE Tier 3 clothes washers whereas spillover (through market effects) was assessed for all three products. Free-ridership for CFLs was not measured using retailer interviews since it was done through intercept surveys. The aim of the interviews was also to understand the process the retailers underwent as part of their participation in the program, and their perception and satisfaction with the program.

2.2.4 In-Store Visits

In the spring (May–June) and fall (October) of 2012, a total of 20 visits and observations were conducted by Econoler in various stores to gather qualitative information to describe the in-store client experience. Seven major chain retailers were visited.

The following elements were assessed in these mystery visits and observations:

- > efficiency of instant rebates awarded at the counter;
- > product promotional displays; and
- > employees' knowledge of the products and program.

A copy of the “mystery shopper” visit protocol is included in Appendix IV.

2.2.5 Participant Survey

An intercept survey with a total of 164 program participants who purchased qualifying CFL or LED lamps during the fall campaign was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA). The interviews were conducted in-store during October 2012 at five of the participant retail banners. The average length of the survey was 5 minutes.

The participant survey was meant to generate feedback on the following aspects of Instant Savings:

- > CFL and LED purchases;
- > free-ridership;
- > program awareness; and
- > discount awareness.

The demographic profile of survey respondents and the survey questionnaire are shown in Appendices V and VI respectively. With a total of 164 respondents, the sampling error, at a 90 percent confidence level for the 2012 intercept survey, is $\pm 6.5\%$.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

In 2011, Econoler performed a comprehensive process evaluation of the program. The 2010 evaluation report and recommendations, the program manual and website, the logic model and program theory were among the program elements that were examined in the process evaluation. Moreover, the PM was interviewed along with the DA, program retailers and participants. The 2011 approach generated a series of recommendations to improve program performance and management.

The 2012 process evaluation is a continuation of the 2011 evaluation and covers the following aspects:

- > follow-up on the 2011 evaluation recommendations regarding process issues;
- > new and/or updated program documentation including program modifications since the last evaluation;
- > program tracking sheet;
- > program partners' perspectives on process issues; and
- > program participants' perspectives on process issues.

Recommendations and follow-ups regarding the impact evaluation (energy or demand) will be reflected in the Impact Evaluation section of this report.

3.2 PROGRAM DOCUMENT ANALYSIS AND INTERVIEW WITH THE PROGRAM MANAGER

The following section describes the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interview with the PM. It also covers the follow-up on recommendations from last year in each applicable section.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory, in which all the information about the program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program, based on a template provided by the Evaluator.

In 2012, the Evaluator noted that the program memory has been included in the program manual along with its various Appendices. The Evaluator is also pleased to report that Instant Savings now has an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff, as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The program manual is intended to capture information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The Instant Savings program manual is now presented in a standardized template, which applies to all ENSC programs and includes the same table of contents with 10 sections. This is a considerable improvement from the 2011 format, and follows one of the Evaluator's major recommendations.

With this new format, most recommendations regarding the program manual, such as documenting major characteristics of the program, justifying the selected eligible products and the two two-month campaign periods per year, as well as providing the parameters used to estimate program objectives, are now covered in the program manual, as well as its attached files and Appendices.

The following table compares the program manual content of 2011 to the new 2012 version. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 4: Program Manual Content – Instant Savings

Program Manual Content	2011	2012
Document revisions	✓	✓
Program description (including nature or type of program)	✓	✓
Program justification	⚠	✓
Program objectives	✓	✓
Incentives	✓	✓
Eligibility criteria	N/A	✓
Program partners and their roles	✓	✓
Program barriers	✓	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	⚠	✓
Details about the savings calculations and types of product	✓	✓
Annual budget	✓	✓
Cost-effectiveness test results	✓	✓
Market study or technical study supporting program elements or assumptions	✓	✓
Marketing plan	⊘	✓
Evaluation plan	⊘	✓
Program theory	✓	✓
Logic model	✓	✓
Program process flow chart	⊘	✓
Partner or participant process flow chart	✓	✓
Program forms	N/A	N/A
 Information included in the program manual  Information partially included in the program manual  No information		

Although the new version of the program manual is a considerable improvement from the 2011 version, the Evaluator has a few minor recommendations for its improvement.

- > **Document the AIR MILES® approach:** The program manual does not provide enough information on the AIR MILES® approach, such as the number provided for each eligible product purchased, or justification from a 2011 pilot project. Overall, the AIR MILES® campaign needs to be better documented in the Instant Savings program manual. Among other things, an example of what information will be found in the AIR MILES® tracking sheet should be added as one of the program manual Appendices.
- > **Document major changes in the Document Revision section:** In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual. For example, this section should briefly describe the addition of the AIR MILES® component in certain stores. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program's logic model. Econoler is currently working with ENSC to make sure that each program's updated logic model reflects the current program strategy and the performance indicators established based on the program theory. The programs' logic models will all be finalized and included in the programs' manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the Evaluator's recommended template for an evaluation plan, which is included as an Appendix of the Instant Savings program manual. The PM provided positive feedback on this important tool that complements the program manual and makes it possible to evaluate the program.

Furthermore, the 2011 report included a recommendation on the incorporation of the base case and parameters to estimate program objectives in the evaluation plan. This recommendation was followed as these two elements are now in the evaluation plan and can be tracked easily. The addition of the evaluation plan to the program documentation is a great improvement from previous years.

3.2.4 Program Charts

The program now has two process charts: one for the partners (DA and retailers) and the other for the PM. These charts were recommended in the 2011 evaluation and are very informative for any new staff responsible for the program as well as for program partners.

Econoler has the following recommendation on the program charts:

- > **Provide partners with the process chart:** The Evaluator recommends that the partners' process chart be communicated to them. After all, it is for the benefit of the partners that these charts have been created. Hence, it is important to distribute it to every partner involved, in order to provide them with an overall view of the program that briefly describes the different steps to follow to complete the participation process. The version date should be indicated in the chart.

3.2.5 Marketing and Outreach Activities

Instant Savings is a difficult program to evaluate by nature, since the identity of the participants is unknown. Hence, the marketing strategy must be comprehensive and be comprised of two vectors:

The first vector is to attract consumers' attention to the products promoted by the program. To this end, Instant Savings has its own marketing strategy. Most of the recommendations from the 2011 evaluation report aimed at achieving this objective are now covered in the 2012 marketing strategy, which includes the following:

- > Improving point of purchase (POP) displays;
- > Issuing a playbook that provides general awareness messages;
- > Enhancing the website to include more educational information on LEDs and on how to install program products, such as programmable thermostats, dimmer switches, indoor and outdoor motion sensors, etc.;
- > Incorporating social media into the marketing strategy to engage Facebook and Twitter followers and increase the number of online impressions;
- > Improving customer engagement events to create a memorable experience for customers, to make them understand the products best suited for them and to increase program participation and sales;
- > Launching a contest between participant stores to increase sales of discounted products, and improve the knowledge of salespeople with regard to the program and its different eligible products;
- > Sending a mystery shopper to some of the participant stores to evaluate several aspects related to product display, in-store promotion and knowledge of store personnel;
- > Improving retailer support and quality assurance (QA) done by the DA and ENSC;
- > Introducing an AIR MILES® incentive in limited stores that choose to participate in such a loyalty rewards program (Rona and Sobeys).

The second vector is to identify participants in order for the program to be adequately evaluated. In its 2011 report, the Evaluator recommended conducting an exit survey at participant stores in order to intercept participants following their purchase of eligible products. This recommendation was followed and the 2012 evaluation of Instant Savings included an intercept survey. ENSC also took action on its own by conducting two omnibus surveys to identify a certain number of participants (enough to have

an adequate statistical significance and precision level) and to compare program awareness while in and out of market campaign.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that the DA is monitoring its own marketing activities, and that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice, because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

The Evaluator has the following recommendation on the marketing plan:

- > **Make the performance indicators in the marketing plan more quantitative:** Instant Savings includes many quantitative performance indicators such as media advertising post reports, tracking of participants to customer engagement events and call volume during, and after marketing campaigns. These performance indicators are not found in the marketing plan. They should be centralized in the marketing plan to provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of performance indicators, the marketing plan should indicate the revision date.

3.3 TRACKING SHEET

Econoler reviewed the content of ENSC's tracking sheet for Instant Savings. The tracking sheet for 2012 is very clear and useful. All recommendations from 2011 were incorporated into the 2012 tracking sheet, which makes it very complete. It provides a quick way to monitor the quantity of each product sold and the achieved savings.

The tracking sheet is filled with detailed data, provided by the retailers during each markdown campaign, such as the quantity of products sold, the retail and promotional pricing as well as technical information on the products. A field shows the retailer where the products were sold, but the store identifier is missing for many National retailers. Most retailers only provide ENSC with overall sales results for the entire province.

Products sold in packages, such as CFLs and programmable thermostats, are identified by the number of packages sold as well as the number of units in each package. Wattage per product is also provided by the retailers in a specific column. This information is available in the tracking sheet for 99.6 percent of all CFLs sold and 94.2 percent of all LED lamps and recessed downlights sold.

The tracking sheet also provides information on the retail pricing and the promotional pricing with the discount offered. The total discount amount given by ENSC to retailers is clearly defined in the tracking sheet. The vast majority of the discounts are coherent with the prescriptive rebates found in the program manual. A few inconsistencies were identified for regular CFLs, programmable

thermostats and dimmer switches sold by the same retailer. These mistakes were due to the fact that the rebates at this retailer's stores were applied manually by the cashier at the time of sale. However, ENSC ensured that the retailer was only reimbursed for the amount rebated to the customer when mistakes were made.

To estimate the gross energy and demand savings generated by the program, ENSC uses specific unitary savings values for each type of product. The unitary values are available in a separate table, and the tracking sheet automatically calculates the program gross savings depending on the product and the quantity. Net savings are calculated using the same approach. The table presenting the unitary savings values for each category of product also includes the net-to-gross ratio (NTGR) and interactive effects factors used for the net savings calculations.

Econoler's review of the tracking sheet showed that ENSC took into consideration the Evaluator's recommendations from last year's evaluation. Indeed, Econoler notes a major improvement from last year on how the information is clearly presented and complete.

In light of these observations, the Evaluator concludes that the 2012 tracking sheet for Instant Savings is complete, consistent and easy to work with. The Evaluator noticed only two adjustments that could be made in the future to improve program monitoring and evaluation. The Evaluator recommends that ENSC:

- > **Ask for the store identifier to be filled in:** The retailer where each product was sold is always identified in the tracking sheet. However, the specific retail store where the sale occurred is rarely provided. ENSC could assess the possibility of asking the retailers to provide this information. Having this information would facilitate the organization of field activities like the intercept surveys. However, the Evaluator understands that this could be difficult for some retailers, since they all use different approaches to collect retail store information.
- > **Separate the technical information in two distinct columns:** In some cases, the retailers only provided a full description of the product and the wattage values were included in this description. The Evaluator recommends having two distinct columns to identify: 1) the product description, corresponding to a string of technical information on the product and 2) the wattage values separately. This would facilitate the calculations of the average wattage for each product category. Moreover, it remains important to keep the full product description which allowed the Evaluator to make spot checks of the wattage values and number of lamps per package provided in the other columns of the tracking sheet.

3.4 IN-STORE VISITS

In the spring (May–June) and fall (October) of 2012, a total of 20 visits and observations were conducted in various participant stores to gather qualitative information to describe the in-store client experience. Seven major chain retailers were visited.

The following elements were assessed in these mystery visits and observations:

- > efficiency of instant rebates awarded at the counter;
- > product promotional displays; and
- > employees' knowledge of the products and program.

The following sections describe the mystery shopper's key findings resulting from the in-store visits.

3.4.1 Spring Campaign

Efficiency of the Instant Rebates Awarded at the Counter

During the spring campaign, the Evaluator found that most retailers visited automatically awarded customers a rebate at the cash register when a qualifying product was purchased. However, the mystery shopper noticed that the rebate processing did not work correctly in two of the ten visits.

In the first case, three eligible products were purchased and none received the instant rebate at the cash register; the cashier said that there was no rebate on these products. The mystery shopper had to ask the in-store event representative for help. In the second case, the retailer did not award the mystery shopper with the instant rebate, since a coupon was required to benefit from the rebate at the cash. This coupon was not displayed in the store. Therefore, the mystery shopper had to ask the cashier for the coupon.

Product Promotional Display

Of the ten stores visited, four participated in the customer engagement event. Overall, the in-store events were fine but not great. Only two out of four representatives were well informed about the products and the applicable rebates. No one gave information on the other programs offered by ENSC. Furthermore, one of the representatives was absent from their booth. The information booths were well placed, however, and could be clearly seen by customers.

Most of the proposed program promotional tools were used in the stores visited. The tools found in participating retail stores included mainly stickers, shelf talkers and vertical signs. However, it should be noted that the promotional material was poorly placed in relation to the products in some sections of the stores visited. The mystery shopper was not always able to identify clearly which products were eligible for a rebate.

Employees' Knowledge of the Products and Program

Overall, the salespeople were aware of the Instant Savings campaign, and of the fact that rebates applied to various products offered. However, as mentioned above, the rebates were not always clearly identified. Even though salespeople were aware of the rebate, they were sometimes unable to identify which amount corresponded to which product (e.g. a rebate of \$3 on regular CFLs vs. \$4 on specialty CFLs).

3.4.2 Fall Campaign

Efficiency of the Instant Rebates Awarded at the Counter

During the fall campaign, all retailers visited automatically awarded customers a rebate at the cash register when a qualifying product was purchased. Therefore, the rebate processing worked correctly every time unlike during the spring campaign in-store visits.

Product Promotional Display

Among the ten stores visited, four participated in the customer engagement event. Overall, the in-store events were quite successful, which increased exposure of the products covered by the program. Indeed, representatives were able to inform clients adequately about available products and applicable rebates. In addition, one representative gave a detailed explanation of other ENSC programs, such as Home Energy Assessment and Appliance Retirement, when the mystery shopper mentioned they were a homeowner. However, this same representative did not mention anything about the Instant Savings campaign, whereas the other three representatives did. It would have been good if these same three representatives had also informed the mystery shopper of ENSC's other residential programs, especially given the fact that they already had the promotional materials for this purpose. However, this was not a mistake on the representatives' part because their main objective was to promote Instant Savings. The mystery shopper also noticed that ENSC buttons were worn by the customer engagement event representatives and by the store personnel in most locations. The buttons were also displayed on the representatives' tables and made available to customers.

Most of the proposed promotional tools were used in the stores visited. The tools found in participating retail stores were mainly stickers but also shelf talkers, posters, horizontal and vertical hang tabs, stickers and vertical signs. The mystery shopper noticed that the rebates were clearly visible, and that the promotional displays were fairly uniform from one chain retailer to another. Furthermore, rebates and promotional displays were located in the lighting section more so than in other sections (e.g. switches, appliances). Rebates and promotional tools were not only more present in the lighting section, but also much better displayed.

Employees' Knowledge of the Products and Program

Overall, the salespeople were aware of the Instant Savings program, and of the fact that the rebates applied to various products. Most of them were able to show the mystery shopper specifically which products were eligible and the respective rebate amounts. The mystery shopper did not notice any of the salespeople using the apron cards designed by ENSC between the spring and fall campaigns, but the cards were handed out by the representatives during the customer engagement events.

3.4.3 In-Store Visits Summary

In summary, the mystery shopper observed a marked improvement in the awarding of rebates at the checkout counter, use of promotional displays and organization of customer engagement events during the store visits in fall 2012.

In contrast to the spring visits, there were no problems with processing the rebate at the checkout counter in the fall. Promotional displays were more uniform from one location to another and especially from one chain retailer to another.

The events were clearly visible during both campaigns, the booths were well placed in the store and the representatives had all the promotional material needed to inform clients about the campaign. The representatives seemed better prepared for incoming clients in the fall than they did in the spring. Contrary to the spring campaign, all of them were present at their booths, and they were able to provide information on eligible products and rebates in the Instant Savings campaign or in other ENSC programs.

3.5 PARTNER PERSPECTIVES

3.5.1 Interview with Delivery Agent

The program's DA was interviewed as part of the process evaluation of Instant Savings. The DA expressed a high level of satisfaction with the overall program and their relationship with ENSC's team.

Nevertheless, the DA's main concern seemed to be with the involvement of retailers, both at the corporate and store levels. Indeed, relationships with retailers were strong according to the DA, but a challenge persisted in making retailers at the corporate level understand the relevance of program components such as POP and in-store customer engagement events. Since some corporate retailers did not always communicate well with their store associates, this challenge also affected participating stores. Many other in-store issues, such as employee turn-over and low engagement, also made retailer involvement more difficult. Thus, the main barriers to Instant Savings implementation were communication with store associates and an understanding of POP and its maintenance. The DA recognized the efforts made in 2012 to engage and educate the stores about the importance of POP. The DA believes that initiatives such as the playbook and the contest need to continue in order to create a sense of involvement among retailers and turn them into program promoters and advocates.

The DA brought up another challenge that arose from both wanting to continuously respond to market trends and demands, and respecting the fact that some retailers required more notice than others. Indeed, program modifications either right before or during Instant Savings campaigns created complications and frustration among retailers. This was particularly true for the spring campaign when very tight timelines were observed, and information was provided to retailers very close to the beginning of the campaign. This was improved for the fall campaign.

Finally, the DA expressed a high level of satisfaction regarding the program marketing and outreach activities. To that effect, they recommend continuing to use calls to action in the marketing material to educate consumers on the benefits of products promoted by Instant Savings and ultimately to change behaviour. Furthermore, the DA suggested using one-on-one interactions during in-store customer engagement events to provide more education.

3.5.2 Interviews with Retailers

Seventeen retailers were interviewed as part of the Instant Savings evaluation. Of the 17 retailers, eight worked at the head office of their respective retailer banner while the remaining nine worked in independent retail stores in Nova Scotia.

The interviewees were asked to rate their level of satisfaction with regard to different aspects of the program and their overall satisfaction with the program. The retailers expressed a very high level of satisfaction with the program. Most of them also mentioned being very satisfied with program support and communication as well as with their interaction with the DA.

The retailers were not as satisfied with the preparation process to the campaigns. Many of them referred to tight timelines, especially for the spring campaign. This dissatisfaction was well known to ENSC, and timelines were improved for the fall campaign. The retailers wish to be informed in advance of all program-related decisions that affect the way they work, such as program dates, eligible products and rebate amounts. This feedback from retailers confirmed what the DA had already noticed. Some retailers suggested communicating information progressively instead of all at once.

Most retailers were satisfied with the look of the marketing material, but thought that its approval came in a little late. Furthermore, they had many constructive comments about content and delivery. Many retailers want the program marketing to be more educational in order to help customers understand the benefits and savings behind energy-efficient products, because customer acceptance still represents a barrier. Considering that it can be difficult to show the benefits of energy-efficient products on promotional tools such as stickers or shelf talkers, customer engagement events are a great step in that direction. Other retailers also brought up the desire to see more mass media advertising to bring customers into the stores, because they noticed that most of them did not know about the program before they walked in. With this in mind, one retailer suggested doing cooperative promotion, meaning that the retailer would split the cost of advertising with ENSC.

Retailers were well aware that marketing material effectiveness was also largely related to the involvement of store associates and personnel. Corporate-level interviewees reported difficulty in communicating all the necessary information to their store personnel and in involving and engaging them, as indicated by the DA. This was not a barrier to the delivery of the program among independent retailers.

Most of the retailers mentioned being satisfied with the products promoted through the program. Some retailers recommended adding indoor and outdoor lighting fixtures, freezers and dishwashers to the

list of eligible products. Two retailers also suggested a greater focus on LED products going forward with the program.

Moreover, many appliance retailers would like to see a change in the variety of energy-efficient appliances discounted under the program. This issue was mentioned primarily for refrigerators. It was also brought up for clothes washers, but for different reasons. For instance, not many models of CEE Tier 3 refrigerators currently exist on the market, which constitutes a very specific class of high-end product. Discounting other energy-efficient models, such as CEE Tier 2 refrigerators, would break this barrier and make this type of product more accessible to consumers. As for clothes washers, many of the retailers carry only CEE Tier 3 washers in their stores. Therefore, the program did not have a great impact on their sales since the rebate became an extra instead of being the main incentive to buy. In a scenario where other models of appliances with different levels of efficiency would be rebated under Instant Savings, retailers indicated rebates should be scaled between lower- and higher-end products.

Most retailers interviewed were very satisfied with the rebate processing, tracking and reporting. Some retailers also hope for faster payment following reporting.

Finally, all retailers interviewed prefer an instant rebate at the cash to an AIR MILES[®] reward or any other type of loyalty reward program. They believe the instant gratification has a greater impact on consumers. Some of them perceive an AIR MILES[®] reward as a possible purchase barrier since not every customer has an AIR MILES[®] card.

Overall, the retailers were very satisfied with the program and wish for it to continue. They all received good comments about the program from their staff members. They strongly believed it increased awareness of energy-efficient products. They also recognized the importance of the presence of ENSC's in-store representatives during the customer engagement events and its positive impact on sales and customer awareness.

3.6 PARTICIPANT PERSPECTIVES

3.6.1 Program Awareness

As part of the intercept survey conducted in participant retail stores, only consumers who purchased discounted products during in-market campaigns were interviewed. These discounted products specifically included ENERGY STAR® CFLs and LEDs. Firstly, participants were asked if they had heard of the program. In terms of overall awareness of Instant Savings, nearly six in ten participants had heard of the program (58%) when answering the survey. This means that a little over 40 percent of participants were not aware of the program when purchasing eligible products.

While there were a number of ways participants found out about Instant Savings, ENSC sources were the primary way (79%). Specifically, nearly eight in ten participants found out about the program through ENSC advertising such as in-store promotions (37%), the ENSC website (21%), newspapers (20%), radio (16%), from an in-store ENSC representative (9%), or at a home show (2%). A small number of participants heard about the program on the Internet (in general), on Facebook, or through word of mouth.

Table 5: Sources of Program Awareness

Sources of Program Awareness*	2012		
	Overall	CFL Purchasers	LED Purchasers
<i>Sample Size**</i>	91	51	35
TOTAL ADVERTISING	79%	78%	83%
In-store promotions	37%	33%	43%
ENSC website	21%	22%	20%
Newspaper	20%	24%	17%
Radio	16%	20%	14%
Through an ENSC representative during an in-store customer engagement event	9%	8%	11%
Home show	2%	--	3%
Internet in general	9%	6%	14%
Facebook	8%	8%	9%
Co-worker, family, friend	5%	6%	3%
Store flyer	2%	4%	--
Store personnel	1%	2%	--
Others	4%	4%	6%
Don't know	4%	6%	3%
*Base: Respondents who were aware of the program			
**Multiple responses			

After being asked if they knew about the program and how they found out about it, participants were questioned to determine if they were aware of the discount prior to product purchase. The majority of those who purchased CFLs (70%) and LEDs (85%) were aware of the discount prior to paying for the lamps. Those who purchased LEDs were more likely to be aware of the discount, which is perhaps not surprising given that the price of these lamps is significantly higher than that of CFLs. While awareness of the program name was moderate, there was a high level of awareness of the discount. This indicates that participants may simply have been unaware of the program, but knew that lamps were being discounted by ENSC.

Table 6: Discount Awareness

Discount Awareness	2012		
	Overall	CFL Purchasers	LED Purchasers
<i>Sample Size</i>	164	99*	65**
Yes, was aware of discount before paying	76%	70%	85%
No, was not aware of discount before paying	24%	30%	15%
*Base: Respondents who purchased CFLs on the day of the survey			
**Base: Respondents who purchased LEDs on the day of the survey			

In-store signage proved to be successful at communicating with customers regarding the program. Indeed, the vast majority of participants who were aware of the discount saw in-store promotions such as stickers, shelf signs or posters. Nine in ten (91%) of those who answered questions related to CFLs, and nearly all (96%) of those who answered questions related to LEDs, indicated they saw stickers, shelf signs or posters in-store.

Table 7: In-Store Promotion Awareness

In-Store Promotion Awareness*	2012		
	Overall	CFL Purchasers	LED Purchasers
<i>Sample Size</i>	120	65**	55
Yes, saw stickers, shelf signs, posters	93%	91%	96%
No, did not see stickers, shelf signs, posters	6%	8%	4%
Don't know	1%	2%	--
*Base: Respondents who were aware of discount prior to purchase			
**Sample size lower than full base due to programming change			

The majority of participants have heard of ENSC, with almost nine in ten (87%) having heard of the organization.

Table 8: ENSC Awareness

ENSC Awareness	2012		
	Overall	CFL Purchasers	LED Purchasers
<i>Sample Size</i>	164	96	61
Yes	87%	83%	90%
No	12%	16%	8%
Don't know	1%	1%	2%

3.6.2 Purchases

Participants were asked the types of lamps they purchased. Of the 164 participants interviewed, six in ten purchased CFLs only (59%). Almost four in ten purchased LEDs only (37%), while four percent purchased both CFLs and LEDs. It should be noted that only customers who purchased discounted CFLs or LEDs were surveyed.

Table 9: Type of Lamp Purchased

CFLs/LEDs Purchased	2012
<i>Sample Size</i>	164
CFLs only	59%
LEDs only	37%
Both	4%

The number of CFL and LED lamps purchased by each participant was counted. Counts were done for individual lamps rather than packages of lamps. Overall and on average, participants purchased a higher number of CFLs than LEDs. On average, participants purchased 7.7 CFLs and 4.0 LEDs.

Table 10: Number of CFLs/LEDs Purchased

Number Purchased	2012			
	Overall	CFL Purchasers	LED Purchasers	Both CFL/LED Purchasers
CFLs				
<i>Sample Size*</i>	103	96	n/a	7
1-2 CFLs	13%	14%	n/a	--
3-4	23%	24%	n/a	1
5-7	22%	23%	n/a	1
8-10	24%	25%	n/a	1
11 or more	17%	15%	n/a	4
Average***	7.7	7.3	n/a	13.4
LEDs				
<i>Sample Size**</i>	68	n/a	61	7
1-2 LEDs	49%	n/a	49%	3
3-4	25%	n/a	23%	3
5-7	15%	n/a	16%	--
8-10	6%	n/a	7%	--
11 or more	6%	n/a	5%	1
Average***	4.0	n/a	3.9	4.6
*Base: Respondents who purchased CFLs **Base: Respondents who purchased LEDs ***Average excludes responses of 'Refused' and 'Don't know'				

In order to understand if lamps purchased during the program campaign were to replace existing CFLs, participants were asked if they have any CFLs currently installed in their home. Approximately one-half of participants have CFLs installed (52%), and a little over one-third have both CFLs and LEDs installed (35%). One in ten participants only has LEDs installed in their home.

Since nearly all participants currently have energy-efficient lighting already installed in their home, the program rebates seem to have encouraged those with CFLs or LEDs to purchase them. The program may be impacting the trial of LEDs. For example, 25 percent of those who purchased LEDs did not currently have LEDs installed in their home.

Table 11: CFLs/LEDs Currently Installed

CFLs/LEDs Currently Installed	2012			
	Overall	CFL Purchasers	LED Purchasers	Both CFL/LED Purchasers
<i>Sample Size</i>	164	96	61	7
CFLs only	52%	73%	25%	1
LEDs only	10%	1%	26%	--
Both	35%	23%	49%	6
No	2%	3%	--	--

In addition to the high number of participants who currently have energy-efficient lighting installed in their home, results suggest that energy-efficient lamps purchased in the past may need replacing. Specifically, participants who purchased CFLs and have CFLs currently installed in their home were asked how many lamps purchased would replace existing CFLs. Approximately two in ten lamps purchased were not to replace existing CFLs. For the majority of participants, at least one of the lamps they purchased was to replace a current CFL in their home. On average, of the 7.7 CFLs purchased, 4.4 were to replace current CFLs in the home.

Table 12: Number of CFLs Purchased on Day of Survey to Replace Current CFLs

Number of CFLs Purchased on Day of Survey to Replace Current CFLs*	2012
<i>Sample Size**</i>	98
0	22%
1-2	23%
3-4	16%
5-7	10%
8-10	15%
11 or more	6%
Don't know	6%
Average**	4.4
*Base: Respondents who have CFLs currently installed in home and who purchased CFLs on day of survey	
**Average excludes responses of 'Refused' and 'Don't know'	

3.6.3 Program Influence

Participants indicated that the discount was important in influencing their decision to install energy-efficient products. This was more so the case for those who bought LEDs (mean score of 8.0) than for those who bought CFLs (mean score of 6.7). Again, this is likely due to the higher price of LEDs, and the higher discount available for these lamps.

Table 13: Importance of Discount in Influencing Installation

Importance of Discount in Influencing Decision to Install Energy-Efficient Products	2012	
	CFL Purchasers	LED Purchasers
<i>Sample Size*</i>	68	55
Mean (0=Had no influence at all, 10= extremely influential on purchase decision):**		
Importance of discount on purchase decision	6.7	8.0
*Base: Respondents who were aware of discount prior to purchase		
**Mean excludes responses of 'Refused' and 'Don't know'		

3.6.4 Other Discounted Products

There may be an opportunity to increase overall understanding and awareness of the program, given that initially there were a number of participants unaware of the program, and only a small number were aware of other products discounted through the program, as shown in the table below. Specifically, just a small number of participants were aware of other energy-efficient products discounted through Instant Savings besides the CFLs and/or LEDs they had purchased. One-third of participants who were aware of the program were also aware of other discounted products (34%).

Table 14: Other Discounted Product Awareness

Other Discounted Product Awareness	2012
<i>Sample Size*</i>	91
Yes, aware of other products	34%
No, not aware of other products	57%
Don't know	7%
Skipped	2%
*Base: Respondents who were aware of the program	

Participants aware of other energy-efficient products discounted through the program mentioned a number of different products. These included motion sensors, programmable thermostats, outdoor timers, power bars or smart strips, hardwired dimmer switches and LED lamps and recessed downlights.

Table 15: Other Discounted Products

Other Discounted Products*	2012
<i>Sample Size**</i>	31
Motion sensors	29%
Programmable thermostats	29%
Outdoor timers	26%
Power bars or Smart strips	19%
Hardwired dimmer switches	19%
LED lamps and recessed downlights	19%
CEE Tier III refrigerators	16%
CEE Tier III clothes washers	13%
Regular or specialty CFLs	10%
Other	10%
Don't know	6%
*Base: Among those aware of other discounted products	
**Multiple responses	

Participants were also asked about their wish to see other products rebated under Instant Savings. Nearly one-half of participants (46%) wanted to see other products rebated through the program. When asked to specify which products, some participants mentioned products that were already discounted, including appliances, thermostats and power bars. Heat pumps, water heaters, water saving devices, such as low flow toilets or low flow showerheads, and heaters/furnaces were also mentioned by a small number of participants.

Table 16: Which Products Should Be Discounted

Which Products Should be Discounted*	2012
<i>Sample Size**</i>	73
Appliances	30%
Heat pumps	12%
Everything/Anything	11%
Water heaters	8%
Water saving devices/Low flow toilets/Low flow showerheads	8%
Heaters/Furnaces	8%
Thermostats	8%
Solar panels/products	5%
Windows/Doors	5%
Insulation	4%
Outdoor lights or fixtures	4%
Power bars	3%
Other	16%
*Base: Among those who would like to see other energy efficiency products rebated through program	
**Multiple responses	

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation is aimed at determining the gross and net savings of Instant Savings for 2012. Both energy and demand savings were examined in this evaluation. To do so, the following parameters were analyzed by Econoler:

- > unitary savings values used for each category of product;
- > replacement ratio of CFLs;
- > demand-to-energy ratio;
- > interactive effects factors;
- > free-ridership; and
- > spillover through market effects generated by the program.

The impact evaluation is the result of three main activities.

First, Econoler reviewed the unitary savings values used in the program tracking sheet. For each product, Econoler validated the source of data and the parameters used in the calculations. Several unitary savings values were validated in last year's evaluation. In these cases, Econoler conducted a literature review to check if more recent studies had been published since then and, if so, validated if updated values should be used to revise the unitary savings calculations.

Second, the intercept survey and retailer interviews were used to estimate the free-ridership level and evaluate if the program had generated spillover through market effects. The three most important products, in terms of tracked savings, were targeted for this activity: CFLs, LED lamps and CEE Tier 3 clothes washers.

Finally, the intercept survey was also used to estimate the replacement ratio of CFLs.

4.2 GROSS SAVINGS

The quantities of products sold through the spring and fall campaigns are all computed in the tracking sheet. For each category of product, ENSC uses the unitary savings values from last year's evaluation. These unitary savings values were, in many cases, revised by the Evaluator based on the 2011 Ontario Power Authority (OPA) Prescriptive Measures and Assumptions report², which is still considered as a recent and reliable secondary data source. However, for the new products introduced

² Ontario Power Authority (OPA), "2011 Prescriptive Measures and Assumptions," Release Version 1, March 2011.

in the program in 2012, i.e. LED recessed downlight fixtures and load sensing power bars, ENSC uses unitary savings values found in the Efficiency Vermont Technical Reference Manual.

The following sections describe in detail how each unitary savings value was estimated by ENSC, and present Econoler's review of these values based on the most recent studies and technical data collected in the tracking sheet.

4.2.1 Regular and Specialty CFLs

Tracked Savings

In the tracking sheet, the quantity of CFLs sold through the program was recorded according to the type of CFLs:

- > ENERGY STAR® regular CFLs; and
- > ENERGY STAR® specialty CFLs.

Last year's evaluation calculated an average unitary savings value of 49.8 kWh per year for both regular and specialty CFLs.

Displaced wattage was calculated for all the CFLs sold through the program, based on the average wattage of the CFLs sold (14.4 watts) and the average equivalent power of the incandescent lamps replaced (64.9 watts), resulting in a displaced wattage of 50.5 watts.

For the hours of operation, ENSC uses a value of 2.7 hours per day. This value was revised by Econoler, based on a metering study conducted for Hydro-Québec's residential lighting program³.

The following equation was used to calculate the unitary savings value of 49.8 kWh per year:

$$\text{Annual Unitary Savings} \left[\frac{kWh}{yr} \right] = \frac{(64.9 W - 14.4 W) \times 2.7 \frac{h}{day} \times 365 \frac{day}{yr}}{1000 \frac{W}{kW}} = 49.8 \frac{kWh}{yr}$$

Revised Savings

This value was reviewed by Econoler during this evaluation. To do so, the Evaluator analyzed the information on CFL wattages recorded in the tracking sheet and conducted a literature review to validate the hours of operation. This year, the displaced wattage values of regular CFLs and specialty CFLs were calculated separately.

³ Econoler, "Evaluation Report: Programme Produits Mieux Consommer – Éclairage résidentiel," presented to Hydro-Québec, Québec, March 30, 2011.

Displaced Wattage

The displaced wattage of 50.5 watts was revised this year according to the new wattage values of the regular and specialty CFLs sold through the program in 2012. This information was provided by the retailers and was available in the tracking sheet for respectively 100 percent and 95.7 percent of all the regular and specialty CFLs sold through the program.

The average displaced wattage was calculated by comparing the average wattage of CFLs sold through the program and the average equivalent wattage of incandescent lamps replaced, using the light output equivalency presented in the figure below.

Figure 2: Light Output Equivalency for Incandescent Lamps to CFLs⁴

LIGHT OUTPUT EQUIVALENCY		
INCANDESCENT BULBS (WATTS)	MINIMUM LIGHT OUTPUT (LUMENS)	COMMON ENERGY STAR QUALIFIED LIGHT BULBS (WATTS)
40	450	9 TO 13
60	800	13 TO 15
75	1,100	18 TO 25
100	1,600	23 TO 30
150	2,600	30 TO 52

The analysis revealed that the average power of the regular CFLs sold through the program is 14.8 watts, and the average equivalent power of the incandescent lamps replaced corresponds to a value of 66.6 watts. For specialty CFLs, the average power is 14.4 watts and replaces an average equivalent power of 61.3 watts. Therefore, the displaced wattage (ΔW), or difference between the CFLs sold through the program and the old lamps replaced, is estimated at 51.8 watts for regular CFLs and 46.9 watts for specialty CFL.

$$\Delta W_{Regular} = 66.6 W - 14.8 W = 51.8 W$$

$$\Delta W_{Specialty} = 61.3 W - 14.4 W = 46.9 W$$

The validity of this approach, which uses the light output equivalency to estimate the displaced wattage, was confirmed in last year's evaluation report. Indeed, the CFL participant survey revealed that the majority of participants (70%) chose their CFLs based on light output equivalency.

⁴ ENERGY STAR, "ENERGY STAR Qualified Light Bulbs – 2006 Partner Resource Guide."

Hours of Operation

Econoler considers that metering data, when available, should always be prioritized over self-declaration estimates which may be influenced by respondent behavioural factors. Therefore, Econoler looked for metering studies on the daily usage of residential lighting to validate the hours of operation used for CFLs. The table below presents the results of this literature review.

Table 17: Daily Usage of CFLs from Metering Studies

Source	Hours of Use (h/day)		Number of homes	Number of loggers	Metering Period
	Indoor	Outdoor			
BC Hydro, 2009 ⁵	2.43	-	18	77	2004
California, 2005 ⁶	2.28	3.1	375	752	2003-2004
Hydro-Québec, 2011 ⁷	2.68	3.6	200	787	2010
Michigan, 2012 ⁸	2.2	3.0	152	628	2010-2012
New England States, 2009 ⁹	2.8		157	661	2008

Since the last evaluation, new studies have been published, including one for Michigan and an updated one for the New England states. However, the Hydro-Québec study is still considered as the most appropriate for Nova Scotia since it was conducted in households located in the province of Québec, i.e. households with similar numbers of hours of illumination per year. Moreover, its study uses one of the largest samples and has one of the biggest numbers of loggers installed.

Therefore, Econoler considers that ENSC should continue using the results from the Hydro-Québec study to estimate daily CFL usage. As with last year's evaluation, the proportions of CFLs installed inside and outside the residence were used to calculate the overall hours of operation to be applied to all the CFLs sold through Instant Savings. Since this information was not collected in the tracking sheet or during the intercept survey, Econoler used the proportions estimated for all residential households in Nova Scotia. A socket study conducted for ENSC in 2011 to investigate CFL installations across Nova Scotia revealed that 94 percent of CFLs are installed inside houses and the remaining 6 percent are installed in outdoor sockets. The same assumptions are used for both regular

⁵ Power Smart Evaluation and Research, "Milestone Report: Lighting Program – CFL Component Evaluation for Fiscal Year 2009," Prepared for BC Hydro, September 28, 2009.

⁶ KEMA, "CFL Metering Study – Final Report," Oakland, California, February 25, 2005.

⁷ Econoler, "Evaluation Report: Programme Produits Mieux Consommer – Éclairage résidentiel," presented to Hydro-Québec, Québec, March 30, 2011.

⁸ Opinion Dynamics & The Cadmus Group, "CFL Hours of Use Study Summary of Approach and Results," July, 2012.

⁹ Nexus Market Research, RLW Analytics & GDS Associates, "New England Residential Lighting Markdown Impact Evaluation," Submitted to: Markdown and Buydown Program Sponsors in Connecticut, Massachusetts, Rhode Island, and Vermont, January 20, 2009.

and specialty CFLs. Based on these parameters, the estimate of the overall hours of operation used for CFLs remains 2.7 hours per day:

$$\text{Overall Hours of Operation} = \left(94\% \times 2.68 \frac{h}{day}\right) + \left(6\% \times 3.6 \frac{h}{day}\right) = 2.7 \frac{h}{day}$$

Unitary Savings

According to the Evaluator's review of the displaced wattage values and the hours of operation, the unitary savings value was revised for both regular and specialty CFLs:

$$\text{Annual Unitary Savings}_{\text{Regular}} = \frac{(51.8 W) \times 2.7 \frac{h}{day} \times 365 \frac{day}{yr}}{1000 \frac{W}{kW}} = 51.0 \frac{kWh}{yr}$$

$$\text{Annual Unitary Savings}_{\text{Specialty}} = \frac{(46.9 W) \times 2.7 \frac{h}{day} \times 365 \frac{day}{yr}}{1000 \frac{W}{kW}} = 46.2 \frac{kWh}{yr}$$

These new values take into account the real wattage values of all the regular and specialty CFLs that were sold through the program in 2012.

Replacement Ratio

CFLs have been available on the market for a number of years now. At this point, it is likely that many CFLs purchased will be replacing other already installed CFLs. Such replacement has already been observed in many jurisdictions and needs to be taken into account since it does not generate savings attributable to the program.

During last year's evaluation, a replacement ratio was measured through the CFL participant survey. The survey revealed an incandescent replacement ratio of 0.80, meaning that 20 percent of the CFLs purchased through the markdown campaigns replaced other CFLs. This ratio was applied to the quantity of regular CFLs registered in the tracking sheet as part of the gross savings calculations. The replacement ratio was only applied to regular CFLs since specialty CFLs were introduced to the market later than regular CFLs. The Evaluator considered that it was thus less likely to see new specialty CFLs replacing old specialty CFLs.

For this year's evaluation, questions to measure the replacement ratio were included in the intercept survey. Participants were asked about the number of CFLs purchased during the markdown campaign that will be used to replace a CFL already installed in their home. Unfortunately, the results obtained from this question were not conclusive, as participants interviewed at the store were often unable to say where they were going to install the CFLs they just purchased. Consequently, the Evaluator chose to use the same replacement ratio of 0.8 that was measured through last year's telephone survey. Since questioning participants during an intercept survey on the future use of the CFLs they just

purchased does not provide conclusive results, Econoler recommends that the replacement ratio be re-evaluated at regular intervals by the means of a socket study like the one conducted in 2011.

Thus, Econoler applied, in its gross savings calculation, a replacement ratio of 0.80 to the quantity of regular CFLs registered in the tracking sheet. For the same reasons as in last year's evaluation, Econoler decided to apply the replacement ratio to regular CFLs only.

Final Unitary Savings Value

The unitary savings value of 51.0 kWh and the replacement ratio of 0.8 are used in the gross savings evaluation for all regular CFLs sold through Instant Savings, which include the spring, fall and AIR MILES® campaigns.

For specialty CFLs, only the unitary savings value of 46.2 kWh was applied in the gross savings calculations.

4.2.2 LED Lamps

Tracked Savings

LED lamps are also rebated under Instant Savings and distributed during in-store customer engagement events. For the LED lamps sold during the spring and fall campaigns, ENSC uses an annual unitary savings value of 41.7 kWh in the tracking sheet. This value is based on the 2011 program evaluation report.

The average displaced wattage of LED lamps was calculated by comparing the average wattage of the LED lamps sold through the program and the average equivalent wattage of the standard lamps replaced, using the manufacturers' specifications. The analysis revealed that the average wattage of LED lamps sold through the program in 2011 was 10.1 watts and the average equivalent wattage for the standard lamps replaced was 52.4 watts, which corresponded to a displaced wattage of 42.3 watts.

For the hours of operation, the daily usage of 2.7 hours per day estimated for CFLs was used.

Therefore, the unitary savings value was established at 41.7 kWh:

$$\text{Annual Unitary Savings} \left[\frac{kWh}{yr} \right] = \frac{(52.4W - 10.1W) \times 2.7 \frac{h}{day} \times 365 \frac{day}{yr}}{1000 \frac{W}{kW}} = 41.7 \frac{kWh}{yr}$$

For the LED lamps given away during in-store customer engagement events, ENSC uses a unitary savings value of 41.7 kWh per year.

Revised Savings

This unitary savings value was reviewed by Econoler during this evaluation. To do so, the Evaluator analyzed the wattage values of the LED lamps sold through the program, and conducted a literature review to validate the hours of operation.

Displaced Wattage

The displaced wattage used by ENSC was revised this year according to the LED wattage values found in the 2012 tracking sheet and the average equivalent halogen or incandescent lamp wattage values specified by the manufacturer. To do so, Econoler consulted the ENERGY STAR Qualified Lamps Product List¹⁰ and the website of participating retailers to investigate on the replacement scenario suggested for the most popular LED models sold through Instant Savings.

This information was collected for the six LED best sellers, which covered 82 percent of all the LED lamps sold through the program. The analysis revealed that the average wattage of the LED lamps was 9.1 watts and the average equivalent wattage for the standard lamps replaced corresponds to a value of 44.0 watts, which corresponds to a displaced wattage of 34.9 watts.

This assumption was validated by comparing the average number of lumens provided by the LED lamps studied. The LED lamps provide 522 lumens on average. According to the ENERGY STAR light output equivalency table, this level of lumens is found between an incandescent lamp of 40 and 50 watts, which confirms the displaced wattage of 34.9 watts estimated for LED lamps.

Hours of Operation

To the best of our knowledge, no organization has measured and released reliable and trustworthy statistics on the hours of operation of LED lamps installed in residential facilities. Since nothing has indicated that the LED value should be significantly different from that of CFLs, Econoler decided that the 2.7 hours of operation per day estimated for CFLs should also be used for LED lamps.

Unitary Savings

The unitary savings value was revised according to the displaced wattage of 34.9 watts and the hours of operation estimated at 2.7 hours per day:

$$\text{Annual Unitary Savings} = \frac{(34.9 \text{ W}) \times 2.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 34.4 \frac{\text{kWh}}{\text{yr}}$$

¹⁰ ENERGY STAR, "ENERGY STAR Qualified Lamps Product List", Posted on January 30, 2013, <www.energystar.gov>.

This new value of 34.4 kWh per year is used in the gross savings evaluation for all LED lamps sold through Instant Savings, which include the spring, fall and AIR MILES® campaigns, as well as for all the LED lamps given away during in-store customer engagement events.

4.2.3 LED Recessed Downlight Fixtures

Tracked Savings

LED recessed downlight fixtures were introduced to the program during the fall campaign. For this product, ENSC uses an annual unitary savings value of 46.8 kWh in the tracking sheet, based on a displaced wattage of 47.5 watts and hours of operation of 2.7 hours per day.

Revised Savings

This unitary savings value was reviewed by Econoler during this evaluation. To do so, the Evaluator analyzed the wattage values of the LED recessed downlight fixtures sold through the program.

Displaced Wattage

The displaced wattage was revised according to the real wattage values of the two best seller models of LED recessed downlight fixtures found in the 2012 tracking sheet and the average equivalent halogen lamp wattage values. To do so, Econoler consulted the website of participating retailers to investigate the replacement scenario specified by the manufacturer.

The two best seller models of LED recessed downlight fixtures represented 95 percent of all the LED recessed downlight fixtures sold through the program during the fall campaign. The analysis revealed that the wattage value of both fixtures is 10.5 watts and the average equivalent wattage for the halogen lamps replaced is 65 watts, which corresponds to a displaced wattage of 54.5 watts.

Hours of Operation

To the best of our knowledge, no organization has measured and released reliable and trustworthy statistics specifically on the hours of operation of LED recessed downlight fixtures installed in residential facilities. Since nothing indicated that the LED value should be significantly different from that of CFLs, Econoler decided that the hours of operation per day estimated for CFLs should also be used for LED lamps. However, the hours of operation were established at 2.68 hours per day, instead of 2.7 hours per day as for indoor and outdoor CFLs, since LED recessed downlight fixtures are installed inside the house.

Unitary Savings

The unitary savings value was revised according to the displaced wattage of 54.5 watts and the hours of operation estimated at 2.68 hours per day:

$$\text{Annual Unitary Savings} = \frac{(54.5 \text{ W}) \times 2.68 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 53.3 \frac{\text{kWh}}{\text{yr}}$$

This new value of 53.3 kWh per year is used in the gross savings evaluation for all LED recessed downlight fixtures sold through Instant Savings.

4.2.4 Dimmer Switches

Tracked Savings

For dimmer switches, ENSC uses a unitary savings value of 23.65 kWh per year. This value is based on the 2011 OPA report and has remained unchanged since the 2010 program evaluation.

Revised Savings

The unitary savings value was reviewed by Econoler during this evaluation. To do so, the parameters used by the OPA to estimate the savings associated with the installation of a dimmer switch were analyzed.

Table 18: OPA's Unitary Savings Calculation for Dimmer Switches

Parameters	Values
Wattage	$2 \times 60\text{W} = 120\text{W}$
Dimmed Wattage	$80\% \times 120\text{W} = 96\text{W}$
Operating Time	2.7 h/day
Annual Savings	23.7 kWh

The OPA assumes that the light output from light fixtures with dimmer switches is lowered by 25 percent, resulting in 20 percent energy savings. Econoler considers this assumption acceptable since the Evaluator has not found any relevant studies that contradict it. Therefore, a unitary savings value of 23.7 kWh per year is used in the gross savings evaluation for all dimmer switches sold through Instant Savings.

4.2.5 Indoor Motion Sensors

Tracked Savings

For indoor motion sensors, ENSC uses a unitary savings value of 63.95 kWh based on the 2010 OPA Prescriptive Measures and Assumptions report¹¹. This value was revised in the 2011 OPA report. Nevertheless, in the 2011 program evaluation report, the Evaluator estimated that the parameters used in the 2010 OPA report were more adequate. Therefore, the value of 63.95 kWh was kept.

Revised Savings

For this year's evaluation, Econoler reviewed the parameters used in the 2010 OPA report to validate if they are still appropriate. The following table presents these parameters.

Table 19: OPA's Unitary Savings Calculation for Indoor Motion Sensors

Parameters	Values
Fixture Wattage	$(2 \times 60W) = 120W$
Old Operating Time	2.7 h/day
New Operating Time – with Sensor	1.24 h/day
Annual Savings	63.9 kWh

The OPA estimates a reduction in operating time of 54 percent, from 2.7 to 1.24 hours per day. The old operating time is consistent with the hours of operation used for CFLs and LEDs and comes from a metering study. Therefore, a unitary savings value of 63.9 kWh per year is used in the gross savings evaluation for all indoor motion sensors sold through the program.

4.2.6 Dimmer Switches with Motion Sensor

Tracked Savings

A few units of this product, which combines a dimmer switch with a motion sensor, were sold during the two campaigns. For this specific product, Econoler provided ENSC with a unitary savings estimate based on the savings associated with the installation of a dimmer switch and a motion sensor. This value was established at 74.81 kWh per year.

¹¹ Ontario Power Authority (OPA), "2010 Prescriptive Measures and Assumptions," Released on 1, January 1, 2010.

Revised Savings

Econoler calculated the unitary savings value for dimmer switches with motion sensor by combining the wattage reduction generated by the dimmer switch and the reduction in hours of operation provided by the motion sensor. To do so, Econoler used the assumptions found in the OPA reports. The following table presents these parameters.

Table 20: OPA's Unitary Savings Calculation for Dimmer Switches with Motion Sensor

Parameters	Values
Fixture Wattage	$(2 \times 60W) = 120W$
Dimmed Wattage	$80\% \times 120W = 96W$
Old Operating Time	2.7 h/day
New Operating Time – with Sensor	1.24 h/day
Annual Savings	74.8 kWh

This unitary savings value of 74.8 kWh per year is used in the gross savings evaluation for all dimmer switches with motion sensors sold through the program.

4.2.7 Outdoor Motion Sensors

Tracked Savings

Outdoor motion sensors are also rebated through Instant Savings. For this product, ENSC uses a unitary savings value of 159.38 kWh per year, based on the 2011 OPA report. This value was reviewed in the 2011 program evaluation report.

Revised Savings

For this year's evaluation, Econoler reviewed the assumptions made by the OPA to calculate the unitary savings value. These assumptions are presented in the table below.

Table 21: OPA's Unitary Savings Calculation for Outdoor Motion Sensors

Parameters	Values
Average Lamp Wattage	242.6 W
Old Operating Time	4.75 h/day
New Operating Time – with Sensor	2.95 h/day
Annual Savings	159 kWh

The OPA assumes that 85 percent of outdoor lighting is for security spotlights with an average power of 275.6 watts¹². It assumes that the remaining 15 percent is for porch lighting, which has an average power of 55.5 watts. Therefore, the average lamp wattage is estimated at 242.6 watts.

For the reduction in operating time, the OPA estimates that it corresponds to 75 percent when the lights are on all night (11.78 h/day), resulting in a new operating time equalling 2.95 hours per day. However, to calculate the unitary savings, the OPA considers an operating time of 4.75 hours per day for the baseline, which corresponds to households leaving lights on only during evening hours.

Econoler has not found any other study that provides a savings estimate as accurate as the one estimated by the OPA. Since Econoler considers the assumptions behind this calculation largely adequate, the unitary savings value of 159 kWh per year will be used in the gross savings evaluation for all outdoor motion sensors sold through the program.

4.2.8 Power Bars with Integrated Timer

Tracked Savings

Power bars with integrated timer help reduce standby power. Various groups of electronic devices can be plugged into a power bar with integrated timer, and a time frame can be set to shut them down completely when they are not used.

In the tracking sheet, ENSC uses an average unitary savings value of 53.09 kWh per year for this product. This value comes from the 2011 program evaluation report and is based on the 2011 OPA report.

¹² Representative lamp mix: $(85\% \times 2 \times 150\text{W incandescent}) + (10\% \times 2 \times 90\text{W halogen}) + (5\% \times 2 \times 26\text{W CFL}) = 275.6\text{W}$.

Revised Savings

The following table presents the parameters used by the OPA to calculate the annual savings resulting from the installation of power bars with integrated timer. The typical proportions of electronic devices that could be plugged into a power bar were taken into account in this calculation.

Table 22: Unitary Savings Calculation for Power Bars with Integrated Timer

Parameters	Entertainment Center	Computer System	Lighting	Other
Proportion	40.3%	15.7%	19.4%	24.6%
Average wattage	38.1W	28W	60W	28W
Old operating time	9 h/day	14 h/day	6 h/day	11 h/day
New operating time – with timer	5 h/day	8 h/day	3 h/day	4 h/day
Operating season	12 months	12 months	8.5 months	8.6 months
Weighted Annual Savings	53.1 kWh			

Since the assumptions from the OPA are still considered adequate and that it is not possible to collect information on the usage of the power bars purchased by the participants due to the relatively small number of units sold, Econoler decided to keep the unitary savings value of 53.1 kWh per year.

4.2.9 Load Sensing Power Bars (Smart Strips)

Tracked Savings

Load sensing power bars (smart strips) were newly introduced to the program in 2012. These power bars are controlled with a load sensing system. This system has the ability to turn off the electronic devices plugged into the switched outlets when the control load power draw is reduced below a certain adjustable threshold. By disconnecting the standby load of these electronic devices, the overall energy consumption of a group of equipment, such as entertainment centers and home office devices, can be reduced.

To estimate the savings from this product in the tracking sheet, ENSC uses a unitary savings value of 61.5 kWh. This value is based on the 2011 Technical Reference Manual from Efficiency Vermont¹³, which provides two unitary savings values, one for entertainment centers and the other one for home office equipment. ENSC calculated an average value of 61.5 kWh per year based on the annual hours of operation estimated for each group.

¹³ Efficiency Vermont, Technical Reference User Manual (TRM) – Measure Savings Algorithms and Cost Assumptions, September 20, 2011, pages 361 to 363.

Table 23: Unitary Savings Calculation for Load Sensing Power Bars

Parameters	Entertainment Center	Home Office
Average Annual Savings per Unit	79.0 kWh	38.4 kWh
Average Usage	6,935 hours per year	5,252 hours per year
Weighted Annual Savings	61.5 kWh	

Revised Savings

Econoler reviewed the assumptions behind this calculation. Efficiency Vermont bases its assumptions on a study conducted by Ecos on smart plug strips.¹⁴ This study analyzed the energy saving estimates reported by a manufacturer as well as results from previous independent research on smart plug strips. Ecos also made laboratory evaluations of product performance and standby power of a sample set of smart plug strips.

The Evaluator considers that annual unitary savings values of 79 kWh for entertainment center and 38.4 kWh for home office equipment coming from this study are accurate and well documented. Although, the weighted average based on the hours of operation of each group of electronic devices used by ENSC to establish the unitary savings is quite random, the Evaluator did not find any information to evaluate these proportions more precisely. Still, the approach used by ENSC gives a small advantage to the entertainment center, which is consistent with the proportions of electronic devices used for power bars with integrated timers. Therefore, Econoler elected to keep the average unitary savings value of 61.5 kWh per year for the load sensing power bars sold through the program.

4.2.10 Heavy Duty Timers

Tracked Savings

For heavy duty timers, ENSC uses a unitary savings value of 383.65 kWh per year. It is based on the 2011 OPA report, and it was reviewed during the last evaluation.

¹⁴ Ecos, Smart Plug Strips: Draft Report, July 22, 2009.

Revised Savings

For this year's evaluation, Econoler reviewed the key parameters used by the OPA to calculate the annual savings resulting from the installation of a heavy duty timer.

Table 24: OPA's Unitary Savings Calculation for Heavy Duty Timers

Parameters	Values
Average wattage	746W (1 HP pool pump power)
Motor efficiency	70%
Old operating time	10 h/day
New operating time – with sensor	6 h/day
Annual operating time	90 days/year
Annual Savings	384 kWh

Econoler conducted a literature review to validate this unitary savings value. As in the last evaluation, it was found that multiple sources cite six hours per day as a reasonable reduced operating time for pool pumps.

In addition, Econoler investigated on the type of application used to calculate the savings associated with the installation of a heavy duty timer around the house. There are several possible usages for a heavy duty timer, and pool pump seems to be one of the typical applications, as it is often recommended on the product specifications. However, it would be difficult to validate the usage of the heavy duty timers sold through the program due to the relatively small number of units sold, in comparison to CFLs and LED lamps. Therefore, Econoler considers adequate to keep using the unitary savings value of 384 kWh per year based on the 2011 OPA report.

4.2.11 Programmable Thermostats

Tracked Savings

Programmable thermostats are rebated through Instant Savings. For this product, ENSC uses a unitary savings value of 223 kWh per year. This value was revised in the 2011 program evaluation report, based on results from Hydro-Québec's 2009 Residential Electronic Thermostats in New Constructions program evaluation¹⁵. This evaluation included both energy savings generated by thermostat accuracy and temperature setback, as shown in the table below.

¹⁵ Econoler, "Évaluation du programme thermostats électroniques – Volet nouvelle construction au marché résidentiel," Final Report presented to Hydro-Québec, February 9, 2009.

Table 25: Main Outputs from Hydro-Québec's Evaluation of Electronic Thermostat Savings

Gross Energy Savings per Thermostat	Housing Type		
	Single-Detached	Duplex / Triplex / Townhouse	Apartment
Unitary savings for electronic thermostat accuracy	121 kWh	94 kWh	61 kWh
Unitary savings for temperature setback	100 kWh	201 kWh	118 kWh
Total unitary savings value	221 kWh	295 kWh	179 kWh

To make these savings applicable to the programmable thermostats sold through Instant Savings, an average unitary savings value based on the proportion of housing type in Nova Scotia's residential market was calculated.

Table 26: ENSC's Unitary Savings Estimation for Programmable Thermostats

Calculation Parameters	Housing Type		
	Single-Detached	Duplex / Triplex / Townhouse	Apartment
Proportion of housing type ¹⁶	76%	11%	13%
Gross Energy Savings per thermostat			
Unitary savings for electronic thermostat accuracy	121 kWh	94 kWh	61 kWh
Average value	110 kWh		
Unitary savings for temperature setback	100 kWh	201 kWh	118 kWh
Average value	113 kWh		

Thus, a unitary savings value of 223 kWh per year was established under the 2011 impact evaluation of the program.

Revised Savings

For this year's evaluation, Econoler verified whether the energy savings from Hydro-Québec are still adequate for calculating the unitary savings value of the programmable thermostats sold through Instant Savings.

For the calculation of savings generated by the electronic thermostat accuracy, the percentages of savings were based on research supervised by Hydro-Québec's laboratory of energy technologies (LTE)¹⁷. The research used results from tests conducted in LTE environmental chambers and single-family homes that compare the operation of bimetallic thermostats versus electronic thermostats and

¹⁶ ENSC, from the 2011 socket study.

¹⁷ Hydro-Québec – Laboratoire des technologies de l'énergie (LTE), "Sommaire exécutif de rapports publiés par Hydro-Québec concernant les économies d'énergie dues aux thermostats électroniques," October 2004.

the energy consumption of houses with bimetallic thermostats versus electronic thermostats. The annual consumption attributed to electric space heating was estimated through a billing analysis that included 25,703 clients and 206,861 billing periods.

For the calculation of savings achieved by the temperature setback, the savings per house was based on billing analysis regression, which compared the consumption of houses with electronic thermostats and houses with programmable thermostats.

Econoler conducted a literature review to see if more recent studies that question these estimations have been published. It seems that Hydro-Québec's 2009 Residential Electronic Thermostats in New Constructions program evaluation report still presents the most accurate savings, considering both the savings from the thermostat accuracy and the temperature setback based on a thorough billing analysis. Since then, Hydro-Québec has published a more recent evaluation report, but the savings are estimated based on 4 building simulations. Therefore, Econoler considers more adequate to continue using the unitary savings value of 223 kWh based on Hydro-Québec's 2009 evaluation report.

4.2.12 CEE Tier 3 Refrigerators

Tracked Savings

Based on the past evaluation, ENSC uses a unitary savings value of 230 kWh per year for the CEE Tier 3 refrigerators sold through the program. This value was calculated based on:

- > an average annual energy consumption for standard refrigerators estimated at 564 kWh in the 2011 OPA Report;
- > an average annual energy consumption for CEE Tier 3 refrigerators estimated at 334 kWh, based on the consumption found in the CEE list of qualified products for refrigerators sold through the spring campaign.

Revised Savings

Econoler reviewed these two parameters by analyzing the top ten refrigerators sold through the program. Their sales covered together 73 percent of all the refrigerators sold through the spring and fall campaigns in 2012.

For the annual energy consumption of standard refrigerators, Econoler updated the value estimated in the 2011 OPA report according to the equivalent standard consumption stated on the EnerGuide label of each model analyzed. The average annual energy consumption estimated for standard refrigerators of similar sizes is 543 kWh. This value is slightly above the one calculated for the ENERGY STAR®

qualified models of similar sizes, based on the model listings found in the 2012 Natural Resources Canada (NRCAN) EnerGuide Appliance Directory¹⁸. However, Econoler considers more adequate using the 543 kWh value, since it takes into consideration the equivalent standard consumption of the real models sold during the markdown campaigns.

For the CEE Tier 3 refrigerators sold through the program, the average annual energy consumption was established at 371 kWh. The annual consumption values used in the calculation were found in the CEE qualifying product list¹⁹. This value is similar to the average annual consumption of 369 kWh established for the ENERGY STAR[®] qualified models in the 2012 NRCAN EnerGuide Appliance Directory.

Using these base and new annual consumption values, the unitary savings value for the CEE Tier 3 refrigerators sold through the program in 2012 is estimated at 172 kWh per year.

Table 27: Unitary Savings Value for CEE Tier 3 Refrigerators

Parameters	Values
Base Annual Consumption – Standard Refrigerator	543 kWh
New Annual Consumption – CEE Tier 3 Refrigerator	371 kWh
Annual Unitary Savings	172 kWh

4.2.13 CEE Tier 3 Clothes Washers

Tracked Savings

For CEE Tier 3 clothes washers, ENSC uses a unitary savings value of 469 kWh per year. This value is based on the 2011 program evaluation, using the following parameters:

- > an average annual energy consumption for standard clothes washers estimated at 604 kWh, based on an average washer size of 55 litres and a usage of 7.5 cycles per week, which corresponds to the Canadian Standards Association criteria²⁰;
- > an average annual energy consumption for CEE Tier 3 clothes washers estimated at 135 kWh, based on the consumption found in the CEE list of qualified products for the clothes washers sold through the spring campaign.

¹⁸ Natural Resources Canada, 2012 EnerGuide Appliance Directory (includes ENERGY STAR qualified appliances).

¹⁹ Consortium for Energy Efficiency (CEE), Residential Refrigerators Qualifying Product List, www.cee.1.org, December 15, 2012.

²⁰ CSA-C360-03, Energy Performance, Water Consumption and Capacity of Household Clothes Washers, January 2005.

Revised Savings

These two parameters were reviewed during this evaluation.

The average energy consumption used for CEE Tier 3 clothes washers was revised to 132 kWh per year according to the annual consumption of the top ten clothes washer models sold through the program in 2012. These annual consumption values were found in the model listings that are contained in the 2012 NRCan EnerGuide Appliance Directory.

For the annual energy consumption of standard clothes washers, Econoler used the average value provided in the 2012 NRCan EnerGuide Appliance Directory. Based on the most recent energy consumption data, standard clothes washers (top loading) have an average energy consumption of 319 kWh per year. In comparison, the 2012 NRCan EnerGuide Appliance Directory also reports the average energy consumption for equivalent ENERGY STAR[®] qualified models, which corresponds to 148 kWh. This value is close to what was calculated by Econoler for the top ten clothes washer models sold through the markdown campaigns in 2012.

Using these base and new annual consumption values, the unitary savings value for the CEE Tier 3 clothes washers sold through the program in 2012 is estimated at 187 kWh per year.

Table 28: Unitary Savings Value for CEE Tier 3 Clothes Washers

Parameters	Values
Base Annual Consumption – Standard Clothes Washer	319 kWh
New Annual Consumption – CEE Tier 3 Clothes Washer	132 kWh
Annual Unitary Savings	187 kWh

4.2.14 Hot Water Tank Wraps

Tracked Savings

Hot water tank wraps were promoted through the AIR MILES[®] campaign. For this product, ENSC uses a unitary savings value of 270 kWh per year, based on the 2011 OPA report. This value is based on a conductance value of 1.429 W/°C for a heater without a tank wrap and of 0.6348 W/°C for an insulated heater with a tank wrap.

Revised Savings

Econoler reviewed the assumptions and the engineering calculations used by the OPA. The thermal resistances used for the bare tank and the insulated tank, as well as the size of the tank, are accurate. Therefore, Econoler concludes that the unitary savings value of 270 kWh per year for hot water tank wraps is adequate.

4.2.15 Demand-to-Energy Ratio

Econoler calculated the demand savings for Instant Savings based on a demand-to-energy ratio of 0.176 MW/GWh. This ratio was obtained from the adjusted 2012 program targets, by dividing the target peak demand savings by the target energy savings.

4.2.16 Revised Gross Savings

The annual gross savings for each category of product installed through the program are presented in Table 29. They were calculated using the revised unitary savings values presented in the previous section. Overall, the total gross energy and demand savings amount to 13.853 GWh and 2.438 MW at the meter.

The gross savings at generator level are also estimated in Table 29, using a line loss factor between the meter and the generator of 1.100 (provided by Nova Scotia Power for residential customers). They correspond to energy and demand savings of 15.238 GWh (14.384 GWh for Instant Savings and 0.854 GWh for the AIR MILES[®] component) and 2.682 MW (2.532 MW for Instant Savings and 0.150 MW for the AIR MILES[®] component).

Table 29: Evaluation Results – Gross Energy and Demand Savings by Product – Lighting Products

Category of Product	Regular CFL	Specialty CFL	LED Lamp	LED Recessed Downlight Fixture	Dimmer Switch	Indoor Motion Sensor	Dimmer Switch with Motion Sensor	Outdoor Motion Sensor
Number of Units								
Number of Units – Spring Campaign	77,681	9,010	7,871	-	2,001	137	3	2
Number of Units – Fall Campaign	115,620	8,493	8,598	578	3,278	111	1	11
Number of Units – Air Miles Campaign	18,976	-	8	-	12	-	-	-
Number of Units – In-Store Events	-	-	8,700	-	-	-	-	-
Total Number of Units Sold	212,277	17,503	25,177	578	5,291	248	4	13
Replacement Ratio	0.80	-	-	-	-	-	-	-
Total Number of Units Generating Savings	169,822	17,503	25,177	578	5,291	248	4	13
Energy Savings								
Unitary savings value (kWh)	51.0	46.2	34.4	53.3	23.7	63.9	74.8	159
Total Gross Energy Savings – at Meter (GWh)	8.661	0.809	0.866	0.031	0.125	0.016	0.000	0.002
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Gross Energy Savings – at Generator (GWh)	9.527	0.890	0.953	0.034	0.138	0.017	0.000	0.002
Demand Savings								
Demand-to-Energy Ratio (MW/GWh)	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176
Total Gross Demand Savings – at Meter (MW)	1.524	0.142	0.152	0.005	0.022	0.003	0.000	0.000
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Gross Demand Savings – at Generator (MW)	1.677	0.157	0.168	0.006	0.024	0.003	0.000	0.000

Table 30: Evaluation Results – Gross Energy and Demand Savings by Product – Other Products

Category of Product	Power Bar with Timer	Smart Power Bar	Heavy Duty Timer	Program-mable Thermostat	CEE Tier 3 Refrigerator	CEE Tier 3 Clothes Washer	Hot Water Tank Wrap	Total for All Categories of Product
Number of Units								
Number of Units – Spring Campaign	57	32	259	916	418	2,244	-	100,631
Number of Units – Fall Campaign	61	24	3,176	3,861	339	2,125	-	146,276
Number of Units – Air Miles Campaign	-	-	-	6	-	-	1	19,003
Number of Units – In-Store Events	-	-	-	-	-	-	-	8,700
Total Number of Units Sold	118	56	3,435	4,783	757	4,369	1	274,610
Replacement Ratio	-	-	-	-	-	-	-	-
Total Number of Units Generating Savings	118	56	3,435	4,783	757	4,369	1	232,155
Energy Savings								
Unitary savings value (kWh)	53.1	61.5	384	223	172	187	270	-
Total Gross Energy Savings – at Meter (GWh)	0.006	0.003	1.319	1.067	0.130	0.817	0.000	13.853
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Energy Savings – at Generator (GWh)	0.007	0.004	1.451	1.173	0.143	0.899	0.000	15.238
Demand Savings								
Demand-to-Energy Ratio (MW/GWh)	0.176	0.176	0.176	0.176	0.176	0.176	0.176	-
Total Gross Demand Savings – at Meter (MW)	0.001	0.001	0.232	0.188	0.023	0.144	0.000	2.438
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Demand Savings – at Generator (MW)	0.001	0.001	0.255	0.206	0.025	0.158	0.000	2.682

4.3 INTERACTIVE EFFECTS

In a residence, interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as heating and cooling. For instance, replacement of incandescent lighting products with CFLs causes an increase in the heating load during winter and a decrease in the cooling load during summer. Indeed, energy-efficient lighting, such as CFLs, releases less heat than the less efficient lighting it replaces.

For CFLs, LED lamps and LED recessed downlights, the evaluation of the interactive effects factor is based on a study conducted by ADS in 1992 for Hydro-Québec. The work carried out in this study modified certain parameters in simulations of an average home in Quebec to determine the impact of these changes on the interactive effects. The simulations were performed with the DOE-2 software²¹ and focused on homes heated entirely by electricity. The simulations were carried out based on three scenarios for interactive effects: low, moderate and high interactive effects. The scenario with minimum interactive effects was finally selected for the calculation because it reflects the evolution of homes since 1992.

The following table presents the calculations of interactive effects. It reflects the proportion of residences in Nova Scotia that are heated by electricity²² and those that have air conditioning units or systems²³.

Table 31: Interactive Effects Calculation for Lighting Products

Parameters	% of Residences	Interactive Effects ²⁴
Electric heating with air conditioning	$33\% \times 18\% = 5.9\%$	-54.4%
Electric heating without air conditioning	$33\% \times 82\% = 27.1\%$	-58.0%
Non-electric heating with air conditioning	$67\% \times 18\% = 12.1\%$	3.6%
Non-electric heating without air conditioning	$67\% \times 82\% = 54.9\%$	0%
Weighted Interactive Effects Factor	100%	-18.5%

These interactive effects occur only when the products are installed inside the house. As CFLs and LED lamps installed through the program can also be used for outdoor lighting, the interactive effects factor for these products was adjusted to take that into account. To do so, Econoler used the same

²¹ DOE-2 is a widely used and accepted software building energy analysis program developed under funding from the U.S. Department of Energy.

²² ENSC, from the 2011 socket study.

²³ Statistics Canada (CANSIM), Households having air conditioning, Nova Scotia, 2009.

²⁴ ADS ASSOCIÉS, "Évaluations des effets énergétiques combinés des mesures d'économies d'énergie – résidence unifamiliale," report presented to Hydro-Québec, 1992.

proportions as those used to calculate the hours of operation, being 94 percent of CFLs installed inside houses and the remaining 6 percent installed in outdoor sockets. This information comes from a socket study conducted for ENSC in 2011 to investigate CFL installations. For LED recessed downlight fixtures, the interactive effects factor remains equal to -18.5 percent since this product is only used for indoor applications.

Table 32: Interactive Effects Factor for CFLs, LED Lamps and LED Recessed Downlights

Category of Product	% Indoor	% Outdoor	Interactive Effects Factor
CFL	94%	6%	$(94\% \times -18.5\%) + (6\% \times 0\%) = -17.4\%$
LED Lamp	94%	6%	$(94\% \times -18.5\%) + (6\% \times 0\%) = -17.4\%$
LED Recessed Downlight	100%	0%	-18.5%

No interactive effects factor is calculated for the other lighting devices sold through the program, i.e. indoor and outdoor motion sensors, as well as heavy duty timers.

For refrigerators, since the compressor in this appliance releases heat, the replacement of an old refrigerator with a more efficient unit would have an effect of less heat being released. However, this effect is reduced when the refrigerator is built-in or leans against an exterior wall. Due to these elements that reduce the interactive effects of a refrigerator replacement, and due to the fact that only 33 percent of the houses in Nova Scotia are electrically heated, interactive effects on the purchase of CEE TIER 3 refrigerators are not considered in the program net savings calculation.

For all other products, interactive effects are also considered to be negligible.

4.4 NET-TO-GROSS RATIO

This section presents the methodology used to transform information obtained through the intercept survey and retailer interviews into a net-to-gross ratio (NTGR). For Instant Savings, the NTGR includes the assessment of free-ridership and spillover by measuring market effects. These two distortion effects were assessed separately for three specific products: CFLs, LED lamps and clothes washers. These products were selected since they are the three most important products sold through the program, in terms of tracked savings.

Once each effect is quantified for each product, their respective NTGR is calculated based on the equation below.

$$NTGR = (1 - \% \text{ free-ridership} + \% \text{ spillover})$$

For all other products, a NTGR of 1 is used. The distortion effects for these products could not be assessed through this evaluation. Indeed, products such as dimmer switches, occupancy sensors and power bars with integrated timer are specialized products which are grouped into larger retail categories making it difficult for retailers to estimate program influence on their sales. Moreover, the

population of buyers for these products is smaller, and this makes it difficult to reach them using a general population telephone survey.

A NTGR of 1 was also used for the products sold through the AIR MILES® campaigns and for the LED lamps distributed during in-store customer engagement events since no specific assessment of free-ridership and spillover was conducted for these special activities.

4.4.1 Free-Ridership

CFLs

The free-ridership level for CFLs was evaluated at 78 percent in the past evaluation. This value was established using a phone survey conducted with participating CFL buyers.

As recommended in the 2011 evaluation report, the assessment of free-ridership for this year's evaluation is based on an intercept survey conducted right after participants' product purchase during the fall campaign. The questionnaire included five free-ridership questions that attempted to assess:

- > if knowing that a discount was offered on the purchase of CFLs played a part in the participant's decision to purchase CFLs;
- > the probability that the participant would have purchased the CFLs if the discount offered had not been in place;
- > the probability that the participant would have purchased the CFLs at a later date if the discount offered had not been in place;
- > the probability that the participant would have purchased the same number of CFLs if the discount offered had not been in place; and
- > the influence of the discount on the participant's decision to purchase CFLs.

Each question was transposed into a level of program attribution, which was used to calculate the global free-ridership level for each participant. The algorithm behind this calculation is presented in Appendix VII.

Even if Econoler's approach was modified because the free-ridership questions were asked through an intercept survey right after the participant's purchase, it remains consistent with the evaluation, measurement and verification methods used in other jurisdictions such as California, New York, Oregon and Pennsylvania. Indeed, the algorithm uses a 0 to 10 scoring system and the questions ask the survey taker to jointly consider and rate the importance of the many likely factors that may have influenced their energy efficiency decision making. This question structure reflects the complex nature of real-world decision making, and helps ensure that all program and non-program influences are considered in the free-ridership assessment.

Using this approach, intercept survey results revealed a free-ridership level of 59 percent. This value is lower than the 78 percent free-ridership level obtained under the 2011 evaluation. Through the

intercept survey, participants were asked about their decision to purchase CFLs closer to the moment of the decision itself, which most likely helped lower free-ridership. However, 30 percent of the CFL buyers interviewed were not aware of the discount prior to paying for their lamps. This percentage has decreased since the last evaluation in 2011. In this regard, in-store signage proved to be successful at communicating with customers regarding the program. Indeed, 70 percent of participants who were aware of the discount saw in-store promotions such as stickers, shelf signs or posters. The mystery shopper visits confirmed a better use of promotional display in 2012, which translated into the discount offered through the program being more visible and eligible products being easier to identify. This in turn led to more customers finding out about the discount prior to paying at the cash register, making it easier to associate the program influence with their decision to purchase CFLs. All these elements allowed for a lower free-ridership level in 2012.

Nevertheless, the free-ridership level of 59 percent obtained for CFLs remains relatively high. The penetration of regular CFLs in the market may explain this result. The socket study conducted in 2011 indicated that households in Nova Scotia have an average of 36 sockets, of which an average of 16 contained CFLs. Overall, this is good news for ENSC as a promoter of energy-efficient products. However, Econoler recommends that ENSC considers removing the rebate offered for regular CFLs.

This free-ridership level is only applied on regular CFLs sold through the spring and fall campaigns. Specialty CFLs represent such a small portion of CFLs sold through the program, and have some particularities, such as higher prices and a lower penetration rate. Therefore, a NTGR of 1 was more accurate for this category of product. Indeed, a huge sample would have been necessary to reach enough specialty CFL buyers to do a statistically representative analysis.

LED Lamps

The free-ridership level for LED lamps sold through the program was evaluated for the first time in 2012. The assessment of free-ridership for this product is based on the intercept survey conducted right after the participant's purchase during the fall campaign. As with CFLs, the questionnaire included five free-ridership questions that attempted to assess:

- > if knowing that a discount was offered on the purchase of LED lamps played a part in the participant's decision to purchase LED lamps;
- > the probability that the participant would have purchased the LED lamps if the discount offered had not been in place;
- > the probability that the participant would have purchased the LED lamps at a later date if the discount offered had not been in place;
- > the probability that the participant would have purchased the same number of LED lamps if the discount offered had not been in place; and
- > the influence of the discount on the participant's decision to purchase LED lamps.

Each question was transposed into a level of program attribution, which was used to calculate the global free-ridership level for each participant. The algorithm behind this calculation is the same as for CFLs.

Using this algorithm, intercept survey results revealed a free-ridership level of 33 percent for LED lamps sold through the program. This free-ridership level can be partly explained by the fact that LED lamps are sold on the market at a higher price than CFLs and have not penetrated households as much as CFLs yet. Furthermore, survey results showed that only 15 percent of participants were not aware that a discount was offered on the purchase of LEDs before paying at the cash register. Therefore, a vast majority of LED buyers interviewed through the intercept survey were aware of the discount prior to paying for their lamps and this discount influenced their decision to purchase this energy-efficient lighting product. As with CFLs, in-store signage was helpful at communicating with customers regarding the discount on LEDs.

This free-ridership level is only applied on the LED lamps sold through the spring and fall campaigns. A NTGR of 1 is used for LED lamps distributed during in-store customer engagement events.

Clothes Washers

For clothes washers, the approach is somewhat different. Since the population of buyers for this product is small, it is difficult to intercept them during an in-store survey. Therefore, the free-ridership level was measured through in-depth interviews with retailers. To do so, the retailers were asked to estimate the percentage of clothes washers that would have been sold in the absence of the discount offered through the program. They were also asked to estimate all other factors that might have influenced the participants' decision to purchase a CEE Tier 3 clothes washer instead of a standard unit. The results were then transposed into a level of free-ridership.

Using this approach, the free-ridership level was estimated at 78 percent for the CEE Tier 3 clothes washers sold through the program in 2012. This value represents a decrease in comparison with last year's free-ridership level evaluated at 85 percent, using the same approach. Though being lower, this free-ridership level is still considered relatively high. Two main factors could be responsible for this. Firstly, most of the retailers interviewed carry only or mainly CEE Tier 3 clothes washers now. Therefore, the choice to buy another model of appliance is limited. Secondly, retailers spoke of the relatively high investment customers make when purchasing CEE Tier 3 clothes washers. Indeed, according to retailers, when customers decide to invest in big appliances such as clothes washers, they have already made up their mind on the model they wish to purchase and know about the benefits of these appliances which include water and energy savings. Therefore, the rebate provided by the program does not weigh in as much.

4.4.2 Spillover

Instant Savings discounts are offered during two distinct periods: in the spring and in the fall. During and between these two periods, eligible product sales may occur due to program influence, even if participants are not aware of the discount. This influence can come from greater knowledge and awareness of energy-efficient products and from a change in retailer offer. These sales should be attributable to the program in the form of market effects.

The retailer interviews were used to estimate the level of spillover by measuring the market effects attributable to the program for three eligible products: CFLs, LED lamps and CEE Tier 3 clothes washers. More specifically, retailers were asked to:

- > rate the influence of the program on their in-store offer – the variety of energy-efficient products available, the knowledge of their salespeople about energy-efficient products and consumer awareness; and
- > estimate program attribution for eligible products sold outside of the two markdown periods.

The answers to these questions were analyzed in order to measure the market effects attributable to the program, and estimate the spillover effects for each product targeted. The results show that retailers attribute to the program a portion of their sales that is influenced by factors other than the discount. For CFLs, the number of eligible products attributable to general program influence corresponds to 29 percent of the CFLs purchased by participants during the campaigns. For LEDs, these sales correspond to 20 percent of the eligible LEDs purchased by participants during the campaigns whereas clothes washer sales correspond to 48 percent of the eligible appliances purchased by participants during the campaigns.

Market effects are obtained by applying the percentage of program attribution declared by the retailers to the sales of eligible products outside the two campaigns. For LEDs, market effects were measured for the first time in 2012. A program attribution of 10 percent was attained through the retailer interviews for this product. For CFLs and clothes washers, a small increase in the percentage of attribution was noticed between the 2011 and 2012 evaluations. Indeed, the program attribution for CFLs went from 15 percent to 17 percent, and from 16 percent to 19 percent for CEE Tier 3 clothes washers.

4.4.3 NTGR Calculation

The NTGR values for each category of product were established using the free-ridership and spillover levels presented above. The table below summarizes the results of these calculations.

Table 33: Net-to-Gross Ratios

Category of Product	Free-Ridership	Spillover	NTGR
Regular CFLs	59%	29%	0.70
Specialty CFLs	-	-	1.00
LED Lamps	33%	20%	0.87
CEE Tier 3 Clothes Washers	78%	48%	0.70
LED Given Away During In-Store Events	-	-	1.00
Products Sold through the AIR MILES® Campaigns	-	-	1.00
All Other Products	-	-	1.00

These values were applied to the gross savings calculations.

4.5 NET SAVINGS

Net energy savings are estimated by adding the interactive effects and the NTGR to the gross energy savings, using the equation below.

$$\text{Net Energy Savings} = \text{Gross Energy Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

The net energy savings were first calculated separately for each product because the interactive effects factors and NTGR differed from one product to another. Table 34 presents the details of this calculation.

Overall, the total net energy and demand savings amount to 9.789 GWh and 1.723 MW at the meter and 10.767 GWh and 1.895 MW at the generator. More specifically, Instant Savings generated net energy and demand savings of 10.061 GWh and 1.771 MW at the generator, while the AIR MILES® component generated net energy and demand savings of 0.706 GWh and 0.124 MW at the generator.

Table 34: Evaluation Results – Net Energy and Demand Savings by Product – Lighting Products

Category of Product	Regular CFL	Specialty CFL	LED Lamp	LED Recessed Downlight Fixture	Dimmer Switch	Dimmer Switch with Motion Sensor	Indoor Motion Sensor	Outdoor Motion Sensor
Energy Savings								
Total Gross Energy Savings – at Meter (GWh)	8.661	0.809	0.866	0.031	0.125	0.016	0.000	0.002
Interactive Effects Factor	-17.4%	-17.4%	-17.4%	-18.5%	0%	0%	0%	0%
NTGR	0.73*	1.00	0.91**	1.00	1.00	1.00	1.00	1.00
Total Net Energy Savings (GWh) – at Meter	5.200	0.668	0.655	0.025	0.125	0.016	0.000	0.002
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Net Energy Savings (GWh) – at Generator	5.720	0.735	0.720	0.028	0.138	0.017	0.000	0.002
Demand Savings								
Total Gross Demand Savings – at meter (MW)	1.524	0.142	0.152	0.005	0.022	0.003	0.000	0.000
Interactive Effects Factor	-17.4%	-17.4%	-17.4%	-18.5%	0%	0%	0%	0%
NTGR	0.73	1.00	0.91	1.00	1.00	1.00	1.00	1.00
Total Net Demand Savings (MW) – at Meter	0.915	0.118	0.115	0.004	0.022	0.003	0.000	0.000
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Net Demand Savings (MW) – at Generator	1.007	0.129	0.127	0.005	0.024	0.003	0.000	0.000

*The NTGR of 0.73 for regular CFLs corresponds to a weighted average calculated to take into account that a NTGR of 0.70 is applied on regular CFLs sold through the spring and fall campaigns (77,681 + 115,620 units) while a NTGR of 1 is used for those sold through the AIR MILES® campaigns (18,976 units):
 $[0.70 \times (77,681 + 115,620) + 1.00 \times 18,976] / (77,681 + 115,620 + 18,976) = 0.73$.

** The NTGR of 0.91 for LED lamps corresponds to a weighted average calculated to take into account that a NTGR of 0.87 is applied on the LED lamps sold through the spring and fall campaigns (7,871 + 8,598 units) while a NTGR of 1 is used for those sold through the AIR MILES® campaigns (8 units) and those given away during in-store customer engagement events (8,700 units):
 $[0.87 \times (7,871 + 8,598) + 1.00 \times (8 + 8,700)] / (7,871 + 8,598 + 8 + 8,700) = 0.91$.

Table 35: Evaluation Results – Net Energy and Demand Savings by Product – Other Products

Category of Product	Power Bar with Timer	Smart Power Bar	Heavy Duty Timer	Program-mable Thermostat	CEE Tier 3 Refrigerator	CEE Tier 3 Clothes Washer	Hot Water Tank Wrap	Total for All Categories of Product
Energy Savings								
Total Gross Energy Savings – at Meter (GWh)	0.006	0.003	1.319	1.067	0.130	0.817	0.000	13.853
Interactive Effects Factor	0%	0%	0%	0%	0%	0%	0%	-
NTGR	1.00	1.00	1.00	1.00	1.00	0.70	1.00	-
Total Net Energy Savings (GWh) – at Meter	0.006	0.003	1.319	1.067	0.130	0.572	0.000	9.789
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Net Energy Savings (GWh) – at Generator	0.007	0.004	1.451	1.173	0.143	0.629	0.000	10.767
Demand Savings								
Total Gross Demand Savings – at meter (MW)	0.001	0.001	0.232	0.188	0.023	0.144	0.000	2.438
Interactive Effects Factor	0%	0%	0%	0%	0%	0%	0%	-
NTGR	1.00	1.00	1.00	1.00	1.00	0.70	1.00	-
Total Net Demand Savings (MW) – at Meter	0.001	0.001	0.232	0.188	0.023	0.101	0.000	1.723
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Net Demand Savings (MW) – at Generator	0.001	0.001	0.255	0.206	0.025	0.111	0.000	1.895

The table below presents comparisons between the energy and demand savings established by this evaluation and those calculated in the 2012 tracking sheet.

Table 36: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	19.009 GWh	16.311 GWh	14.263 GWh	0.71	10.167 GWh
Evaluation Results	17.622 GWh	15.241 GWh	13.256 GWh	0.81*	10.767 GWh
Demand Savings					
Tracked Savings from ENSC	1.889 MW	1.621 MW	1.418 MW	0.71	1.011 MW
Evaluation Results	3.101 MW	2.682 MW	2.333 MW	0.81*	1.895 MW

***NTGRs were different for each category of product. The NTGRs presented in this table correspond to the rounded averages obtained by dividing the net savings by the installed gross savings (with interactive effects).*

These net evaluated energy savings exceeded those tracked by ENSC by 6 percent, even if some unitary savings values were revised downward. The main element that explains this result is the difference between the NTGR measured for this evaluation and that used in the tracking sheet, which was based on the 2011 evaluation. For regular CFLs, which contribute to more than 60 percent of gross savings, the NTGR went from 0.53 to 0.70. The free-ridership level measured this year through an intercept survey at the store exit right after the purchase lowers the free-ridership level for regular CFLs. Moreover, the inclusion of the percentage of outdoor installations for CFLs and LED lamps in the interactive effects calculation allowed for a more precise evaluation of savings and reduced their impact on the evaluated savings.

CONCLUSION

The 2012 evaluation of Instant Savings demonstrated that the program works well overall and constitutes the right approach in a market transformation and resource acquisition perspective. Additions were made to the program to help improve its design and implementation. Notably, the amount of discounts on several products was raised, more products were made eligible and many efforts were deployed to improve program marketing and advertising. Indeed, the 2012 marketing strategy included improving POP, issuing a playbook, incorporating social media, launching a contest between participant stores to increase knowledge of salespeople with the program and improving retailer support and quality assurance (QA). Moreover, positive program elements, such as customer engagement events, were maintained in 2012 to continue providing customers with information about energy-efficient products and their benefits. LED giveaways were also integrated into these events.

Furthermore, the Evaluator found major improvements to the program since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving little time to follow up on all the process and impact recommendations before the new evaluation window, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management such as the process charts, the evaluation plan and a standardized program manual. Moreover, the tracking sheet now contains all necessary information for evaluation purposes.

ENSC's efforts in improving program marketing and advertising contributed to program awareness and to partner satisfaction in 2012. Indeed, a majority of CFL and LED buyers from the intercept survey knew about the program and the discounts prior to purchasing their lamps. Survey results showed that in-store signage proved to be successful at communicating with customers regarding the program and the discount. Retailers also provided positive feedback regarding the program marketing as they indicated being satisfied with the look of the promotional tools.

The DA and the retailers interviewed provided high satisfaction ratings with regard to the program in general and most of its aspects. They mentioned a challenge; though, that relies on involving store associates and personnel in the program. Efforts need to be made to help retailers see the benefits they would obtain from taking part in the program. According to all partners, retailer involvement constitutes the main barrier to Instant Savings implementation.

Many retailers provided helpful feedback concerning the list of eligible products. Appliance retailers would like to see a change in the variety of refrigerators discounted under the program since CEE Tier 3 refrigerators constitute a very specific class of high-end product. As for other program products, some retailers suggested a greater focus on LED products in the future.

The evaluation revealed that Instant Savings generated net energy savings of 10.767 GWh and demand savings of 1.895 MW at the generator in 2012, compared to 13.802 GWh and 1.388 MW in 2011. To calculate the net savings of Instant Savings in 2012, Econoler reviewed the unitary savings values estimated by ENSC for each eligible product and included free-ridership and spillover, measured through market effects, for the three most popular products: regular CFLs, LED lamps and clothes washers.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Document the AIR MILES® approach*: The program manual does not provide enough information on the AIR MILES® approach, such as the number provided for each eligible product purchased, or justification from a 2011 pilot project. Overall, the AIR MILES® campaign needs to be better documented in the Instant Savings program manual. Among other things, an example of what information will be found in the AIR MILES® tracking sheet should be added as one of the program manual Appendices. *See Section 3.2.1 Program Manual for more details
	2. Generate greater involvement from the retailers: The DA mentioned an important concern during the evaluation process. They spoke of the difficulty to involve retailers in the program, both at the corporate and store levels. Indeed, a challenge persists in making retailers at the corporate level understand the relevance of program components such as POP and in-store customer engagement events. Since some corporate retailers do not always communicate well with their store associates, this challenge also affects participating stores. The retailers recognized this difficulty and its impact on the effectiveness of the campaigns. They reported the challenge that lies in communicating all the necessary information to their store personnel and in involving and engaging them, as indicated by the DA. The success of Instant Savings relies largely on the collaboration of retailers. ENSC already made a great effort to involve and engage retailers. Indeed, the communication and the relationship between the DA and the retailers are stronger than ever. Furthermore, initiatives such as the playbook and the contest were developed to create a sense of interest among store associates. The Evaluator recommends continuing strengthening the relationship with the corporate retailers while pursuing more concrete actions with the store associates. The latter are in direct contact with the clients and can become program promoters if they are well involved. By being informed of the benefits they can obtain from engaging in the program, they might be more likely to promote it.

Executive Summary	3. Focus on LED products going forward with the program*: Some retailers recommended upgrading the lighting offer under Instant Savings. Indeed, they believe that LED lamps are the future, and that the demand for regular CFLs is slowly decreasing. Following this trend in the market, ENSC made efforts in this regard in 2012 by adding LED recessed downlight fixtures to the list of eligible products. The Evaluator recommends continuing this approach and centering the program lighting offer around LED products over the years to come. Given the relatively high free-ridership level measured for regular CFLs since the two last evaluations, Econoler also suggests planning the withdrawal of regular CFLs as an eligible product for 2014. *See Section 4.4.4 Free-Ridership for more details
	4. Modify the offer of appliances under the program to consider the most energy-efficient appliances available on the market: This recommendation targets the offer of refrigerators and clothes washers under Instant Savings. Firstly, interviews with retailers highlighted an issue regarding the energy-efficient refrigerators discounted under the program. Retailers pointed out that not many models of CEE Tier 3 refrigerators currently exist on the market, which constitutes a very specific class of high-end product. Moreover, many CEE Tier 3 refrigerators are larger in size. ENSC is already considering rebating smaller CEE Tier 2 refrigerators that are more energy-efficient than some of the larger CEE Tier 3 models. The Evaluator agrees with this approach and recommends adding to the program smaller models of CEE Tier 2 refrigerators with low annual energy consumptions to increase sales for this product and avoid encouraging the purchase of bigger refrigerators when it is not needed. As for clothes washers, many of the retailers interviewed mentioned carrying only CEE Tier 3 washers in their stores. Therefore, the program did not have a great impact on their sales since the rebate became an extra instead of being the main incentive to buy among customers. Discounting a selection of energy-efficient clothes washers limited to the highest energy-efficient models would allow for targeting the models that provide the most significant energy savings. Furthermore, this would help the program to have greater impact and publicity, and thus lower the free-ridership level for clothes washers, which is relatively high.

Executive Summary	5. Improve the content of the tracking sheet*: Econoler's review of the tracking sheet showed that ENSC took into consideration the recommendations from last year's evaluation and the Evaluator concludes that the 2012 tracking sheet for Instant Savings is complete, consistent and easy to work with. In addition to the improvements already made to the tracking sheet, Econoler noticed two adjustments that could be made in the future to continue the improvements brought to the tracking sheet and facilitate program evaluation: ➤ When possible, ask for the store identifier to be filled in. Having this information would facilitate the organization of field activities like the intercept surveys. However, the Evaluator understands that this could be difficult for some retailers, since they all use different approaches to collect retail store information. ➤ Separate the technical information in two distinct columns to identify: 1) the product description, corresponding to a string of technical information on the product and 2) the wattage values separately. This would facilitate the calculations of the average wattage for each product category. *See Section 3.3 Tracking Sheet for more details
Program Manual	6. Document major changes in the Document Revision section: In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual. For example, this section should briefly describe the addition of the AIR MILES® component in certain stores. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.
Program Charts	7. Provide partners with the process chart: The Evaluator recommends that the partners' process chart be communicated to them. After all, it is for the benefit of the partners that these charts have been created. Hence, it is important to distribute it to every partner involved, in order to provide them with an overall view of the program that briefly describes the different steps to follow to complete the participation process. The version date should be indicated in the chart.

Marketing and Outreach Activities	8. Make the performance indicators in the marketing plan more quantitative: Instant Savings includes many quantitative performance indicators such as media advertising post reports, tracking of participants to customer engagement events and call volume during, and after marketing campaigns. These performance indicators are not found in the marketing plan. They should be centralized in the marketing plan to provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of performance indicators, the marketing plan should indicate the revision date.
Regular and Specialty CFLs	9. Re-evaluate the replacement ratio at regular intervals by the means of a socket study like the one conducted in 2011.

APPENDIX II - INTERVIEW GUIDE WITH DELIVERY AGENT

PROGRAM NAME: INSTANT SAVINGS ON ENERGY EFFICIENT PRODUCTS

How to complete this form

This is a Word document that integrates some form features. To enter your answers, simply position your cursor on the shaded sections and begin typing. Since this is a form, you cannot write anywhere else in the document. For the boxes, just click on the one next to your answer. Click again to uncheck it.

Please complete this form within the next 48 hours, [save the file](#) and send it back to us at alaperle@econoler.com.

Thank you!

Part I: General Questions

Please indicate your company name.

Q1a. How would you describe your role(s) as an Efficiency Nova Scotia energy efficiency program partner?

Q1b. How long have you held that role/those roles (specify months or years)?

Q2a. How would you qualify your participation process in this program?

- ☐ Simple
☐ Complex

Q2b. If you checked "Complex," please indicate which parts of your involvement or participation process have been the most complex.

Q3. On a scale from 1 to 10, where 1 is very poor and 10 is excellent, please rate your satisfaction in regard to the:

Aspects of the program	Score 1 = very poor 10 = excellent	Reason If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Program marketing and outreach activities		
Relationship with Efficiency Nova Scotia staff		
Relationship with retailers		

Part II: Questions Specific to the Instant Savings on Energy Efficient Products Program

Q4a. Regarding program on-course modifications, (additional eligible products, program name change, etc.) do you feel that these modifications:

- ☐ Are easily adapted into the way you work
- ☐ Require minor changes in the way you work
- ☐ Require major changes in the way you work
- ☐ Not applicable/No program on-course modifications

Q4b. If you answered “Require major changes in the way you work,” would you say those major changes have caused problems in the way the program is managed or delivered?

- ☐ Yes
- ☐ No

Q4c. If you answered “Yes,” what have those problems been?

Q5. Is zone pricing still an issue in some of the participating retailer stores?

- ☐ Yes
- ☐ No

Comments:

Q6. In your opinion, what are the main barriers to the delivery of the program, in order of importance?

Q7a. Approximately how many complaints have you received from participants thus far in 2012?

Number of complaints:

Q7b. What was the complaint/were the complaints about?

Q8a. Now, approximately how many complaints have you received from retailers thus far in 2012?

Number of complaints:

Q8b. What was the complaint/were the complaints about?

Q9. What suggestions do you have to improve program performance?

Q10. More precisely, what suggestions do you have concerning program marketing and outreach activities?

Thank you very much for your time and co-operation.

Your answers will be treated in strict confidence—no names will ever be mentioned in the evaluation report. Our hope is that these results will contribute to improving program performance. You may be contacted by phone if we need to clarify your answers.

Date	
Your name	
Area code and phone number	
Email	

APPENDIX III - INTERVIEW GUIDE WITH RETAILER PARTNERS

CORPORATE RETAILER INTERVIEW GUIDE EFFICIENCY NOVA SCOTIA INSTANT SAVINGS PROGRAM

October 23, 2012

Hello, may I please speak with _____?

1. Yes [GO TO INTRODUCTION]
2. No [SAY "Perhaps you can help me anyway." GO TO INTRODUCTION]

INTRODUCTION

Hello, my name is _____, from Econoler. I am calling on behalf of Efficiency Nova Scotia Corporation for the Instant Savings on Energy Efficient Products program.

[TO BE READ IF NECESSARY]

The program was formerly known as the "Retail Markdown" program. Throughout the interview, I will refer to it as the "Instant Savings" program.

IDENTIFICATION AND SCREENING OF RESPONDENT

According to our records, your company has participated in the Instant Savings program from Efficiency Nova Scotia. Econoler has been mandated by Efficiency Nova Scotia to conduct an evaluation of this program. We have a few questions about your company's participation in this program. Specifically, I'd like to speak with someone from the head office who is knowledgeable about the stocking and supplying of products that were rebated by the program. These products include ENERGY STAR® CFLs, LED bulbs lighting controls, programmable thermostats, power bars with timers and CEE Tier III clothes washers and CEE Tier III refrigerators. Would that person be you?

_ Person responsible available [CONTINUE]

_ Person responsible currently unavailable [ARRANGE CALL BACK WITH THE RIGHT PERSON]

_ No person responsible for stocking or management of products [CONTINUE INTERVIEW WITH CORPORATE MANAGER - CONTINUE]

_ Don't know [CONTINUE INTERVIEW WITH CORPORATE MANAGER - CONTINUE]

_ Refused [THANK AND TERMINATE]

Confidentiality

Please note that your responses will be kept strictly confidential and that we will not share the information you provide with any other party in a way that could identify your individual or corporate responses.

Recording of the Interview

Please note that the interview will be recorded for transcription purposes only. The recording will remain strictly confidential.

SECTION V - VERIFICATION OF PRODUCTS FROM DATABASE

V1. From the database, check the products that received the program rebate for each period and validate the information with the interviewee.

	April-June campaign	October-November campaign
ENERGY STAR CFLs	☐	☐
ENERGY STAR LED bulbs	☐	☐
CEE Tier III clothes washers	☐	☐

ASK IF ENERGY STAR CFLs WERE REBATED THROUGH THE PROGRAM – AND DURING WHICH CAMPAIGN(S)

SECTION C - ENERGY STAR CFLs

C1. I now have a few questions about your sales of ENERGY STAR CFLs. Please note that we are considering here regular CFLs as well as specialty CFLs.

We would like to know your approximate sales volume for ENERGY STAR CFLs for the spring and fall 2012 campaigns and for 2012 altogether [IF RESPONDENT CANNOT ANSWER FOR ENERGY STAR CFLs, ASK FOR ALL CFLs).

- A. According to our information, you sold _____ ENERGY STAR CFLs DURING the spring campaign? Is this accurate?
- B. Analysis has shown that sales tend to be higher in the fall than in the spring for this type of product. Do you think that your sales of ENERGY STAR CFLs from the campaign currently in effect will indeed be higher than your sales of ENERGY STAR CFLs from the spring campaign? If not, will they be lower or about the same? Can you give me an estimate?
- C. Roughly, what percentage of your 2012 sales of ENERGY STAR CFLs approximately occurs during the two campaigns?
Is your answer based on a number of units or a number of packs? [IF ANSWER IS A NUMBER OF CFL PACKS, ASK HOW MANY CFLs ON AVERAGE ARE IN EACH PACK]

C6. How influential was the Instant Savings program on each of the following aspects of your stores? Please answer using a scale where 0 means “Not at all influential” and where 10 means “Very influential.”

- a. The knowledge of your salespersons with regard to CFLs
Scale:
- b. The knowledge of consumers with regard to CFLs
Scale:
- c. The variety and quantity of CFLs offered in your stores
Scale:

C7. The Instant Savings program offers instant rebates during two specific campaigns. Outside these two campaigns, Efficiency Nova Scotia continues to promote energy-efficient products such as CFLs, which can influence the purchase of such products. This influence can occur in different forms. For instance, your sales people may have a better knowledge of CFLs; your offer of CFLs may change and be more attractive; you may offer additional rebates on CFLs outside the campaigns because of Efficiency Nova Scotia's influence. Therefore, what percentage of your sales of CFLs outside of the two rebate periods do you attribute to the program (or think occurred because of the program)?

[SINCE THE SECOND REBATE PERIOD IS NOT OVER YET, ASK THE RESPONDENT TO ANSWER BASED ON A PROJECTION] [IF THE RESPONDENT HAS DIFFICULTY PROVIDING AN EXACT PERCENTAGE, ASK FOR A RANGE]

Enter %:

C8. Have you noticed a decrease in sales of incandescent light bulbs either during or between the Instant Savings rebate campaigns? If so, could you quantify this decrease?

ASK IF ENERGY STAR LED BULBS WERE REBATED THROUGH THE PROGRAM – AND DURING WHICH CAMPAIGN(S)

SECTION L – ENERGY STAR LED BULBS

L1. I now have a few questions about your sales of ENERGY STAR LED bulbs. By ENERGY STAR LED bulbs, we refer to ENERGY STAR LED screw-in bulbs and ENERGY STAR LED recessed downlights rebated through the program. Note that ENERGY STAR LED recessed downlights are only rebated during the fall campaign.

We would like to know your approximate sales volume for ENERGY STAR LED bulbs for the spring and fall 2012 campaigns and for 2012 altogether.

- A. According to our information, you sold _____ ENERGY STAR LED bulbs DURING the spring campaign? Is this accurate?
- B. Analysis has shown that sales tend to be higher in the fall than in the spring for this type of product. Do you think that your sales of ENERGY STAR LED bulbs from the campaign currently in effect will indeed be higher than your sales of ENERGY STAR LED bulbs from the spring campaign? If not, will they be lower or about the same? Can you give me an estimate?
- C. Roughly, what percentage of your 2012 sales of ENERGY STAR LED bulbs approximately occurs during the two campaigns?

Is your answer based on a number of units or a number of packs? [IF ANSWER IS A NUMBER OF PACKS, ASK HOW MANY LED BULBS ON AVERAGE ARE IN EACH PACK]

L2. During the spring campaign, the Instant Savings program provided a rebate for each ENERGY STAR LED lamp and fixture sold in your stores. If this rebate had not been available, do you think that your spring sales of ENERGY STAR LED bulbs would have been about the same, lower or higher?

- ☐ Same [SKIP TO L3]
- ☐ Lower
- ☐ Higher [SKIP TO L3]
- ☐ Don't know [SKIP TO L3]
- ☐ Refused [SKIP TO L3]

L2a. By what percentage do you estimate your stores' sales of ENERGY STAR LED bulbs would have been lower during the spring campaign if the rebate had not been available?

RECORD PERCENTAGE ____%

L3. Do you think that your fall sales of ENERGY STAR LED bulbs will be about the same, lower or higher than they would have been without the rebate offered?

- ☐ Same [SKIP TO L6]
- ☐ Lower
- ☐ Higher [SKIP TO L6]
- ☐ Don't know [SKIP TO L6]
- ☐ Refused [SKIP TO L6]

L3a. By what percentage do you estimate your stores' sales of ENERGY STAR LED bulbs would be lower during the fall campaign if the rebate was not available? [SINCE THE SECOND CAMPAIGN IS NOT OVER YET, ASK THE RESPONDENT TO ANSWER BASED ON A PROJECTION]

RECORD PERCENTAGE ____%

L6. How influential was the Instant Savings program on each of the following aspects of your stores? Please answer using a scale where 0 means "Not at all influential" and where 10 means "Very influential."

- a. The knowledge of your salespersons with regard to ENERGY STAR LED bulbs
Scale:
- b. The knowledge of consumers with regard to ENERGY STAR LED bulbs
Scale:
- c. The variety and quantity of ENERGY STAR LED bulbs offered in your stores
Scale:

L7. The Instant Savings program offers instant rebates during two specific campaigns. Outside these two campaigns, Efficiency Nova Scotia continues to promote energy-efficient products such as LED bulbs, which can influence the purchase of such products. This influence can occur in different forms. For instance, your sales people may have a better knowledge of LEDs; your offer of LEDs may change and be more attractive; you may offer additional rebates on LEDs outside the campaigns

because of Efficiency Nova Scotia's influence. Therefore, what percentage of your sales of ENERGY STAR LED bulbs outside of the two rebate periods do you attribute to the program (or think occurred because of the program)? [SINCE THE REBATE CAMPAIGN IS NOT OVER YET, ASK THE RESPONDENT TO ANSWER BASED ON A PROJECTION] [IF THE RESPONDENT HAS DIFFICULTY PROVIDING AN EXACT PERCENTAGE, ASK FOR A RANGE]

Enter %:

ASK IF CEE TIER III CLOTHES WASHERS WERE REBATED THROUGH THE PROGRAM – AND DURING WHICH CAMPAIGN(S)

SECTION W – CEE TIER III CLOTHES WASHERS

W1. I now have a few questions about your sales of CEE Tier III clothes washers.

We would like to know your approximate sales volume for CEE Tier III clothes washers for the spring and fall 2012 campaigns and for 2012 altogether.

- A. According to our information, you sold _____ CEE Tier III clothes washers DURING the spring campaign? Is this accurate?
- B. Analysis has shown that sales tend to be higher in the fall than in the spring for this type of product. Do you think that your sales of CEE Tier III clothes washers from the campaign currently in effect will indeed be higher than your sales of CEE Tier III clothes washers from the spring campaign? If not, will they be lower or about the same? Can you give me an estimate?
- C. Roughly, what percentage of your 2012 sales of CEE Tier III clothes washers approximately occurs during the two campaigns?

W2. During the spring promotion, the Instant Savings program provided a rebate for each CEE Tier III clothes washer sold in your stores. If this rebate had not been available, do you think that your spring sales of CEE Tier III clothes washers would have been about the same, lower or higher?

- ☐ Same [SKIP TO W3]
- ☐ Lower
- ☐ Higher [SKIP TO W3]
- ☐ Don't know [SKIP TO W3]
- ☐ Refused [SKIP TO W3]

W2a. By what percentage do you estimate your stores' sales of CEE Tier III clothes washers would have been lower during the spring campaign if the rebate had not been available?

RECORD PERCENTAGE ____%

W3. Do you think that your fall sales of CEE Tier III clothes washers will be about the same, lower or higher than they would have been without the rebate offered?

- ☐ Same [SKIP TO W6]
- ☐ Lower
- ☐ Higher [SKIP TO W6]
- ☐ Don't know [SKIP TO W6]
- ☐ Refused [SKIP TO W6]

W3a. By what percentage do you estimate your stores' sales of CEE Tier III clothes washers would be lower during the fall campaign if the rebate was not available? [SINCE THE SECOND CAMPAIGN IS NOT OVER YET, ASK THE RESPONDENT TO ANSWER BASED ON A PROJECTION]

RECORD PERCENTAGE ____%

W6. How influential was the Instant Savings program on each of the following aspects of your stores? Please answer using a scale where 0 means "Not at all influential" and where 10 means "Very influential."

- a. The knowledge of your salespersons with regard to CEE Tier III clothes washers
Scale:
- b. The knowledge of consumers with regard to CEE Tier III clothes washers
Scale:
- c. The variety and quantity of CEE Tier III clothes washers offered in your stores
Scale:

W7. The Instant Savings program offers instant rebates during two specific campaigns. Outside these two campaigns, Efficiency Nova Scotia continues to promote energy-efficient products such as CEE Tier III clothes washers, which can influence the purchase of such products. This influence can occur in different forms. For instance, your sales people may have a better knowledge of CEE Tier 3 clothes washers; your offer of CEE Tier 3 clothes washers may change and be more attractive; you may offer additional rebates on CEE Tier 3 clothes washers outside the campaigns because of Efficiency Nova Scotia's influence. Therefore, what percentage of your sales of CEE Tier III clothes washers outside of the two rebate periods do you attribute to the program (or think occurred because of the program)?

[SINCE THE SECOND REBATE PERIOD IS NOT OVER YET, ASK THE RESPONDENT TO ANSWER BASED ON A PROJECTION] [IF THE RESPONDENT HAS DIFFICULTY PROVIDING AN EXACT PERCENTAGE, ASK FOR A RANGE]

Enter %:

SECTION S - SATISFACTION WITH ENSC'S INSTANT SAVINGS PROGRAM

I will now ask you questions on your satisfaction with different aspects of Efficiency Nova Scotia's Instant Savings on Energy Efficient Products.

S1. On a scale from 1 to 10 (where 1 is "very bad" and 10 is "excellent"), how would you rate your overall satisfaction with the program?

Scale:

S1a. If your answer to S1 was equal to or less than 8, would you care to share the reason or reasons for such a score?

Reason(s):

S2. On a scale from 1 to 10 (where 1 is "very bad" and 10 is "excellent"), what is your satisfaction level in regard to the preparation process to the campaigns?

Scale:

S2a. If your answer to S2 was equal to or less than 8, would you care to share the reason or reasons for such a score?

Reason(s):

S3. On a scale from 1 to 10 (where 1 is "very bad" and 10 is "excellent"), what is your satisfaction level in regard to program marketing and advertising?

Scale:

S3a. If your answer to S3 was equal to or less than 8, would you care to share the reason or reasons for such a score?

Reason(s):

S4. On a scale from 1 to 10 (where 1 is "very bad" and 10 is "excellent"), what is your satisfaction level in regard to program support and communications?

Scale:

S4a. If your answer to S4 was equal to or less than 8, would you care to share the reason or reasons for such a score?

Reason(s):

S5. On a scale from 1 to 10 (where 1 is "very bad" and 10 is "excellent"), what is your satisfaction level in regard to the items covered by the program?

Scale:

S5a. If your answer to S5 was equal to or less than 8, would you care to share the reason or reasons for such a score?

Reason(s):

S6. On a scale from 1 to 10 (where 1 is "very bad" and 10 is "excellent"), what is your satisfaction level in regard to the program rebates?

Scale:

S6a. If your answer to S6 was equal to or less than 8, would you care to share the reason or reasons for such a score?

Reason(s):

S7. On a scale from 1 to 10 (where 1 is “very bad” and 10 is “excellent”), how would you rate your interaction with Summerhill?

Scale:

S7a. If your answer to S7 was equal to or less than 8, would you care to share the reason or reasons for such a score?

Reason(s):

S8. On a scale from 1 to 10 (where 1 is “very bad” and 10 is “excellent”), what is your satisfaction level in regard to rebate processing, tracking and reporting?

Scale:

S8a. If your answer to S9 was equal to or less than 8, would you care to share the reason or reasons for such a score?

Reason(s):

SECTION BR - BARRIERS AND RECOMMENDATIONS

BR1. In your opinion, what are the main barriers to the delivery of the program by order of importance?

BR2. Efficiency Nova Scotia also offers Air Miles instead of rebates at stores that choose to participate in a loyalty rewards program. What is your preference between providing the customer with an instant rebate at the cash and providing the customer with Air Miles or some other loyalty reward program when purchasing eligible products?

BR3. Do you have any suggestion to improve the program?

☐ No

☐ Yes

BR3a. If “Yes,” please explain the nature of the improvement(s):

END: Those are all the questions I have for you today. Do you have anything to add regarding the program or this interview?

I thank you very much for your collaboration and the time you took to answer our questions.

APPENDIX IV – ON-SITE VISIT PROTOCOL

1 Visit Report

Store Name: _____

Address: _____

Date of Visit: _____

Eligible Products

Energy Star Regular CFLs (multipacks of 2 or more)

Energy Star Specialty CFLs (single or double packs)

Energy Star Specialty CFLs (multipacks of 3 or more)

Energy Star LED light bulbs

Energy Star LED Recessed Downlights

Programmable Thermostats for Baseboard Heaters

Power Bars with Timers/Load Sensing Power Bars

Indoor or Outdoor Motion Sensors (hard-wired)

Dimmer Switches (hard-wired)

Heavy Duty Outdoor Timers (plug-in)

Energy Star CEE Tier III Refrigerators

Energy Star CEE Tier III Clothes Washers

1.1 Product Purchase Details

Table 1: Product Purchase Situation

- *In the table below, please check off the items which apply to your product.*

Product Purchase Situation	
Product to purchase:	xxxxxxx
Instant rebate received directly at the counter upon presentation of the product to purchase	
Instant rebate received at the counter only after having provided a coupon (Home Hardware)	
Indicate if the rebate was clearly presented on the bill (except for Atlantic Superstore)	
The cashier mentioned something about the rebate	
Problems encountered when purchasing the product(s) at the cash register	
If applicable, description of the problem met:	

1.2 Promotional Display Evaluation

Table 2: In-Store Promotional Material

- In the table below, please indicate by using Yes/No for each product category whether the promotional material was displayed in store as well as the quantity of each type of promotional material.
- If needed, please provide additional observations or comments in the Comments section below.
- Apron Cards: have been designed for store associates to assist with providing information on rebated products.

Canadian Tire

Promotional Material	Lighting			Controls			Thermostats			Appliances		
	Yes	No	No.	Yes	No	No.	Yes	No	No.	Yes	No	No.
Shelf Talkers												
Posters												
Stickers												
Street signs												
Vertical Hang tabs												
Comments:												

Atlantic Superstore

Promotional Material	Lighting			Controls			Thermostats			Appliances		
	Yes	No	No.	Yes	No	No.	Yes	No	No.	Yes	No	No.
Shelf Talkers												
Posters												
Stickers												
Comments:												

Home Depot

Promotional Material	Lighting			Controls			Thermostats			Appliances		
	Yes	No	No.	Yes	No	No.	Yes	No	No.	Yes	No	No.
Shelf Talkers												
Posters												
Stickers												
Vertical signs												
Comments:												

Home Hardware

Promotional Material	Lighting			Controls			Thermostats			Appliances		
	Yes	No	No.	Yes	No	No.	Yes	No	No.	Yes	No	No.
Shelf Talkers												
Posters												
Stickers												
Coupons												
Horizontal Hang tabs												
Comments:												

Central

Promotional Material	Lighting			Controls			Thermostats			Appliances		
	Yes	No	No.	Yes	No	No.	Yes	No	No.	Yes	No	No.
In-house Shelf Talkers												
In-house posters												
In store displays												
Comments:												

Kent

Promotional Material	Lighting			Controls			Thermostats			Appliances		
	Yes	No	No.	Yes	No	No.	Yes	No	No.	Yes	No	No.
Shelf Talkers												
Posters												
Stickers												
Horizontal Hang tabs												
Comments:												

Costco

Promotional Material	Lighting			Controls			Thermostats			Appliances		
	Yes	No	No.	Yes	No	No.	Yes	No	No.	Yes	No	No.
Shelf Talkers												
Posters												
Stickers												
Comments:												

Observations

In the store visited, the products eligible for rebates are easily identified.

The products are located at eye level on the shelf.	Yes	No
Indicate the percentage of available products that are eligible versus ineligible (i.e., Energy Star versus other bulbs).		
The mystery shopper was able to identify eligible products by themselves. (Comment on the percentage of products identified, the size of promotional material on the shelf, whether or not they are grouped together, etc.)	Yes	No
The mystery shopper had to ask a salesperson for help finding eligible products.	Yes	No
Was the salesperson able to indicate which products were eligible?	Yes	No

How did you learn about the rebate?		
You saw the instant rebate coupon (Home Hardware – may be behind the counter).	Yes	No
You saw promotional material announcing a rebate on certain products.	Yes	No

Comments:

Is the overall in-store exposure of the promotional material optimal?

Indicate the number of promotional items (use the number of promotional items indicated in the promotional display section) versus store size (large retailer, small hardware store).		
Describe the location where promotional material is displayed (ex.: at the store entrance, in the same sections as target products).		
The promotional material is located near eligible products.	Yes	No

Comments:

1.3 In-Store Event

- Do not ask the following questions directly to the representative. Simply show interest in the product/event.

In-Store Event				
Section of the Store where the Event Takes Place				Comments
Location of the event (which section in the store). Is it a high traffic area?				
Information Provided by the Representative	Yes	No	N/A	Comments
Did the representative provide you with information on the products (products rebates and where to find them in-store)?				
Did the representative provide you with information on the rebate offered (amounts & how they are processed)?				
Did the representative provide you with information on other programs promoted by ENSC?				
Visibility of the event	Yes	No	N/A	Comments
Event promotional material: Tent cards, etc.				
Event T-shirt				
Other Comments				

1.4 Knowledge of the Program and Products

- *Note to mystery shopper: For the next section (Knowledge of the Program), ask 2 of the following 4 questions.*

Knowledge of the Program

1. Are there rebates that apply to this type of product?

2. What is the amount of the rebate?

3. Is it the same amount for all products?

4. Until when does the rebate apply?

- *Note to mystery shopper: For the Knowledge of Products section, ask both questions. On the other hand, ask question 5 only if the Energy Star logo is displayed.*

Knowledge of Products

5. What does the ENERGY STAR logo mean? (Ask only if the ENERGY STAR logo is displayed.)

6. Could you tell me how these products (products eligible for the instant rebate) differ from other products sold in your store?

APPENDIX V – DEMOGRAPHICS

The profile of the program participants interviewed for the survey is presented in the following tables.

The majority of participants interviewed reside in single-family detached homes.

Table 37: Type of Home

Type of Home	2012			
	Overall	CFL Purchasers	LED Purchasers	Both CFL/ LED Purchasers
<i>Sample Size</i>	164	96	61	7
Single-family detached house	77%	72%	84%	6
Semi-detached house	9%	9%	8%	--
Apartment or condo building that has fewer than five stories	5%	7%	2%	1
Townhouse or duplex which shares adjacent walls	4%	6%	--	--
Mobile home or house trailer	4%	4%	5%	--
Apartment or condo building that has five or more stories	1%	1%	2%	--

Most participants own their home.

Table 38: Home Ownership

Home Ownership	2012			
	Overall	CFL Purchasers	LED Purchasers	Both CFL/ LED Purchasers
<i>Sample Size</i>	163	96	60	7
Own/buying	92%	88%	98%	7
Rent/lease	8%	13%	2%	--

Those participants who rent or lease their home pay the electricity bill themselves.

Table 39: Method of Electricity Bill Payment

You Pay Electric Bills	2012			
	Overall	CFL Purchasers	LED Purchasers	Both CFL/LED Purchasers
<i>Sample Size</i>	13	12	1	0
I pay the electricity bill	10	10	--	--
My landlord pays the electricity bill	2	1	1	--
'Other'	1	1	--	--
Base: Respondents who rent or lease their home				

Two-thirds of respondents were male (66%) and approximately one-third were female (34%).

Table 40: Gender

Gender	2012			
	Overall	CFL Purchasers	LED Purchasers	Both CFL/LED Purchasers
<i>Sample Size</i>	163	95	61	7
Male	66%	58%	77%	5
Female	34%	42%	23%	2

APPENDIX VI - PARTICIPANT INTERCEPT SURVEY QUESTIONNAIRE

Participant Intercept Survey
ENSC Instant Savings Program
October 25, 2012

INTRODUCTION AND ELIGIBILITY

Hello, my name is _____ and I am with Corporate Research Associates, and we are performing the evaluation of the Instant Savings program provided by Efficiency Nova Scotia Corporation. We are gathering information from customers who just purchased energy efficient lights, also known as CFLs, and LEDs.

- I1. Did you purchase either CFLs or LEDs today? [CODE ONE ONLY]
- 1. CFLs
 - 2. LEDs
 - 3. Both
 - 98. (Don't Know) [ASK AGAIN. IF STILL DK, THANK AND TERMINATE].
 - 99. (Refused) [THANK AND TERMINATE].
- I2. [IF CODE 1 IN I1] To the best of your knowledge, was the price of this/these CFL light bulb(s) discounted at the cash register? [CODE ONE ONLY]
- 1. Yes
 - 4. No [ASK AGAIN. IF STILL SAYS NO, THANK AND TERMINATE].
 - 98. (Don't Know) [ASK AGAIN. IF STILL DK, THANK AND TERMINATE].
 - 99. (Refused) [THANK AND TERMINATE].
- I2a. [IF CODE 2 IN I1] To the best of your knowledge, was the price of this/these LED light bulb(s) discounted at the cash register? [CODE ONE ONLY]
- 1. Yes
 - 4. No [ASK AGAIN. IF STILL SAYS NO, THANK AND TERMINATE].
 - 98. (Don't Know) [ASK AGAIN. IF STILL DK, THANK AND TERMINATE].
 - 99. (Refused) [THANK AND TERMINATE].

- I2b. [IF CODE 3 IN I1] To the best of your knowledge, was the price of these CFL and LED light bulb(s) discounted at the cash register? [CODE ONE ONLY – PROBE FOR DETAILS]
1. Yes – CFLs only
 2. Yes – LEDs only
 3. Yes – Both
 4. No [ASK AGAIN. IF STILL SAYS NO, THANK AND TERMINATE].
 98. (Don't Know) [ASK AGAIN. IF STILL DK, THANK AND TERMINATE].
 99. (Refused) [THANK AND TERMINATE].
- I3. The survey will take about five minutes. You will receive a \$5 incentive as a thank you for your cooperation. Would you be willing to answer the survey?
1. Yes [CONTINUE – GO TO P1].
 2. No [THANK AND TERMINATE].

Purchase (P Series)

- P1. Are there any CFLs or LEDs currently installed in your home? [CODE ONE ONLY – PROBE FOR DETAILS]
1. Yes – CFLs only
 2. Yes – LEDs only
 3. Yes – Both
 4. No
 98. (Don't Know)
 99. (Refused)
- P2. How many [BASED ON RESPONSE TO Q.I1, ASK SEPARATELY FOR 'CFLs' AND 'LEDs'] did you purchase today? [ENTER THE NUMBER OF BULBS NOT PACKAGES. PROBE TO AVOID ACCEPTING A RANGE]
1. Enter number of CFLs bought: ____ [POSE Q.P3]
 2. Enter number of LEDs bought: ____ [POSE Q.AW1, BUT FIRST POSE Q.P3 IF APPLICABLE]
 98. (Don't Know) [GO TO AW1]
 99. (Refused) [GO TO AW1]

[IF 1=0 AND 2=0 CONFIRM THAT THE RESPONDENT BOUGHT LED OR CFL BULBS TODAY, AS PER RESPONSE IN I1. IF NO SUCH PURCHASE, THANK AND TERMINATE]

P3. [POSE P3 ONLY IF THERE ARE CFLs INSTALLED IN THE HOME (P1=1 OR 3) **AND IF** THEY PURCHASED CFLs (P2)] Of the [INSERT NUMBER OF CFLs FROM Q.P2] CFLs that you purchased today, how many will replace another CFL or compact fluorescent bulb currently installed in your home?

ENTER NUMBER OF BULBS ____

98. (Don't Know)

99. (Refused)

Awareness of Program and Efficiency Nova Scotia (AW Series)

AW1. Have you ever heard of the Efficiency Nova Scotia Instant Savings program? [CODE ONE ONLY]

1. Yes [GO TO AW2]

2. No [GO TO AW3]

98. (Don't Know) [GO TO AW3]

99. (Refused) [GO TO AW3]

AW2. How have you heard of the Instant Savings program? PROBE: Anywhere else? [DO NOT READ RESPONSES – CODE AS MANY AS APPLY]

1. (Radio ads)

2. (Newspaper ads)

3. (In-store promotions)

4. (Efficiency Nova Scotia website)

5. (Store personnel)

6. (Facebook)

7. (Internet in general)

8. (Through an Efficiency Nova Scotia representative during an in-store customer engagement event)

9. (Twitter)

96. (Other: specify: _____)

98. (Don't Know)

99. (Refused)

AW3. Efficiency Nova Scotia Corporation is an independent organization responsible for helping Nova Scotians reduce their energy consumption and improve their energy efficiency at home and at work. Before I read you this description, had you ever heard of Efficiency Nova Scotia? [CODE ONE ONLY]

1. Yes

2. No

98. (Don't Know)

99. (Refused)

Free-Ridership (FR Series)

[ONLY ASK ONE FR SECTION PER PARTICIPANT]

[IF A RESPONDENT GETS I2, THEN THEY GET THE CFL FR SEQUENCE]

[IF A RESPONDENT GETS I2A, THEY GET THE LED FR SEQUENCE]

[IF A RESPONDENT GETS I2B, IF THEIR RESPONSE IS CODE 1 OR CODE 3, THEN THEY GET THE CFL FR SEQUENCE. IF THEY SAY CODES 2, THEN THEY GET THE LED FR SEQUENCE]

CFL SEQUENCE

FR0a. [POSE FR0a ONLY IF I2 = 1] You bought CFLs today. Efficiency Nova Scotia offered a discount on packages of CFLs. Before paying at the cash register, were you aware that a discount was offered on the purchase of CFLs? [CODE ONE ONLY]

1. Yes
2. No [GO TO FR0b]
98. (Don't Know) [GO TO FR0b]
99. (Refused) [GO TO FR0b]

FR0b. [ASK IF NOT AWARE OF THE DISCOUNT (FR0a=2, DK, REF)] I just want to make sure I understand - You did not know about the discount on specific packages CFLs before paying at the register? [CODE ONE ONLY]

1. Yes, I knew about the discount
2. No [GO TO SECTION PR OR LED SEQUENCE, AS APPROPRIATE]
98. (Don't know) [GO TO SECTION PR OR LED SEQUENCE, AS APPROPRIATE]
99. (Refused) [GO TO SECTION PR OR LED SEQUENCE, AS APPROPRIATE]

[ASK IF AWARE OF THE DISCOUNT (FR0a=1) OR (FR0b=1)]

FR0c. How did you learn about the discount offered on the purchase of specific packages of CFLs? [DO NOT READ RESPONSES – CODE AS MANY AS APPLY]

1. (Radio ads)
2. (Newspaper ads)
3. (In-store signage)
4. (Efficiency Nova Scotia website)
5. (Store personnel)
6. (Facebook/Social Media)
7. (Internet in general)
8. (Through an Efficiency Nova Scotia representative during an in-store customer engagement event)
9. Friends
96. (Other SPECIFY: _____)
98. (Don't Know)
99. (Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0a=1) OR (FR0b=1)]

FR0c1. Did you see the stickers, shelf signs or posters in the light bulbs section of the store promoting the discount offered on CFLs? [CODE ONE ONLY]

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0a=1) OR (FR0b=1)]]

FR1. You mentioned that you were aware, before paying at the cash register, that a discount is offered on the purchase of CFLs. Did knowing this play a part in your decision to buy CFLs today? [CODE ONE ONLY]

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0a=1) OR (FR0b=1)]]

FR3. How likely would you have been to buy the CFLs that you purchased today if the discount had NOT been offered? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Bought these CFLs" and a 10 indicating that you "Definitely **Would Have Bought these CFLs.**" [PROBE TO AVOID ACCEPTING A RANGE]

___ Response ___ 98 Don't Know ___ 99 Refused

[ASK IF AWARE OF THE DISCOUNT (FR0a=1) OR (FR0b=1)]]

FR4. If the discount had NOT been offered, when would you have purchased the CFLs that you purchased today? Would it have been...[CODE ONE ONLY]

- 1. Definitely today
- 2. Probably today
- 3. Probably at a later date
- 4. Definitely at a later date
- 96. (Would not have purchased them at all)
- 98. (Don't Know)
- 99. (Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0a=1) OR (FR0b=1)]]

FR5. **Without** the discount, would you have definitely purchased the same number of CFLs, probably purchased the same number, probably purchased fewer or definitely purchased fewer? [CODE ONE ONLY]

1. Definitely the same number
2. Probably the same number
3. Probably fewer
4. Definitely fewer
99. [Don't know/Refused]

[ASK IF AWARE OF THE DISCOUNT (FR0a=1) OR (FR0b=1)]

FR7. How influential was the discount offered by Efficiency Nova Scotia on your decision to purchase the CFLs that you purchased today? Please give your answer on a scale of 0 to 10, where 0 indicates the discount 'had no influence at all on your purchase decision' and 10 indicates that the discount was 'extremely influential on your purchase decision. [PROBE TO AVOID ACCEPTING A RANGE]

___ Response ___98 Don't Know ___99 Refused

LED SEQUENCE

FR0aa. [POSE FR0aa ONLY IF I2 = 2 OR 3] You bought LEDs today. Efficiency Nova Scotia offered a discount on packages of LEDs. **Before paying at the cash register**, were you aware that a discount was offered on the purchase of LEDs? [CODE ONE ONLY]

1. Yes
2. No [GO TO FR0bb]
98. (Don't Know) [GO TO FR0bb]
99. (Refused) [GO TO FR0bb]

FR0bb. [ASK IF NOT AWARE OF THE DISCOUNT (FR0aa=2, DK, REF)] I just want to make sure I understand - You did not know about the discount on specific packages of LEDs before paying at the register? [CODE ONE ONLY]

1. Yes, I knew about the discount
2. No [GO TO SECTION PR OR CFL SEQUENCE, AS APPROPRIATE]
98. (Don't know) [GO TO SECTION PR OR CFL SEQUENCE, AS APPROPRIATE]
99. (Refused) [GO TO SECTION PR OR CFL SEQUENCE, AS APPROPRIATE]

[ASK IF AWARE OF THE DISCOUNT (FR0aa=1) OR (FR0bb=1)]

FR0cc. How did you learn about the discount offered on the purchase of specific packages of LEDs?

[DO NOT READ RESPONSES – CODE AS MANY AS APPLY]

1. (Radio ads)
2. (Newspaper ads)
3. (In-store signage)
4. (Efficiency Nova Scotia website)
5. (Store personnel)
6. (Facebook/Social Media)
7. (Internet in general)
8. (Through an Efficiency Nova Scotia representative during an in-store customer engagement event)
9. (Friends)
96. (Other SPECIFY: _____)
98. (Don't Know)
99. (Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0aa=1) OR (FR0bb=1)]

FR0cc1. Did you see the stickers, shelf signs or posters in the light bulbs section of the store promoting the discount offered on LEDs? [CODE ONE ONLY]

1. Yes
2. No
98. (Don't know)
99. (Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0aa=1) OR (FR0bb=1)]

FR11. You mentioned that you were aware, before paying at the cash register, that a discount is offered on the purchase of LEDs. Did knowing this play a part in your decision to buy LEDs today? [CODE ONE ONLY]

1. Yes
2. No
98. (Don't know)
99. (Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0aa=1) OR (FR0bb=1)]

FR31. How likely would you have been to buy the LEDs that you purchased today if the discount had NOT been offered? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Bought these LEDs" and a 10 indicating that you "Definitely **Would Have Bought these LEDs.**" [PROBE TO AVOID ACCEPTING A RANGE]

___ Response ___ 98 Don't Know ___ 99 Refused

[ASK IF AWARE OF THE DISCOUNT (FR0aa=1) OR (FR0bb=1)]

FR41. If the discount had NOT been offered, when would you have purchased the LEDs that you purchased today? Would it have been...[CODE ONE ONLY]

1. Definitely today
2. Probably today
3. Probably at a later date
4. Definitely at a later date
96. (Would not have purchased them at all)
98. (Don't Know)
99. (Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0aa=1) OR (FR0bb=1)]

FR51. **Without** the discount, would you have definitely purchased the same number of LEDs, probably purchased the same number, probably purchased fewer or definitely purchased fewer? [CODE ONE ONLY]

1. Definitely the same number
2. Probably the same number
3. Probably fewer
4. Definitely fewer
99. (Don't know/Refused)

[ASK IF AWARE OF THE DISCOUNT (FR0aa=1) OR (FR0bb=1)]

FR71. How influential was the discount offered by Efficiency Nova Scotia on your decision to purchase the LEDs that you purchased today? Please give your answer on a scale of 0 to 10, where 0 indicates the discount 'had no influence at all on your purchase decision' and 10 indicates that the discount was 'extremely influential on your purchase decision. [PROBE TO AVOID ACCEPTING A RANGE]

___ Response ___98 Don't Know ___99 Refused

Products Rebated (PR Series)

PR1. [ASK IF AW1=1] Besides the [CFLs or LEDs] that you purchased with a discount today, are you aware of any other energy efficiency products that are discounted through the Instant Savings program? [CODE ONE ONLY]

1. Yes [GO TO PR2]
 2. No [GO TO PR3]
- VOLUNTEERED
- 97 (Skipped) [GO TO PR3]
 98. (Don't Know) [GO TO PR3]
 99. (Refused) [GO TO PR3]

[ASK IF PR1 = 1]

PR2. What are those products? Any others? [DO NOT READ RESPONSES – CODE AS MANY AS APPLY]

1. (Regular or specialty CFLs)
2. (LED lamps and recessed downlights)
3. (Hardwired dimmer switches)
4. (Motion sensors)
5. (Power bars or Smart strips)
6. (Outdoor timers)
7. (Programmable thermostats)
8. (CEE Tier III refrigerators)
9. (CEE Tier III clothes washers)
10. 96. (Other SPECIFY: _____)
11. 97 (Skipped) [GO TO PR3]
98. (Don't Know)
99. (Refused)

[ASK ALL RESPONDENTS]

PR3. Besides CFLs or LEDs, are there any other energy efficiency products you would like to see rebated through the Instant Savings program? [ACCEPT MULTIPLE. RECORD VERBATIM RESPONSE]
 Any others?

97 (Skipped) [GO TO D1]

98. (Don't Know)

99. (Refused)

Demographics (D Series)

These final questions are asked for statistical purposes only. The information collected is strictly confidential.

D1. What type of residence do you live in? [READ RESPONSES 1-7; SELECT ONE RESPONSE]

1. Detached single-family house
2. Semi-detached house
3. Mobile home or house trailer
4. Townhouse or duplex which share adjacent walls
5. Row house (Single story apartment building)
6. Apartment or condo building that has fewer than five stories
7. Apartment or condo building that has five or more stories
96. Other [SPECIFY: _____]
98. (Don't know)
99. (Refused)

- D3. Do you own or rent this residence? [CODE ONE ONLY]
1. Own/buying [GO TO D10]
 2. Rent/lease [GO TO D4]
 96. (Other (Describe)) _____ [GO TO D4]
 99. (Refused) [GO TO D4]

- D4. Do you or does your landlord pay the electric bills for your residence? [CODE ONE ONLY]
1. (I pay the electric bills)
 2. (My landlord pays the electric bills)
 96. (Other (Describe)) _____
 98. (Don't Know)
 99. (Refused)

- D10. [DO NOT READ] Gender [CODE ONE ONLY]
1. Male
 2. Female

END: Those are all the questions I have for you. I thank you very much for your time and cooperation and have a nice day! Here is your \$5 for participating in our survey.

APPENDIX VII - ALGORITHM FOR FREE-RIDERSHIP CALCULATION

FR0a. Before paying at the cash register, were you aware that a discount was offered on the purchase of [CFLs or LEDs]?	IF 1. Yes : GO TO FR1 IF 2 OR 9 : Ask FR0b
FR0b. I just want to make sure - You did not know about the discount on specific packages of [CFLs or LEDs] before paying at the register?	IF 1. Yes: : GO TO FR1 IF 2. No: FR0 = 100% IF 9 DK: FR0 = EMPTY
PA1 Score:	IF FR0 = 100% OR EMPTY: FR0 and FINISH OTHERWISE CONTINUE
FR1. Did knowing that a discount was offered on the purchase of [CFLs or LEDs] play a part in your decision to buy [CFLs or LEDs] today?	IF 1. Yes: FR1 = 0% IF 2 OR 9 : FR1 = 100%
FR3. How likely would you have been to buy the [CFLs or LEDs] that you purchased today if the discount had not been offered? (Scale 0 to 10)	FR3 = Answer x 10%
PA2 Score:	IF FR1 = 0%: FR3/2 IF FR1 = 100% : FR3
FR4. If the discount had not been offered, when would you have purchased the [CFLs or LEDs] that you purchased today? 1. Definitely today 2. Probably today 3. Probably at a later date 4. Definitely at a later date 4. (Would not have purchased them at all) 9. (Don't know / Refused)	IF 1: FR4 = 100% IF 2: FR4 = 50% IF 3: FR4 = 25% IF 4. : FR4 = 0% IF 6. : FR4 = 0% IF 9. : FR4 = 0%
PA3 Score:	FR4
FR5. [ASK IF AWARE OF THE DISCOUNT (FR0a=1 OR FR0b=1)] Without the discount, would you have purchased the same number of [CFLs or LEDs]? 1. Definitely the same number 2. Probably the same number 3. Probably less 4. Definitely less 9. (Don't know / Refused)	IF 1: FR5 = 100% IF 2: FR5 = 50% IF 3: FR5 = 25% IF 4. : FR5 = 0% IF 9. : FR5 = 0%
PA4 Score:	FR5
FR7. How influential was the discount offered by ENSC on your decision to purchase the [CFLs or LEDs] that you purchased today? (Scale 0 to 10)	FR7 = (10 – Answer) x 10%
PA5 Score:	FR7
Final Free-Ridership	MEAN VALUE OF : (PA1 ; PA2 ; PA3 ; PA4 ; PA5)
Inconsistency Test #1	IF FR3 ≥ 70% AND IF FR1 = 0%: PA2 = EMPTY
Inconsistency Test #2	IF ABS(FR5-FR7) ≥ 30%: KEEP MIN (PA4 ; PA5)
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4 ; PA5)



HOME ENERGY ASSESSMENT IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 4, 2013



ECONOLER

ACRONYMS

CATI	Computer-Assisted Telephone Interviewing
CEATI	Center for Energy Advancement through Technology Innovation
CRA	Corporate Research Associates
DA	Delivery Agent
DHW	Domestic Hot Water
DWHR	Drain Water Heat Recovery
DSM	Demand Side Management
EA	Energy Advisor
EE	Energy Efficiency
EEH	EnerGuide for Existing Houses
ENSC	Efficiency Nova Scotia Corporation
ETS	Electric Thermal Storage
HDD	Heating Degree Day
HEA	Home Energy Assessment
LIHS	Low Income Homeowner Service
LTE	Laboratory of Energy Technologies
MURB	Multi-Unit Residential Buildings
NRCan	Natural Resources Canada
NSPI	Nova Scotia Power Incorporated
NTGR	Net-to-Gross Ratio
PM	Program Manager
RDI	Residential Direct Install

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioural or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Diversity factor	The ratio of the sum of the individual maximum demands of the various subsystems to the maximum demand of the whole system.
EnerGuide rating	An EnerGuide rating shows a standard measure of the home's energy performance. It does not take into account occupants' behaviour and is thus just a measure of the house's efficiency. It shows how energy-efficient the home is through modelled heat losses of the home, based on several factors including heating systems and air leakage.
Demand-to-energy ratio	A ratio obtained by dividing the target peak demand savings by the target energy savings of a given program for a given year.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.

Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.
Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e., a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or <u>replicates</u> included in a <u>statistical sample</u> .
Spillover (internal)	Percentage of savings attributable to participants who continue to implement the energy efficiency measures introduced by a program after participating in it once, without participating in the program a second time.
Tracked savings	Gross and net savings calculated by ENSC in the tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Home Energy Assessment (HEA), which is a component of the Existing Houses program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM), five delivery agents (DAs) and two energy advisors (EAs), as well as on two on-site visits, 25 participant simulations and a telephone survey of 80 participants.

PROGRAM COMPONENT OVERVIEW

HEA encourages homeowners in Nova Scotia to improve the energy efficiency (EE) and comfort of their home while reducing its environmental impact and the burden of high energy cost.

HEA provides financial incentives to homeowners to reduce electrical energy and other fuel consumption. The incentives provided by Efficiency Nova Scotia Corporation (ENSC) for measures targeted at reducing electricity consumption are funded by electricity rate-payers, whereas ENSC's incentives for measures aimed at reducing other fuel consumption are funded by tax-payers. ENSC acts as a single administrator for participants regardless of the energy source used for heating.

HEA includes a pre-retrofit assessment (also called a "D audit"). The assessment is conducted to examine the house, complete a blower door test and collect information such as the levels of insulation (attic, exterior wall, etc.), the type and quantity of doors and windows, as well as the types of heating and hot water systems. Following that walk-through assessment, proposed measures are calculated using a simulation tool, HOT2000, and submitted to the homeowner through a report. Once the measures have been implemented, a post-retrofit evaluation is conducted to assess the upgrades made and give the house an EnerGuide rating.

HEA was formerly known as EnerGuide for Existing Houses (EEH). On April 1, 2012, as a result of the changes made to the program regarding eligible measures and rebates and the withdrawal of the federal government from the program, a new program was created under the name HEA, in order to avoid all confusion among participants. The main modifications made to the former program concern the types of measures eligible for rebates. Indeed, all former measures related to mechanical heating systems were removed from the list of rebated measures and transferred into the Fuel Substitution program, as well as other programs such as Instant Savings and Solar. HEA now focuses on insulation measures related to the building envelope.

The Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Moreover, following recommendations from the 2011 evaluation report, additional efforts were made in program promotion and communication.

The program aimed to achieve net electricity savings of 4.20 GWh and demand savings of 1.3 MW for 2012.

KEY FINDINGS

The 2012 evaluation of HEA demonstrated that the program is well designed and adapted to each house that takes part in the program. The program had 1,839 participants for the year 2012, which constitutes an increase compared to last year (1,494 participants) and 2010 (1,516 participants). In terms of net electricity savings, the program generated 7.184 GWh at the generator, which represents a significant increase in comparison with the net savings from 2011 (4.805 GWh).

Implementation of Measures

This year, survey results showed that draft proofing and window/door/skylight replacement were the two most recommended measures. Among all the recommended measures, draft proofing, electric water heater exposed pipe insulation and tank insulation were the most implemented by participants.

Furthermore, the survey indicated that not all measures recommended to homeowners had been implemented. As observed with the 2011 and 2010 survey results, the main reason indicated by participants for not implementing one or more of the recommended measures was cost, which they considered too high.

Satisfaction

Satisfaction with the program is high among participants. Indeed, nearly all participants expressed a high level of satisfaction with the program overall and with the impact of the measures implemented. Very high levels of satisfaction were noted in regard to the energy assessments and the courtesy of the EAs.

On the other hand, opinions regarding overall program satisfaction were divided among the program partners. While half the partners expressed a very high level of satisfaction with HEA, the other half were rather dissatisfied. This dissatisfaction is mainly due to the many program changes during the last couple of years as well as the lack of financial commitment and long-term goals from both governments with respect to the program.

Furthermore, one of the recommendations from the 2011 evaluation report was to strengthen the relationship between the DAs and ENSC by notifying the DAs in advance of any major modifications to the program or consulting with them on potential measures to be included in the program. The interviews revealed that there is still improvement to be made in terms of communication.

A great majority of the partners reported the near absence of collaboration and support from Natural Resources Canada (NRCan) to the program after the training activities. Moreover, EAs talked about the issues regarding the current management of the HOT2000 software by NRCan. They reported that

the software still contained several deficiencies and that NRCan should grant more human resources to finally fix this issue.

When asked about the program marketing and outreach activities, the majority of the program partners stated that they were happy with this year's improvement and proposed continuing aggressive ongoing marketing with a consistent message. For additional improvement, offering more information on the measures provided through the program still came out as one of the main recommendations suggested by program participants surveyed through this year's evaluation.

Program Energy Savings

Econoler estimated the gross savings of HEA in 2012 through a comparative analysis of information available in the tracking sheet, a billing calibration with 172 participants and the review and proper adjustment of prescriptive measure savings from the old EEH program. More specifically, the review of the tracking sheet included an analysis of energy savings for each prescriptive measure and an assessment of how the savings were calculated. The analysis of building simulations and their respective electricity billing was used to calibrate the simulation results and estimate gross energy savings more realistically.

In its net savings calculations, Econoler took into consideration the free-ridership and internal spillover measured through the participant survey. Through this analysis, Econoler found a free-ridership level of 30 percent, which is similar to that found in the 2011 evaluation (31%). On the other hand, Econoler found no internal spillover for this program. In comparison, the 2011 program evaluation had a very low spillover effect of 1 percent.

The next table presents the key distortion effects calculated through the program impact evaluation.

Table 1: Distortion Effects and Net-to-Gross Ratio

Distortion Effects	2012
Free-Ridership Level	30%
Spillover Level	0%
Net-to-Gross Ratio	0.70

The evaluation revealed that HEA generated net energy savings of 7.184 GWh and demand savings of 2.370 MW in 2012, as shown in the next table.

Table 2: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	9.177 GWh	9.177 GWh	0.70	6.424 GWh
Evaluation Results	10.277 GWh	10.262 GWh	0.70	7.184 GWh
Demand Savings				
Tracked Savings from ENSC	3.051 MW	3.051 MW	0.70	2.136 MW
Evaluation Results	3.399 MW	3.161 MW	0.70	2.370 MW

The net savings tracked by ENSC were compared with the evaluated savings for 2012. Both the energy and demand savings calculated for this evaluation are higher than the tracked savings, by 12 percent and 11 percent respectively. For the energy savings, this difference can be explained mainly by the adjustment made to the gross energy savings per EnerGuide point, from 817 kWh to 914 kWh. This adjustment came from a review of more than 500 participants and a calibration of the savings from a billing analysis of 172 participants. This approach used a much bigger sample size than that used in 2011 and is therefore more precise. Furthermore, since the energy savings per EnerGuide point was only calculated from the heating consumption reduction, solar DHW systems and DHW tank wraps were accounted as prescriptive measures, whereas ENSC considered those measures included in the savings per EnerGuide point.

With regard to net demand savings, the Evaluator made a small adjustment to ENSC's tracked savings by taking into account the unitary peak demand savings related to the installation of ETS systems.

RECOMMENDATIONS

Econoler finds that HEA is a good EE initiative that includes all the necessary ingredients to implement measures tailored specifically to the conditions of each house. The program includes good practices and reached a satisfactory level of energy savings. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- HEA-R1. Strengthen the relationship with the DAs:** The interviews with the DAs revealed that there is still improvement to be made in terms of communication between ENSC and the DAs. These improvements include notifying the DAs in advance of any major modifications to the program or consulting with them on potential measures to be

included in the program. On this matter, the PM agrees that any modification to the program along with its justification should be communicated to the DAs in advance, so they can be better prepared to support the program. The Evaluator strongly supports an open and constant communication channel as well as strong cooperation between ENSC and the DAs. Therefore, Econoler encourages any means of communication that would allow information to be better transferred between the two parties. The launch by ENSC in 2013 of a Trade Allies Internet portal is a step in the right direction towards better communication with the DAs.

- HEA-R2. Consider the possibility of providing technical support for HOT2000:** A great majority of the EAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies, and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee or employing an external expert to provide HOT2000 expertise to the EAs when needed. This expert would also be necessary for the HOT2000 simulation review presented in the following recommendation.
- HEA-R3. Perform a continuous HOT2000 simulation review process:** The review of 25 HOT2000 simulations proved that there was a high variability in the quality provided by the EAs. Most of the errors found were recurrent and attributable to the same EAs. While some of these issues were trivial, others substantially changed the EnerGuide rating being simulated by the software. Therefore, the Evaluator considers that a small sampling, with a focus on negative and low EnerGuide rating projects, should be reviewed by ENSC each year. This would help find and address potential errors in the on-site data collection and building simulations. Positive and negative feedback could then be given to the EAs, with a view to continuously improving their work. This HOT2000 simulation review process could also allow ENSC to identify any needs for additional training among the EAs.

1 COMPONENT DESCRIPTION

Efficiency Nova Scotia Corporation's (ENSC) Home Energy Assessment (HEA) encourages homeowners in Nova Scotia to improve the energy efficiency (EE) and comfort of their home while reducing its environmental impact and the burden of high energy costs. HEA was formerly known as EnerGuide for Existing Houses (EEH). On April 1, 2012, as a result of the changes made to the program in eligible measures and rebates as well as the withdrawal of federal government rebates from the program, a new program was created under the name HEA, in order to avoid all confusion among participants.

EEH was administered with support from Natural Resources Canada's (NRCan) ecoENERGY Retrofit Homes program. However, on January 28, 2012, the federal program reached its goal of 250,000 participants and thus stopped accepting new registrations. Therefore, no new participants were able to enrol in the Federal EnerGuide program as of January 28, 2012. Nevertheless, homeowners who have participated previously in EnerGuide (federal, provincial or ENSC) are still able to enter HEA to complete more energy efficiency upgrades.

HEA's main modifications to the former program concern the types of measures eligible for rebates. Indeed, all former measures related to mechanical heating systems, such as air- and ground-source heat pumps, solar domestic hot water systems, programmable electronic thermostats, tank wrap and pipe wrap were removed from the list of rebated measures and transferred into the Fuel Substitution program, as well as other programs such as Instant Savings and Solar. HEA now focuses on insulation measures related to the building envelope, such as exterior wall, exposed floor, basement, and crawl space, as well as draft proofing and windows/doors/skylights. HEA's rationale was developed specifically to help homeowners make smart efficiency upgrade choices that will result in energy savings. By focusing on building envelope measures that reduce the energy needed for space heating (which accounts for the highest end-use energy consumption in Nova Scotia homes), HEA helps homeowners identify and invest in significant energy savings measures.

In this regard, the program provides incentives from ENSC (rate-payer funds) for demand-side management (DSM) measures in order to reduce electricity consumption. The program also provides incentives with financial support from the Province of Nova Scotia for efficiency measures to reduce other fuel consumption. ENSC acts as a single administrator for all participants, independent of the energy source from which the savings are achieved.

HEA is implemented by six delivery agents (DAs) across Nova Scotia who provide services to homeowners. Participating homeowners first contact one of the program DAs in their area to schedule a pre-retrofit assessment (also called a "D audit"). The cost of the pre-retrofit assessment is a maximum of \$200, plus tax where applicable. This amount covers both pre- and post-retrofit home energy assessments. A certified energy advisor (EA) then performs a complete examination of the participant's house and proceeds with a blower door test to determine air tightness. The EA also collects additional information such as the levels of insulation (attic, exterior wall, etc.), the type and

quantity of doors and windows, as well as the types of heating and hot water systems. Once the walk-through assessment is complete, a pre-retrofit report is sent to the homeowner within a few weeks. The report includes a pre-retrofit EnerGuide rating and outlines the effectiveness of optional upgrades. This EnerGuide rating along with the effectiveness of the proposed energy efficiency measures are calculated using a simulation tool developed by NRCan, namely HOT2000.

The homeowner then has 12 months to complete the upgrades and schedule a post-retrofit assessment (E audit), which is already included in the original cost. This interval reduction, from 18 months to 12 months, occurred when HEA was launched. During the post-retrofit assessment, the EA verifies the upgrades that have been completed and performs another blower door test. Based on the results of the post-retrofit assessment, a final EnerGuide rating is established. The participant is eligible for program rebates, up to an overall cap, based on the completed upgrade measures.

Participants of this program are also eligible for ENSC's Residential Direct Install (RDI), in which low-cost energy efficiency measures (e.g., lighting and water conservation products) are installed at no cost to the participant.

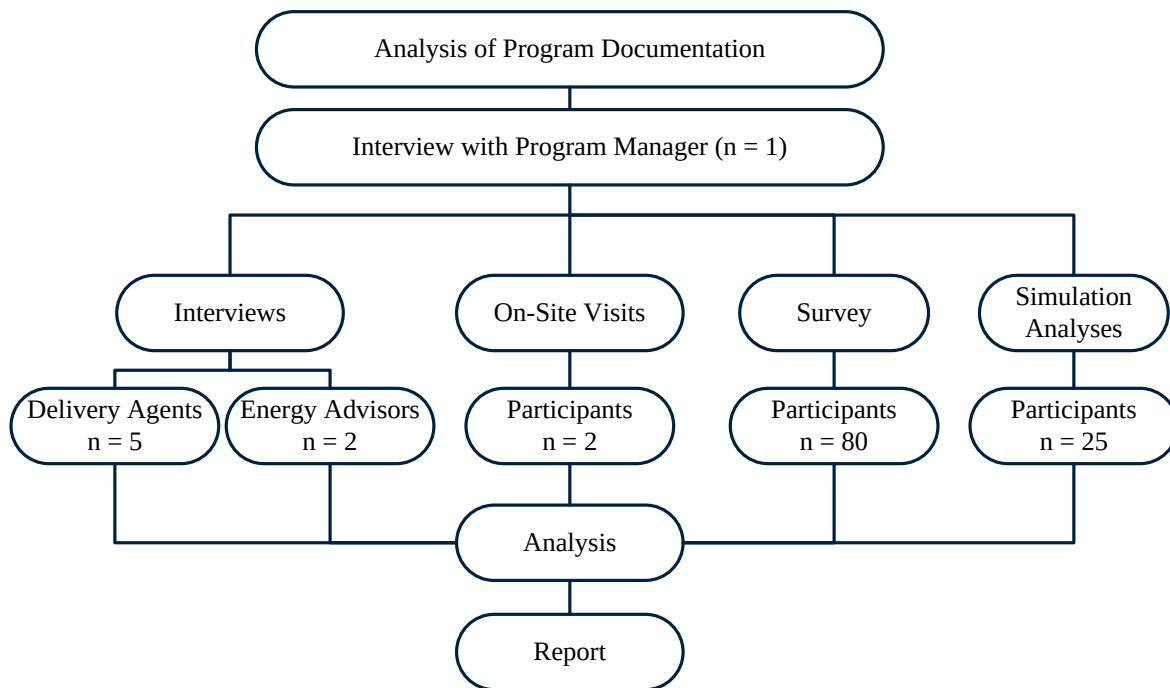
The program aimed at achieving net electricity savings of 4.2 GWh and demand savings of 1.3 MW for 2012. Savings generated by HEA are accounted for under the Existing Houses program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for HEA. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was obtained primarily from the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews with the Program Manager (PM), in July 2012 and September 2012 respectively. These interviews were intended, among other things, to follow up on the 2011 evaluation recommendations regarding process issues, as well as to understand the main changes that occurred in the program delivery in 2012. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 Interviews with Delivery Agents and Energy Advisors

In October 2012, five interviews with the program DAs (also called service organizations) and two interviews with EAs were conducted in order to understand, among other things, their involvement in the program, their participation process, as well as their perception of and satisfaction with the program.

The protocols used for the interviews with the DAs and the EAs are presented in Appendices II and III for reference.

2.2.4 On-Site Visits

In November 2012, two on-site visits were conducted at houses in which measures from HEA had been implemented. This part of the process evaluation was carried out by Econoler's subcontractor ecoPlus Services, which appointed a certified ecoENERGY advisor to conduct the on-site evaluation of the EAs' assessments. The sampling was established to include two different DAs.

These site visits were done to ensure that EAs were following the EnerGuide guidelines and that all pertinent information for running the house simulation with HOT2000 was collected.

Further explanations of the methodology used for the on-site visits are available in the Process Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix IV.

2.2.5 HOT2000 Simulation Review

As part of this year's evaluation, Econoler also collected and reviewed a sample of 25 HOT2000 simulations. The main purpose of this verification was to validate the input data and assumptions used by the EAs, ensuring that they are all within a realistic range and concur with the actual residential building being assessed. Most of the sample projects were selected randomly, but Econoler prioritized a number of projects with outlier values, such as an initial EnerGuide rating below 20 or an EnerGuide rating increase of more than 40 points between the D and E audits.

This in-depth assessment of HOT2000 simulations was conducted by Econoler's subcontractor ecoPlus Services. Further explanations of the methodology used for this task as well as the key

outcomes of this assessment are available in the Process Evaluation section of this report. Finally, a copy of the HOT2000 simulation evaluation protocol is included in Appendix IV.

2.2.6 Participant Survey

A telephone survey with a total of 80 program participants was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in October and November 2012 utilizing computer-assisted telephone interviewing (CATI) technology. The average length of the survey was 17 minutes.

The participant survey was meant to generate feedback on the following aspects of HEA:

- > spillover and free-ridership;
- > program awareness;
- > participant motivations, concerns and barriers;
- > satisfaction with the program; and
- > recommendations for improvements.

The demographic profile of the survey respondents and the survey questionnaire are shown in Appendices V and VI respectively. The table below shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2011 and 2012 telephone surveys.

Table 3: Sample Size and Sampling Error

Survey	Population	Sample Size (n)	Sampling Error at 90% Confidence Interval
2011 Participants	1,494	70	±9.6%
2012 Participants	1,839 ¹	80	±9.0%

¹ The population of participants for the 2012 survey was 1,783 at the time the survey was being conducted. This population refers to electrically heated clients from both EGH and HEA. Given the fact that the majority of the population were former EGH clients, they therefore had access to federal NRCan incentives as well. Furthermore, EGH clients had access to ENSC EDSM rebates, such as heat pumps and ETS units, while current HEA clients have access to building envelope measures, including insulation, draft proofing, windows and doors.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

In 2011, Econoler performed a comprehensive process evaluation of the program. The 2010 evaluation report and recommendations, the program manual and website, the application forms, the logic model and the program theory were among the program elements that were examined for the process evaluation. The PM was interviewed along with the DAs, EAs and participants. On-site visits were also part of the evaluation methodology. The 2011 approach generated a series of recommendations to improve the program performance and management.

The 2012 process evaluation is a continuation of the 2011 evaluation and covers the following aspects:

- > follow-up on the 2011 evaluation recommendations regarding process issues;
- > new and/or updated program documentation including program modifications since the last evaluation;
- > program tracking sheet;
- > program partners' perspectives on process issues; and
- > program participants' perspectives on process issues.

Recommendations and follow-ups regarding impact evaluation (energy or demand) will be addressed in the Impact Evaluation section of this report.

3.2 PROGRAM DOCUMENT ANALYSIS AND INTERVIEW WITH THE PROGRAM MANAGER

The following section describes the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interview with the PM. It also covers the follow-up on recommendations from last year in each applicable section.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory, in which all the information about the program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program based on a template provided by the Evaluator.

In 2012, the Evaluator noted that the program memory has been included in the program manual along with its various Appendices. The Evaluator is also pleased to report that HEA has an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The program manual is intended to capture information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The HEA program manual is now presented in a standardized template which applies to all ENSC programs and includes the same table of contents with 10 sections. This is a considerable improvement from the 2011 format and follows one of the Evaluator's major recommendations.

With this new format, most recommendations regarding the program manual, such as describing the partners roles and activities, including the unitary savings used for each prescriptive measure, explaining what is a type "E" audit and providing the parameters to estimate the program objectives, are now covered in the program manual, as well as its attached files and Appendices. As for the recommendation about providing the details behind the incentive calculation, it will be addressed when the new PM becomes more familiar with the program. This is a good example of the usefulness of a program memory.

The following table compares the program manual content of 2011 to the new 2012 version. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 4: Program Manual Content - HEA

Program Manual Content	2011	2012
Document revisions	✓	✓
Program description (including nature or type of program)	✓	✓
Program justification	⊘	✓
Program objectives	✓	✓
Incentives	✓	✓
Eligibility criteria	✓	✓
Program partners and their roles	⚠	✓
Program barriers	✓	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	✓	✓
Details about the savings calculations and types of measure	⊘	✓
Annual budget	✓	✓
Cost-effectiveness test results	✓	✓
Market study or technical study supporting program elements or assumptions	⊘	⊘
Marketing plan	⊘	✓
Evaluation plan	⊘	✓
Program theory	⊘	✓
Logic model	✓	✓
Program process flow chart	✓	✓
Partner or participant process flow chart	✓	✓
Program forms	✓	N/A
✓ Information included in the program manual ⚠ Information partially included in the program manual ⊘ No information		

The program manual is useful and well designed. For further improvement, the Evaluator has a few minor recommendations.

- > **Document major changes in the Document Revision section:** In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual. For example, this section should briefly describe the retirement of NRCan incentives, any new incentive mechanism and the removal of ductless mini-split heat pumps from the list of eligible measures. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.
- > **Be consistent in the program name formulation across all residential programs:** ENSC increases focus on serving customers through a one-window service approach and is therefore planning to market all residential activities as services instead of programs. So far, this change has already been implemented for HEA, Low Income Homeowner Service (LIHS) and Multi-Unit Residential Buildings (MURB), which are now presented as services. The Evaluator recommends that consistency be maintained in the program names in internal and external documents (e.g., on the ENSC website). All activities should therefore be named only as a service or as a program, thus avoiding the confusion caused by two sets of names in the same portfolio. In a view to offer a one-window service approach, the program portfolio names should be planned carefully and globally, and not one program at a time. This latter approach would ensure that participants have all the necessary information to understand ENSC's offer, starting with the names of the different services. It would also prevent confusion among participants as to the difference between a service and a program, especially given that several programs already changed names a few times in the past.

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program's logic model. Econoler is currently working with ENSC to make sure that each program's updated logic model reflects the current program strategy, and the performance indicators established based on the program theory. The programs' logic models will all be finalized and included in the programs' manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the Evaluator's recommended template for an evaluation plan, which is included as an Appendix of the HEA program manual. The PM provided positive feedback on this important tool that complements the program manual and makes it possible to evaluate the program.

The addition of the evaluation plan to the program documentation is a great improvement from previous years. For additional improvements, the Evaluator has the following recommendation about the evaluation plan:

- **Adapt the evaluation plan template to meet program needs:** Since HEA is an assessment program with specific savings for each recommended measure, the program Base Case (section 3) could be simplified by eliminating all lines in the table containing N/A. The table could start with the gross savings for each measure with the source of calculation and then keep only the lines that will be used to calculate the net savings (last line of the table) such as the different distortion effects, installation rates, etc. This would simplify the table.

3.2.4 Program Charts

The program has two process charts: one for the partners and the other for the participants. These charts are very informative for any new staff responsible for the program as well as for program partners and participants.

For additional improvements, Econoler has the following recommendation on the program charts:

- **Provide partners and participants with simplified process charts:** The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well designed. Moreover, the partners should be given copies of their process chart. After all, since these charts are intended for the partners and the participants, they must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version date should be indicated in each chart.

3.2.5 Marketing and Outreach Activities

Due to the restructuring of the residential sector, to avoid program silos and to provide a one-window approach for participants, an integrated marketing plan has been drawn up and is being implemented for this sector. Indeed, ENSC is moving away from program-specific marketing towards a more all-inclusive approach, which offers a full suite of energy-saving services and rebates for customers. Over the last year, a focus was put on developing a customer-centric approach:

- **Facebook:** Launched in September 2011, the Facebook page is being followed by over 28,000 people, which is a great accomplishment considering that there are fewer than 500,000 potential followers in Nova Scotia. It provides followers with energy saving tips and informs them about special offers, ways to meet with energy-efficiency representatives in person and energy-efficiency contests they can enter. It encourages followers to access all the energy-efficiency services for which they are eligible.

- > **New Website:** ENSC's new website will feature robust categorization (allowing the user to find specific content in a variety of ways), as well as a state-of-the-art predictive index. These combined features will make it easier for the user to locate specific services and for the website to suggest other appropriate services based on the user's needs and online behavioural patterns.
- > **Email Marketing:** Email addresses for e-newsletter communication are collected at various points of contact: home shows, retail in-store engagement events, program application forms and inbound calls.
- > **Customer Relationship Management:** The back end of the residential services is being retooled to fit the customer-centric approach. The systems undergoing development will allow ENSC to call up customer history and provide thoughtful advice on future energy savings, whether through personal contact, direct mail, or online communication.

In addition to the overall residential marketing strategy, other marketing activities were specifically designed in order to promote HEA among homeowners:

- > Radio advertising (summer and fall);
- > Newspaper advertising (summer and fall);
- > Online advertising (summer and fall);
- > Television advertising (fall);
- > Heating Assistance Rebate program mailout (fall); and
- > Retailers pilot (in-store presence in selected stores across the province).

As for the follow-up on the 2011 evaluation recommendations, it is to be noted that recommendations for the actual website, especially in the "How the Service Works" section, about clarifying steps 3 and 4 of the participation process as well as multiple and maximum rebates, have been applied. These processes and operations have been considerably modified and are now much simpler and easily understood.

Furthermore, in the 2011 evaluation, the Evaluator recommended informing participants about the expected savings of their projects in order to overcome one of the main program barriers, which is the cost of the measures. In 2012, the EAs were required to provide the homeowner with more personalized information and specific details about their construction project, in a section of the report generated by the HOT2000 software where comments can be made. It was decided by ENSC not to display data related to savings either in energy units or dollars, as HOT2000 tends to overestimate savings and, therefore, overestimate the potential dollar savings, which can give customers false expectations.

Finally, the 2011 recommendation about establishing a list of program-approved contractors for the benefit of participants is being studied in consultation with ENSC trade allies.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice, because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

For additional improvements, the Evaluator has the following recommendation on the marketing plan:

- **Make the performance indicators more quantitative:** To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

3.3 TRACKING SHEET

Econoler has reviewed the content of the tracking sheet for HEA.² In general, this tracking sheet is useful because it contains most of the necessary information for the PM to regularly monitor program savings. The necessary fields for program administration and evaluation purposes are present.

Due to the modification of the program on April 1, 2012 the tracking sheet contains two databases. The "EDSM Forms" tab is used to track the prescriptive measures that are still approved for projects that had their initial evaluation (D audit) before April 2012. This tab is similar to the one used for the EEH program last year. Since this database will no longer be used after 2012, Econoler does not have any recommendations related to "EDSM Forms" tab.

The second tab, called "Building Envelope," provides information on every project completed in 2012. Each project has one unique identification number, the NRCAN ID. The EnerGuide File Number for the D and E audits allows NRCAN to track the D and E simulation files. The first two characters of the EnerGuide File Number can be used to identify which SO completed the assessment. The majority of the participant information essential for conducting surveys was present in the tracking sheet.

² As part of this program process analysis, the Evaluator did not review the HEA program data included in ENSC's online tracking system, namely the Demand Side Management Data System (DSMDS). At the time of writing this report, ENSC was working on the DSMDS to make it more accessible and to ensure that the information it contains is up to date.

The necessary data for calculating the estimated gross savings are included in the tracking sheet:

- > Initial and Final EnerGuide Ratings data come from the HOT2000 simulations developed by the DAs.
- > Evaluated EnerGuide point savings value. For 2012 projects, ENSC used 817 kWh of savings per EnerGuide point. This figure came from the 2011 program evaluation report.
- > Main heating system type.

The energy impact for each project is presented in various columns. The total savings in kWh are calculated based on the EnerGuide point difference between D and E audit and the savings per EnerGuide point established in the 2011 evaluation report of EEH program.

Several recommendations presented in the 2011 evaluation report were implemented by the PM. The E audit date, added to the tracking sheet, can be used as the end date of the renovation to better select the billing period needed if conducting a pre-post installation billing analysis in the future. Also, fields have been added to present building energy consumption data since ENSC now receives this information from NRCan.

The Evaluator believes that a number of adjustments could be made in the future to improve tracking sheet consistency and facilitate program evaluation. Therefore, the Evaluator recommends that ENSC:

- > **Add the utility account number:** For the impact evaluation of HEA, a HOT2000 calibration is required to calibrate the energy consumption obtained from the simulations. A comparison between simulated and real consumption is performed to establish the final savings per EnerGuide point. For 2013, ENSC indicates that the waiver signed by participants was changed so that this information will be provided by the homeowner and made available in the tracking sheet.
- > **Add the percentage of electric heating:** In 2011, the electricity savings were calculated by the Evaluator based on the percentage of space heating load delivered by electricity. This information was available from the EDSM form filled out by participants. For 2012, EDSM forms were filled out by only a portion of participants, so ENSC uses 100 percent when the main heating system is supplied by electricity and 0 percent when it is supplied by other fuel. For 2013, ENSC indicates that the waiver signed by participants was changed so that this information will be provided by the service organizations and made available in the tracking sheet.
- > **Set limitations for entries and develop a validation process:** To ensure that correct values are entered in the tracking sheet, a validation process should be developed by ENSC. This will ensure that values such as negative building envelope savings are not taken into account for the tracked gross savings, for example.

- **Track gross savings and net savings separately:** ENSC should firstly calculate the gross savings for electrically and non-electrically heated houses. Secondly, based on these savings, the net savings can be determined using the net-to-gross ratio and the line loss factor for electrically heated houses.

3.4 ON-SITE VISITS

The on-site visits conducted as part of the HEA evaluation were used to assess the procedure and ecoENERGY protocol that EAs must follow during assessments. The ecoENERGY protocol was established by NRCan to provide a framework for ecoENERGY-certified EAs. The assessments must be conducted by a certified ecoENERGY advisor who is able to answer all participants' questions about energy use in the home, gather information for identifying potential energy efficiency measures, and collect energy bills and receipts. Each parameter that will later be used in the HOT2000 models has to be documented appropriately, and procedures must be explained clearly to the participants.

The on-site visit quality assessment was twofold. Firstly, the Evaluator joined two EAs during one of their on-site visits to validate that they were following the data collection protocol and communicating adequately with program participants. Then, Econoler collected the two EAs' HOT2000 simulations along with all the data they collected on-site, with the aim of evaluating the EAs' ability to properly generate an accurate and replicable HOT2000 simulation of the household being assessed.

The on-site visits resulted in a positive view of the assessment process under HEA. During the two on-site visits, the Evaluator indeed noted that the EAs followed ecoENERGY protocol procedures very well in general. The EAs' ability to collect the data required to produce an accurate EnerGuide rating with HOT2000 was possibly their strongest point. The EAs met by Econoler clearly understood the concept of "building envelope," meaning there was no confusion between the building sections inside the building envelope and those outside. The EAs' communication skills were also very good. Because they felt at ease, the homeowners were not afraid to ask questions, which the EAs succeeded in answering in clear and simple language.

After the on-site visits, Econoler reviewed the HOT2000 simulations and EnerGuide reports developed by the two EAs. It appeared that the EAs were able to produce very accurate EnerGuide ratings using the software. The EAs avoided the common mistake of oversimplifying the house features and thereby created rather detailed simulations that more accurately reflect the actual household assessed. Moreover, the EnerGuide reports developed under HEA were of very high quality. Indeed, they were more detailed and more specific than what is usually seen. Instead of using the standardized version of the EnerGuide report, the two EAs have created their own customized version, which makes the report more personalized.

The Evaluator still noted a number of opportunities to enhance EA on-site visit effectiveness. Though possessing great knowledge of the overall assessment procedures, the EAs lacked knowledge regarding air quality and moisture issues. Such issues were observed during the on-site visits but

never mentioned to the homeowners. Furthermore, the Evaluator noticed that more information could be given to homeowners regarding the values and content of the EnerGuide report provided to homeowners following the assessment, as well as the importance of proper ventilation in airtight houses.

Taking into account the findings from the two on-site visits and the subsequent HOT2000 simulation review, the Evaluator recommends to:

- **Explain the values and content of the EnerGuide report:** As mentioned before, the quality of the EnerGuide reports reviewed was very high. That being said, it is important that the EAs explain the values and content of these reports while still on-site. Usually, EnerGuide reports get sent to the homeowners in the weeks following the assessment. If clients are not informed of the potential benefits of the report, they may end up not even reading it. Therefore, EAs should always carry with them an example of an EnerGuide report, so they can show homeowners all the valuable information it contains, such as the EnerGuide rating, the air leakage rate, the equivalent leakage area, the list of recommended upgrades and all the many charts explaining energy consumption.
- **Improve EAs' knowledge of indoor air quality and moisture problems:** NRCan guidelines specifically mention that it is the responsibility of an EA to determine if any actual or potential indoor air quality, health and safety, or ventilation issues exist in the home at the time of the initial evaluation. For instance, one of the houses assessed during the on-site visit process clearly exhibits evidence of air quality issues. However, the EA did not mention it in the report or even verbally to the homeowner. It is important to notify the client of any air moisture problems before the renovation work begins so that the problem can be addressed before new insulation material is installed in the walls and ceilings. In such cases, the EA should be able to provide the homeowner with a few basic guidelines on how to deal with indoor air quality issues. The "Energy Advisor Workshop" document published by NRCan and the Canada Mortgage and Housing Corporation (CMHC) website are two sources where the advisor and the homeowner can find valuable information about indoor air quality.
- **Stress the importance of proper ventilation in airtight houses:** In older houses, the function of the blower door test is to help identify air leakage areas. Newer homes are typically built to be very airtight. Consequently, the value of the blower door test is not so much to determine space heating cost reduction but rather to find out if the house is sufficiently ventilated. It is important that the EAs inform the owners of airtight houses that the blower door test results will be used to perform a calculation to determine whether the house requires additional mechanical ventilation. They should also let the homeowner know that the results of this test will appear in the EnerGuide report. Furthermore, EAs often recommend the installation of a heat recovery ventilator (HRV) among the proposed building upgrades. It is a good opportunity while on-site to give a few guidelines to the homeowner about HRVs, such as how they prevent many air quality and moisture issues in houses that are airtight.

3.5 HOT2000 SIMULATION REVIEW

The first point noticed during the HOT2000 simulation review was the high variability in professionalism and training found between EAs. Some of these organizations presented very accurate files which displayed very good understanding of the simulation process as defined by NRCan guidelines. On the other hand, other EAs presented files that contained a number of recurrent omissions, incomplete information and calculation mistakes. In addition, almost every file assessed was missing at least a few of the required pictures. Some of these errors were significant and led to inaccurate EnerGuide rating calculations.

Despite this, most of the EAs assessed provided very complete and detailed EnerGuide reports. In most cases, the reports contained several recommendations for the homeowners as well as very specific information about the energy performance of the house.

To improve the HOT2000 simulations used under this program, Econoler recommends that ENSC:

- **Perform a continuous HOT2000 simulation review process:** The review of 25 HOT2000 simulations proved that there was a high variability in the quality provided by the EAs. Most of the errors found were recurrent and attributable to the same EAs. While some of these issues were trivial, others substantially changed the EnerGuide rating being simulated by the software. Therefore, the Evaluator considers that a small sampling (between 1 and 5 percent, depending on the number of program participants) of all project folders should be reviewed by ENSC each year. This would help find and address potential errors in the on-site data collection and building simulations. Positive and negative feedback could then be given to the EAs, with a view to continuously improving their work. This HOT2000 simulation review process could also allow ENSC to identify any needs for additional training among the EAs.

3.6 PARTNER PERSPECTIVES

3.6.1 Perceptions Related to Program Changes

A total of five DAs and two EAs were interviewed for the evaluation of HEA. The program partners were questioned about the recent changes made to the program and their impact on their work.

Opinions were divided regarding overall program satisfaction. While half the interviewed program partners expressed a very high level of satisfaction regarding HEA, the other half were rather dissatisfied. This dissatisfaction is mainly due to many program measures being offered and then cancelled at different times during the last couple of years as well as the lack of financial commitment and long-term goals from the federal government with respect to the program. These changes have sent an unclear and confused message to the general public. On this matter, most of the complaints that DAs received from participants pertained to the rebate amounts. Indeed, the most significant barrier to the program identified by the program partners was the customer cost for the implementation

of measures as compared to the incentives provided. In addition, a number of complaints were made about the new 12-month timeline to get the upgrades completed.

Moreover, the great majority of the DAs interviewed expressed concerns about the viability of the program in light of the many modifications recently made to the program. These modifications included removing the eligibility of ductless mini-split heat pumps because of the high level of free-ridership, suspending the service to small multi-unit residential buildings for cost-effectiveness reasons and eliminating all heating equipment from the eligible incentives since this would be covered under Fuel Substitution. According to them, the removal of mechanical equipment incentives, especially for the ductless mini-split heat pump, has resulted in a major decrease in their activities. On this matter, one EA stated that, when they were rebated, heating systems represented the customers' main interest whereas insulation measures required more convincing from the advisor. Heating systems represented the great majority of their calls in the past, and as much as the insulation incentives have contributed to the program, the removal of mechanical measures has resulted in a decrease in their activities.

Furthermore, one of the recommendations from the 2011 evaluation report was to strengthen the relationship between the DAs and ENSC by notifying the DAs in advance of any major modifications to the program or consulting with them on potential measures to be included in the program. The interviews revealed that there is still improvement to be made in terms of communication. On this matter, ENSC recognized there were challenges in 2012 regarding communication and agreed that any modification to the program along with its justification should be communicated to the DAs in advance so they can be better prepared to support the program. The Evaluator thus strongly supports an open and constant communication channel as well as strong cooperation between ENSC and the DAs. This effort will be supported by a Trade Allies Internet portal to be launched in 2013.

3.6.2 Relationship with Program Partners

All of the program partners had a very high level of satisfaction regarding their relationship with ENSC staff. On the other hand, a great majority of the DAs reported the near absence of collaboration and NRCan's lack of commitment to the program. Furthermore, while one EA expressed a high level of satisfaction with the training activities offered by NRCan, another expressed dissatisfaction regarding the support offered after training.

Moreover, even with the withdrawal of the federal government from the program, EAs talked about the issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies and that NRCan should grant more human resources to finally fix this issue.

3.6.3 Assessment Process

Regarding the assessment process in general, both EAs reported that the EnerGuide methodology is appropriate in the context of the program. The 2011 evaluation report mentioned recommendations related to explaining the protocol in detail to the client, taking photographs of the architectural elements of the house and enforcing the protocol procedure for performing the blower door test. The EAs were questioned on these elements and stated that they always made sure to properly explain the protocol to clients, to take pictures of the house and to follow the blower door protocol to the letter. They also made sure clients were provided with either the paper or the digital version of the “Keeping the Heat In” booklet.

3.6.4 Opinion on Marketing Strategy

Concerning the marketing and outreach activities, the majority of the program partners stated that even though it took a long time before the marketing strategy was put in place, they were happy with the result. They proposed continuing aggressive ongoing marketing (radio, TV, home shows, merchant marketing promoting energy assessment) with a consistent message.

Although not stopping the ongoing promotional activities with the general public, the program partners suggested concentrating greater marketing efforts on renovators and contractors, such as heating contractors, by working more closely with those who have a lot of experience in the industry. As a way to improve program efficiency, some DAs also proposed the implementation of more workshops to educate homeowners and contractors on the proper products and services to achieve the best home improvement and on the incentives available for energy upgrades.

Finally, increasing the incentive amounts also came up as a common suggestion for attracting more participants, which would lead to more assessments, thus ensuring the growth of the energy efficiency industry and making it possible for EAs to train and find sustainable employment in order to establish this industry as a profession. Indeed, every time the program gets stopped or slows down, the DAs lose their advisors and have to start from the beginning to train new resources.

3.7 PARTICIPANT PERSPECTIVES

The survey was conducted with participants that completed their upgrades during 2012. Therefore, the following 2012 results include participants from both the old delivery model under EEH (n=72) and the new delivery model under HEA (n=8).

3.7.1 Program Awareness

Survey respondents were asked how they became aware of the program. Results indicated that there were two primary ways participants found out about the program – through word of mouth and through ENSC advertising. Indeed, the high number of participants who heard about the program through word

of mouth (40%) can be considered an indication of the program's success. In addition, ENSC advertising, via newspapers (15%), the Internet (15%), television (11%) or radio (6%), is proving successful at communicating with participants about the program.

Table 5: Program Awareness

Sources of Program Awareness	2011*	2012*
<i>Sample Size</i>	70	80
Word of mouth	40%	40%
Newspaper ad or story	23%	15%
The Internet	10%	15%
Television	10%	11%
Radio	10%	6%
From a contractor	7%	6%
Building supply dealer/store	4%	5%
Previous/past participants	--	5%
Facebook	--	5%
TeamBuy	--	4%
Trinity Inspection Services (DA)	--	3%
ACAP Cape Breton (DA)	--	1%
ENSC website	--	1%
Home show	9%	--
Nova Scotia Power bill insert	3%	--
Others	13%	10%
Don't know	7%	8%
*Multiple responses		

3.7.2 Motivations and Barriers to Participation

Saving money was the primary motivation for participation in the program, with three in ten participants wanting to save on energy costs (29%) and one quarter motivated by the rebates available through the program (24%). Furthermore, a small number of participants were previously thinking of implementing the energy efficiency measures (16%) and a little over one in ten wanted to participate in the program to find out how efficient their home was (13%). The top three reasons for participating may suggest the importance of the program rebates in customers' decision to implement measures.

Table 6: Reasons for Participating

Reasons for Participating	2011		2012	
	Primary Reason	Secondary Reasons*	Primary Reason	Secondary Reasons*
<i>Sample Size</i>	70	70	80	80
To save on energy costs/bills	33%	17%	29%	13%
Rebates	14%	9%	24%	11%
Already thinking about implementing energy efficiency measures	9%	13%	16%	9%
Find out how efficient my home was/evaluation	17%	6%	13%	15%
To get an expert opinion on how to make my home more efficient	14%	16%	10%	16%
To save energy	3%	--	6%	6%
To help the environment	6%	3%	1%	3%
To improve heating	1%	6%	--	--
Blower door test	--	--	--	--
Others	3%	7%	1%	5%
No other reasons	--	4%	--	31%
Don't know	--	29%	--	3%
Refused	--	1%	--	--
*Multiple responses				

In terms of concerns prior to participating in the program, very few participants had any concerns (8%).

Table 7: Concerns with Program Prior to Taking Part

Participant Concerns	2011	2012
<i>Sample Size</i>	70	80
Yes	6%	8%
No	94%	93%

The concerns held by participants were varied. Participants were concerned that the improvements would cost a lot, that they would not like the measures that were recommended, that the rebates would be too low or that their home would be inefficient.

Table 8: Specific Concerns with Program Prior to Taking Part

Specific Concerns about Program*	2012 (#)
<i>Sample Size**</i>	6
That improvements would cost a lot	3
Wouldn't like what they recommended	1
Rebates would be too low/insufficient	1
That my home would be inefficient	1
Other	1
*Base: Respondents who had concerns with program prior to taking part	
**Multiple responses	

3.7.3 Program Influence

Respondents were asked to rate the importance of the program elements that might have influenced their decision to implement energy-efficient measures through the program. Program incentives (mean of 8.6 on a 10 point scale), information and advice from the EA (mean of 8.5) and information and advice provided through the program (mean of 8.5) were all important to participants. The EnerGuide label and designation was also considered important (mean of 7.7). Finally, previous experience with the program or with a similar program was considered far less important (mean of 4.4).

Table 9: Importance of Program in Influencing Decisions

Importance of Program in Influencing Decisions	2011	2012
<i>Sample Size</i>	70	80
Average rating: 10="Extremely important," 0="Not important at all"		
Program incentives	8.4	8.6
Information or advice from the energy assessment/advisor	8.5	8.5
Information or advice provided through the program	8.3	8.5
<i>Sample Size</i>	70	77
EnerGuide label and designation themselves	6.8	7.7
<i>Sample Size</i>	70	66
Previous experience with the EEH program or a similar program from either ENSC or Nova Scotia Power	4.6	4.4

3.7.4 Recommendations and Implementation through the Program

Participants were asked if they implemented all, some, or none of the measures that were recommended. Notably, participants were receptive to the recommendations made, as all participants opted to implement all or some of the recommended measures.

Table 10: Recommended Energy Efficiency Measures Implemented

Recommended Energy Efficiency Measures Implemented	2011	2012
<i>Sample Size*</i>	64	79
Implemented some of the measures recommended	42%	65%
Implemented all measures recommended	50%	32%
Did not implement any measures recommended	6%	--
Don't know	2%	4%
*Base: Respondents who indicated they were given recommendations for at least one of the eligible measures		

Participants were given a number of measures and asked whether a measure was recommended and, if so, whether they implemented that measure. This year, the most recommended measure was draft proofing (76%), followed by windows, doors and skylights (70%), electric water heater tank insulation (69%) and electric water heater exposed pipe insulation (68%). In terms of implementation, draft proofing was the most implemented measure by participants (45%), followed by electric water heater exposed pipe insulation (41%) and tank insulation (39%). The following recommended measures had the lowest implementation rate: electric thermal storage central hydronic systems (0%), electric thermal storage room units (0%), high-efficiency air to air heat pumps with non-electric backup (0%), electric thermal storage hot air furnaces (1%), drain water heat recovery (1%), high-efficiency ground source heat pumps (3%), high-efficiency air to air heat pumps with electric backup (4%) and solar domestic water heating systems (4%).

Table 11: Recommended and Implemented Measures

Measures	2011		2012	
	Recom- mended	Imple- mented	Recom- mended	Imple- mented
<i>Sample Size</i>	70	70	80	80
Draft proofing	n/a	n/a	76%	45%
Windows/Doors/Skylights	n/a	n/a	70%	30%
Electric water heater tank insulation	51%	44%	69% ³	39% ⁴
Electric water heater exposed pipe insulation	56%	51%	68% ⁵	41% ⁶
Ceiling insulation	n/a	n/a	60%	24%
Electronic programmable thermostats	63%	51%	59%	21%
Basement insulation	n/a	n/a	56%	16%
Exterior wall insulation	n/a	n/a	53%	20%
High-efficiency air to air heat pumps with electric backup	30%	7%	49%	4%
Crawlspace insulation	n/a	n/a	39%	10%
Exposed floor insulation	n/a	n/a	36%	9%
High-efficiency ductless mini-split heat pumps	17%	7%	31%	11%
Solar domestic water heating systems	24%	11%	21%	4%
Drain water heat recovery	11%	1%	19%	1%
High-efficiency ground source heat pumps	17%	3%	15%	3%
High-efficiency air to air heat pumps with non-electric backup	4%	1%	15%	--
Electric thermal storage room units	19%	9%	13%	--
Electric thermal storage hot air furnaces	6%	--	9%	1%
Electric thermal storage central hydronic systems	1%	--	1%	--

³ This result may include homeowners who had this measure implemented under RDI.

⁴ This result may include homeowners who had this measure implemented under RDI.

⁵ This result may include homeowners who had this measure implemented under RDI.

⁶ This result may include homeowners who had this measure implemented under RDI.

The following table shows the measure uptake (implementations as a percentage of recommendations) of each proposed energy efficiency measure. Analysis of these indicators reveals that among the measures that have been recommended to participants through the program, electric water heater exposed pipe insulation (60%), draft proofing (59%), and electric water heater tank insulation (57%) were those that had the highest uptake among program participants.

Table 12: Uptake of Measures

Proposed Energy Efficiency Measures	2011	2012
	Measure Uptake	Measure Uptake
<i>Sample Size</i>	70	80
Electric water heater exposed pipe insulation	91%	60%
Draft proofing	n/a	59%
Electric water heater tank insulation	86%	57%
Windows/Doors/Skylights	n/a	43%
Ceiling insulation	n/a	40%
Exterior wall insulation	n/a	38%
Electronic programmable thermostats	81%	36%
High-efficiency ductless mini-split heat pumps	41%	35%
Basement insulation	n/a	29%
Crawlspace insulation	n/a	26%
Exposed floor insulation	n/a	25%
High-efficiency ground source heat pumps	18%	20%
Solar domestic water heating systems	46%	19%
Electric thermal storage hot air furnaces	--	11%
High-efficiency air to air heat pumps with electric backup	23%	8%
Drain water heat recovery	9%	5%
Electric thermal storage room units	47%	--
High-efficiency air to air heat pumps with non-electric backup	25%	--
Electric thermal storage central hydronic systems	--	--

Those participants who implemented upgrades that were recommended generally involved a contractor when undertaking the upgrades. Approximately one half of participants hired a contractor to complete all of the upgrades (45%), while one third did some of the work themselves and used a contractor for some of the upgrades (33%). Two in ten reported that they did the work themselves (22%).

Table 13: Implementation of Recommended Upgrades

Implementation of Recommended Upgrades	2012
<i>Sample Size*</i>	76
I hired a contractor to complete the upgrades	45%
Some upgrades were implemented by me and others by a contractor/Mix of both	33%
I did the work myself	22%
*Base: Respondents who implemented recommended upgrades	

Those participants who did not implement all of the measures recommended were asked the reason for this decision. Cost was the primary reason, with four in ten participants saying that it was too expensive to implement all the measures (43%). A further one in ten stated they did not have the financial means to implement the measure(s) (12%). One quarter did not believe they needed all of the measures that were recommended (24%).

Table 14: Reasons all Recommended Measures were not Implemented

Reasons Measures were not Implemented*	2011		2012	
	Primary Reason	Secondary Reasons**	Primary Reason	Secondary Reasons**
<i>Sample Size*</i>	31	30	51	50
Too expensive	61%	7%	43%	12%
Didn't think they really needed it	3%	7%	24%	6%
Didn't have the financial means	6%	7%	12%	4%
Too busy	6%	--	10%	2%
Rebate not big enough	3%	3%	2%	--
Planned to implement in the future	--	7%	2%	--
Wanted to implement measures that weren't covered through the program	--	--	2%	--
Payback too long	--	7%	--	2%
Others	16%	3%	4%	6%
No other reasons	--	--	--	70%
Don't know/Refused	3%	60%	2%	2%
*Base: Respondent who did not implement some of the recommended measures **Multiple responses				

3.7.5 Impact of Measures

Participants were asked a series of questions regarding comfort, in order to assess the impact the program measures have had. Eight in ten participants noticed a change in the comfort level of their home (81%). Of these participants, nearly one half noted that the house was warmer (46%), and four in ten noticed a reduction in their energy costs (37%). Other areas noted were a more comfortable temperature throughout the home (22%), fewer drafts (17%), the home being easier to heat (17%) or a cooler home in the summer (14%).

Table 15: Specific Impacts of Measures on Comfort

Noticed Change in Comfort Level	2011	2012
<i>Sample Size</i>	70	80
Yes	90%	81%
No	9%	13%
Don't know	1%	6%
Changes Noticed*	2011	2012
<i>Sample Size**</i>	63	65
House is warmer	32%	46%
Reduced cost of energy	16%	37%
More comfortable temperature throughout the home	10%	22%
Fewer drafts throughout the home	27%	17%
Easier to heat	5%	17%
House is cooler in summer	6%	14%
Even temperatures throughout the home	29%	9%
More convenient to control temperatures automatically	10%	5%
House is less humid	8%	2%
Others	10%	14%
Don't know	2%	--
*Base: Respondents who noticed changes in comfort level		
**Multiple responses		

3.7.6 Satisfaction with the Program

The program achieved a very high level of satisfaction. Indeed, nearly all participants were very satisfied (60%) or satisfied (35%) with the program overall. Participants who were not satisfied indicated that the time period given to complete the upgrades was too short, there were problems with the pre- or post-retrofit report, or that it was difficult to schedule or long before having an appointment with the EA.

Table 16: Satisfaction with the Program

Satisfaction with the Program	2011	2012
<i>Sample Size</i>	<i>70</i>	<i>80</i>
Very satisfied	61%	60%
Satisfied	29%	35%
Neither satisfied nor dissatisfied	6%	1%
Dissatisfied	3%	3%
Very dissatisfied	1%	--
Don't know	--	1%

Respondents were asked about their satisfaction with specific aspects of the program. The results showed a very high level of satisfaction. Indeed, all participants were satisfied with the courtesy of the EA, and the vast majority were satisfied with the first energy assessment, its scheduling and timing, the information provided by the EA, the report, the courtesy of office staff, the final energy assessment and its scheduling and timing. In addition, most participants were satisfied with the rebates provided by the program overall (85%) and with the time frames allotted for upgrade completion (82%).

Table 17: Satisfaction with Specific Aspects of the Program

Satisfaction with Specific Aspects of the Program*	2011	2012
<i>Sample Size</i>	70	80
Courtesy of EA	99%	100%
First energy assessment overall	99%	96%
Scheduling and timing of the first assessment	97%	96%
Information provided by EA	97%	96%
Report received about homes' current energy use and recommendations	96%	96%
Final energy assessment overall	94%	96%
Courtesy of Service Provider or Service Organization office staff	n/a	95%
Scheduling and timing of the final assessment	96%	94%
Rebates provided by the program overall	86%	85%
Time allotted to complete upgrades	n/a	82%
*Respondents giving a rating of "Very satisfied" plus "Satisfied"		

In addition to these satisfaction levels with specific aspects of the program, nearly all participants were satisfied with the measures that were implemented through the program (94%).

Table 18: Satisfaction with Energy Efficiency Measures

Satisfaction with Energy Efficiency Measures	2011	2012
<i>Sample Size</i>	70	80
Very satisfied/satisfied	96%	94%

3.7.7 Recommendations for Improvements

In terms of recommendations for improvements, almost one half of participants were unable to offer any suggestions (49%), indicating that, in general, there are few issues with this program. That said, a small number of participants would like to see more information on the measures recommended (11%), increased rebates (11%), a longer time period to complete the implementation (10%), more products/measures eligible for rebates (10%) or increased advertising about the program (10%).

Table 19: Recommendations for Improvements

Suggestions*	2011	2012
<i>Sample Size</i>	70	80
Offer more information on the products/measures recommended	14%	11%
Increase rebates/give bigger rebates	7%	11%
Increase the period given to complete the implementation	9%	10%
Offer more products/measures eligible for rebates	6%	10%
Advertise the program more or in a better way	1%	10%
Improve communication	3%	5%
More information to accompany rebate/incentive cheque	--	3%
Complete the first or final assessment sooner	3%	1%
Others	11%	13%
No recommendations	50%	49%
*Multiple responses		

Four in ten participants (40%) indicated they would like more information when they receive the rebate or incentive cheque, while six in ten participants (60%) did not express the need for more information. When asked about the type of information they would like to receive, one half of the participants (50%) who required more information indicated that they would like more detail on the measures that would get a rebate or a breakdown of the rebate calculation. Approximately two in ten would like to see energy savings tips (17%) or more information on other programs or measures that are available (17%).

Table 20: Specific Information Would Like to See with Rebate/Incentive Cheque

Specific Information*	2012
<i>Sample Size**</i>	<i>24***</i>
More detail on what measures would get a rebate/Break down of the rebate calculation	50%
More energy saving tips	17%
Other programs/measures available	17%
Others	4%
Don't know	17%
*Multiple responses	
**Respondents who would like more information with rebate/incentive cheques	
***Sample size lower due to programming error	

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation is aimed at determining the gross and net savings of the program for 2012. As explained in Section 1, HEA implementation started in April 2012 and can be seen as a modification of the EEH program. HEA includes only building envelope measures whereas EEH also promoted a series of prescriptive measures. Since both programs were running in 2012, the impact evaluation needs to consider the savings from both programs. Savings from the EnerGuide point increase (building envelope upgrades) and those from prescriptive measures are presented in this section.

Both energy and demand savings were considered in this evaluation. To do so, Econoler analyzed the following parameters:

- > HOT2000 simulations;
- > prescriptive measure savings from the old EEH program;
- > free-ridership; and
- > internal spillover.

The impact evaluation was essentially based on a comparative analysis of the tracking sheet and a billing calibration. More specifically, the review of the tracking sheet included an analysis of energy savings for each prescriptive measure and an assessment of how the savings were calculated per EnerGuide point. The analysis of 172 simulation results and their respective electricity billing was used to calibrate the simulation results and estimate gross energy savings more realistically.

In addition, the participant survey provided information to calculate the net-to-gross ratio (NTGR) for this program, including free-ridership and internal spillover. The NTGR established was used to calculate net savings.

4.2 GROSS SAVINGS

The final tracking sheet provided by ENSC for 2012 contained a total of 1,839 participants. These participants were bundled with 811 participants from LIHS to calculate the energy savings per EnerGuide point value to be used for both programs. The incremental energy savings per EnerGuide point (hereafter referred to as “savings per EnerGuide point”) along with the savings from prescriptive measures are needed to calculate gross savings. The methodology for evaluating these elements is described in the following sections.

4.2.1 Savings per EnerGuide Point

ENSC calculates a portion of the program’s energy savings linked to building envelope using an incremental savings coefficient per increase of EnerGuide point (also referred to as “savings per

EnerGuide point”). The difference between initial (D audit) and post-retrofit (E audit) simulation ratings was used to calculate the increase in EnerGuide points. For this calculation, ENSC used an energy savings of 817 kWh per EnerGuide point, which came from the 2011 EEH program evaluation report.

For 2012, the Evaluator elected to proceed with an evaluation approach similar to the one completed in 2011, but with a larger sample size and specific to the space heating savings only (as opposed to considering the whole household consumption). The next sections describe the methodology followed by Econoler to define the energy savings per EnerGuide point for 2012.

Data Processing

In the 2012 tracking sheet, ENSC collected information on the initial and final EnerGuide ratings but did not receive any information on the annual electrical consumption provided in the HOT2000 simulations. Since this information was required to assess the savings achieved per EnerGuide point, ENSC asked NRCan to provide Econoler with a file containing the initial and final annual energy consumptions of all the 2012 LIHS and HEA participants.

The requested information was provided by NRCan for a total of 5,839 LIHS and HEA participants, which included electric and non-electric heating households. Upon merging all data together, participants were sorted to consider only those for whom all the required information was available. More particularly, Econoler kept only the participants that satisfied the following criteria:

- **Participants from the tracking sheet that could be matched to the projects from NRCan’s database:** Crucial information like the D and E audit numbers was missing for several projects in the LIHS tracking sheet, which prevented a successful match between both databases.
- **Participants that only used electric space heating:** Households must be only electrically heated to obtain a reduction in electricity consumption and allow for a comparison with electricity billings.
- **Participants for whom both initial and final EnerGuide ratings were available and consistent:** Projects with an EnerGuide rating that decreased or remained unchanged after project implementation were removed from the analysis.

Using the above criteria, 506 participants were kept for further analyses. After processing the data, Econoler compared these participants and the participant population to ensure that the analysis of savings per EnerGuide point and the billing calibration are conducted on a representative sample.

EnerGuide Rating

The 506 participants selected by Econoler were used to analyze the average space heating energy savings per EnerGuide point through the comparison of D and E simulation results. Since the majority of EnerGuide rating savings came from space heating load decrease, Econoler decided to calculate the savings per EnerGuide point only from the space heating reduction observed between pre- and

post-retrofit simulations. This approach was more precise, since it removed possible mistakes entered for the base load and domestic water heating energy consumption in the HOT2000 simulations. The EnerGuide points of all 2012 participants were available in the tracking sheet, while the annual electrical energy consumption data from the HOT2000 simulations were provided by NRCan.

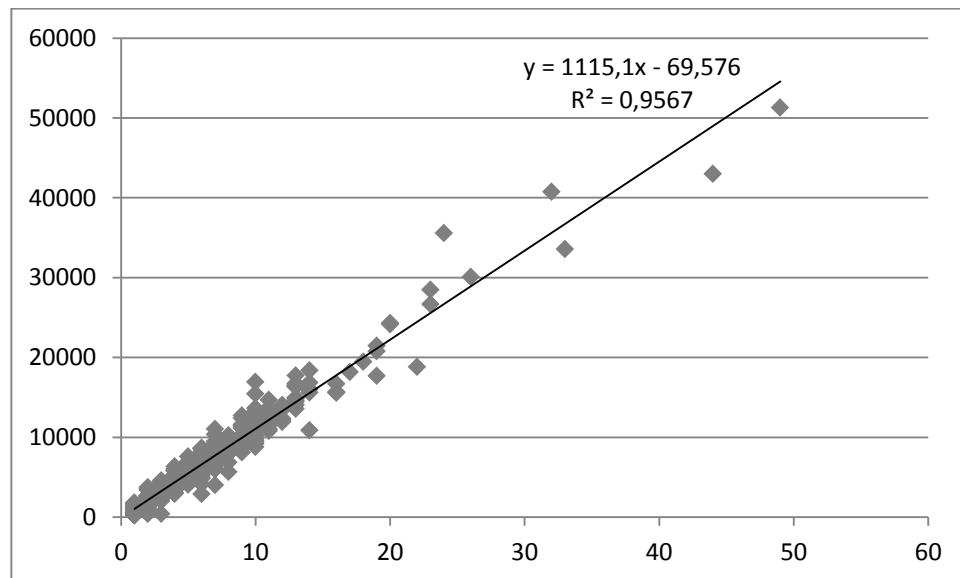
To avoid giving more weight to any of the participants, Econoler calculated the average savings per EnerGuide point of each participant before summing all values. At the end, Econoler computed the overall average of each participant's unitary savings value per EnerGuide point, as shown in the next table.

Table 21: Calculation of Average Savings per EnerGuide Point from HOT2000 Data

Description	Values and Units
Average increase of EnerGuide point per participant	From 1 to 49
Average space heating savings per participant	From 211 to 51,301 kWh/year
Average space heating savings per EnerGuide point, per participant	From 143 to 1,869 kWh/year
Overall average savings per EnerGuide point, for all sample participants	1,074 kWh/year

As per the above table, Econoler estimated the overall value of savings per EnerGuide point at 1,074 kWh/year, using data from all sample participants. This is quite similar to last year's result of 1,089 kWh/year. For the sake of improving the precision of the previous analysis, Econoler conducted a linear regression analysis, based on the space heating savings between the D and E audits of all sample participants as a function of the respective incremental EnerGuide rating of each participant. The next figure features the results of this regression analysis along with the calculated linear equation for estimating the simulated space heating savings of a residential building in relation to its EnerGuide rating improvement.

Figure 2: Linear Regression Analysis between the Incremental EnerGuide Rating and Space Heating Savings



This linear regression was established using 506 points (one point per participant). The coefficient of determination R^2 (0.957) showed that this regression is statistically acceptable (over 0.75) and thereby likely representative of the population. In addition, the t-statistic of the slope of the curve is 105, which shows that the estimated coefficient (1,115.1) is relevant and that there is a significant relationship between the energy consumption (y) and the EnerGuide rating increase of the corresponding house (x). For this type of analysis, the absolute value of the t-statistic should be 1.98 or higher to show a significant relationship between y and x at the 5 percent significance level.

Moreover, the Evaluator found that the regression coefficient for 2012 (1,115 kWh) was almost equal to the EnerGuide savings per point calculated in 2011 (1,074 kWh). However, the Evaluator wants to put into perspective the following considerations with regard to the regression analysis of 2012:

- > The linear equation is considered representative for the range of data used for performing the regression analysis; i.e., for EnerGuide ratings improvement ranging from 1 to 49.
- > Out of this range, the linear equation can be considered good for estimating energy consumption values with a more significant uncertainty level. It is worth noting that 92 percent of all EnerGuide rating values for the overall population are located inside the range of 1 to 49.

Since the statistical parameter R^2 confirms that the linear regression coefficient is acceptable and that the number of participants considered is high, the Evaluator decided to use the linear regression value of 1,115 kWh per EnerGuide point.

Calibration of Simulation Results

To evaluate the accuracy of the results obtained from the HOT2000 simulations, a billing analysis was performed over 416 participants (94 from LIHS and 322 from HEA). These program participants corresponded to projects that strictly use electricity for space heating and were people for whom Nova Scotia Power Incorporated (NSPI) could provide billing data. By conducting a billing analysis on these specific participants, the Evaluator was able to compare the heating consumption calculated by HOT2000 under the D audit simulations with the real space heating consumption of the selected households, taken from NSPI billing data before project implementation.

The regression model used for the billing analysis follows the Princeton Scorekeeping Method (PRISM). This standard statistical method calculates a regression specific to each participant instead of analyzing all data as a whole. The linear regression model of the daily electricity consumption is expressed by the following equation:

$$\text{CONS} = A + (B \times \text{HDD})$$

Where:

CONS = Average daily consumption;

A = Daily base consumption constant;

B = Unitary consumption coefficient per Heating Degree Day (HDD);

HDD = Average daily HDDs.⁷

The daily base consumption constant (A) represents the everyday electric consumption which does not vary in relation to the outdoor temperature (i.e., the HDDs). Examples of equipment that are part of the daily base consumption are lights, appliances, domestic hot water (DHW) heaters and various electronic devices. On the other hand, the unitary consumption coefficient (B) is defined as the electric consumption that varies according to the outdoor temperature, i.e., electricity consumption due to space heating.

One full year of billing data was needed before the D audit date to perform the analysis. Thus, participants for whom one full year of billing data was not available were dropped from the analysis, reducing the initial sample size of 416 participants to 348 participants.

⁷ For a given day, the number of HDDs corresponds to the number of degrees Celsius below a critical threshold heating need, 18 °C in this case. When the outside temperature for a given day is greater than or equal to this threshold, the number of HDDs is set to "0" for that day.

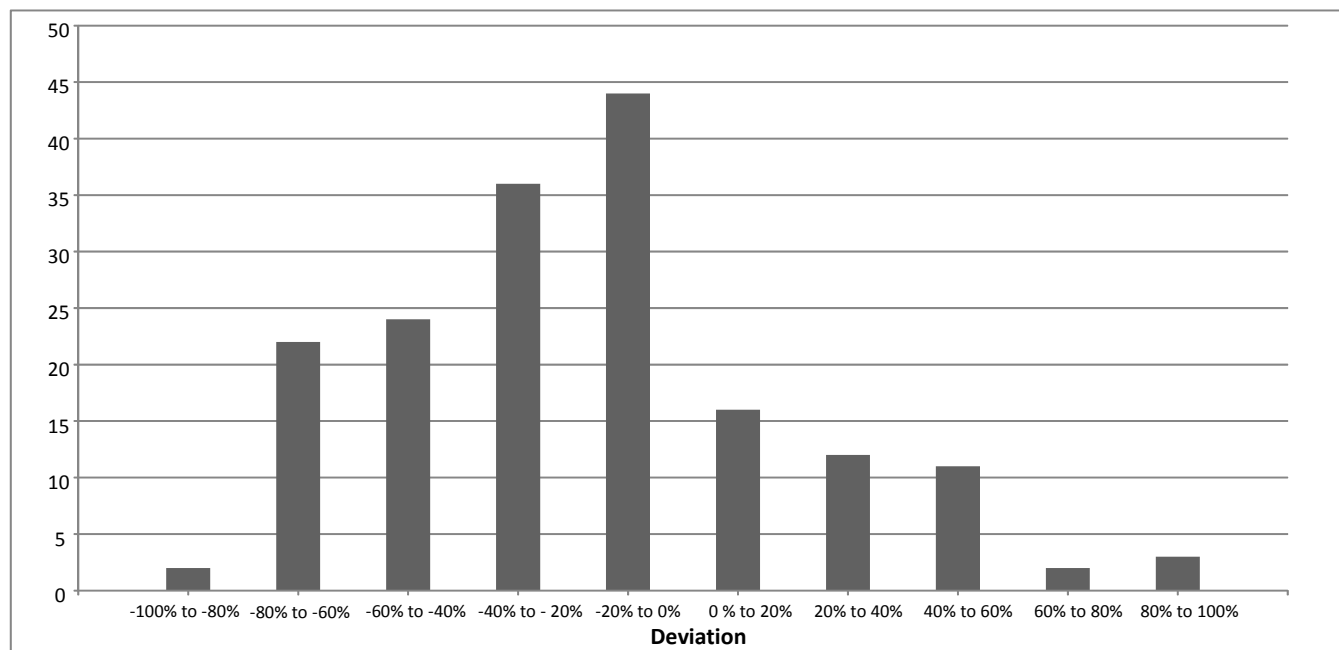
Subsequently, the pre-retrofit consumption data were analyzed using the linear regression model presented above. For each participant, the values of the constant A and the coefficient B were calculated. Further to this analysis, some participants were rejected for the following reasons:

- > non-significant correlation of the unitary consumption coefficient with the HDDs;
- > negative unitary consumption coefficient (B);
- > negative daily base consumption constant (A).

For each remaining participant, the space heating proportion was calculated using the annual average HDDs based on each participant's geographical region. It should be noted that the annual average HDDs used were normalized over a 30-year period (1971 to 2000) and are the same values used by HOT2000. Once the normalized heating consumption was calculated using the billing data, a comparison was made with the heating consumption figures estimated by HOT2000 and provided by NRCan. This comparison analysis was completed with a total of 172 participants and showed a wide variation between the simulated and real heating consumptions, being overestimated by 100% in some cases and underestimated by 100% in other cases.

The following figure shows the distribution of the difference between the normalized real electric heating consumption and their simulated counterparts.

Figure 3: Deviations of the Normalized Billing Heating Consumption from HOT2000



The average deviation of energy consumption from HOT2000 simulations was an overestimation of 18 percent. Therefore, Econoler applied an adjustment factor of 18 percent when calibrating the

simulated savings per EnerGuide point value of 1,115 kWh, defined in the previous section. This calibration adjustment resulted in a final EnerGuide point savings value of **914 kWh**.

4.2.2 Prescriptive Measure Savings

Projects that were finalized in 2012 as part of the EEH program included prescriptive measures. Similar to the approach used for the 2011 evaluation, the same four prescriptive measures have to be evaluated separately from the EnerGuide point analysis. Their gross savings will be calculated using a unitary savings value for each project in which these measures are implemented. In addition, since the Evaluator changed the methodology for calculating the EnerGuide point savings by focusing only on space heating savings for 2012, DHW measures are no longer reflected in the savings per EnerGuide point. Econoler has since decided to add solar DHW systems as a new prescriptive measure for this year's evaluation, bringing the number of prescriptive measures to five.

The next sections present the analysis conducted by Econoler to validate the unitary savings values to be used for each prescriptive measure.

Solar DHW Systems Connected to Electric Water Heater Tanks

ENSC does not use a unitary savings value for this product since it is covered by the HOT2000 simulations and included in the EnerGuide point savings. As explained before, the new approach used by the Evaluator to calculate EnerGuide point savings excludes savings from domestic hot water measures. Consequently, a unitary savings value needs to be used for this year's evaluation.

Econoler calculated an average unitary savings value for this measure by analyzing the Solar tracking sheet. Indeed, since this measure was transferred into Solar for all participants who applied after January 28, it is possible to analyze the type of products installed by participants who applied through EEH or Performance Plus. From this analysis, the Evaluator calculated an average unitary savings value of 2,234 kWh. This unitary savings value will be used to calculate the gross savings of this prescriptive measure for 2012.

Drain Water Heat Recovery (DWHR)

For this product, ENSC uses a unitary savings value of 805 kWh per year for each installed system. This value is calculated using the online calculator from the Center for Energy Advancement through Technology Innovation (CEATI).⁸ In more detail, ENSC estimates that the average household uses 2 showers per day at 8 minutes per shower. The estimated shower flow is 9.5 litres per minute, which

⁸ Center for Energy Advancement through Technology Innovation (CEATI), "Drain Water Heat Recovery Energy Savings Calculator," Web, February 6, 2013, <<http://www.ceati.com/calculator/>>.

is based on the maximum rated flow for showerheads in the building code. For the water temperature calculations, ENSC uses Halifax groundwater temperature and a shower temperature of 41°C.

Econoler considers that the unitary savings value of 805 kWh is appropriate for estimating the savings generated by the installation of a DWHR system.

Electric Hot Water Heater Pipe Insulation

The EEH program proposed the installation of water heater pipe insulation where the domestic hot water is electrically heated. For this product, ENSC uses a unitary savings value of 74 kWh. This value was used for the 2010 and 2011 evaluations of EEH, based on an insulated pipe 10-feet long and 0.75 inches in diameter, which were considered as a common length and size in residential applications.

Using the detailed assumptions used in the 2011 OPA Prescriptive Measures and Assumptions report, Econoler observed that the unitary savings value of 74 kWh used by ENSC corresponds approximately to the value calculated for 6 feet of insulation.

Table 22: Unitary Savings Values by Length of Insulated Pipe

Length of Insulated Pipe	Unitary Savings Value
3 feet	38 kWh/year
6 feet	76 kWh/year
9 feet	114 kWh/year
12 feet	152 kWh/year
15 feet	190 kWh/year

While three feet seems to be a common length when purchasing pipe insulation, the length of pipe insulated for residential applications typically varies between 6 and 15 feet, according to the literature. The length of pipe that can be insulated in a house is often limited, since the largest portion of the pipes is hidden in the walls. In the savings calculation, it is assumed that the pipe insulation is installed immediately downstream of the hot water storage tank, where most of the heat loss would occur. Moreover, the general equation used to calculate the energy savings cannot be used on an infinite length of insulated pipe, since it assumes that the water temperature is uniform throughout the insulated portion of the pipe.

For this year's evaluation, since no information on the length of insulation installed was collected in the tracking sheet, Econoler will use a unitary savings value of 76 kWh per year, based on the OPA report and a six-foot insulated pipe (compared to the 74-kWh value currently used and for which we do not have all the calculation details).

Electric Hot Water Heater Tank Wraps

For this product, ENSC does not consider unitary savings, since the EnerGuide point savings value calculated for the 2011 EEH program evaluation took hot water heater tank wraps into account.

As explained before, the new approach used by the Evaluator for 2012 to calculate EnerGuide point savings excludes savings from domestic hot water measures. Therefore, savings were calculated for all water tank wraps installed based on the unitary savings value of 270 kWh per year. This value was calculated using the conductance values of 1.429 W/°C for a heater without a tank wrap and of 0.6348 W/°C for an insulated heater with a tank wrap, as revealed in the 2011 OPA Prescriptive Measures and Assumptions report. This same value was also used in the 2011 EEH program impact evaluation report. After reviewing the assumptions and the engineering calculations used by the OPA, Econoler considers the unitary savings value to be appropriate.

Programmable Thermostats

For programmable thermostats, ENSC uses a unitary savings value of 221 kWh per year. This value comes from the 2011 EEH program impact evaluation report. It is based on the 2009 evaluation of Hydro-Québec's Residential Electronic Thermostats in New Construction program,⁹ in which energy savings generated by thermostat accuracy and temperature setback were estimated as presented below.

Table 23: Main Outputs from Hydro-Québec's Evaluation of Electronic Thermostat Savings

Calculation Parameters	Housing Type		
	Single Detached	Duplex/Triplex/ Townhouse	Apartment
Gross Energy Savings for Electronic Thermostat Accuracy			
Savings per Thermostat (kWh)	121	94	61
Gross Energy Savings for Temperature Setback with Programmable Thermostats			
Savings per Thermostat (kWh)	100	201	118

For the calculation of savings due to electronic thermostat accuracy, the percentages of savings were based on research supervised by Hydro-Québec's laboratory of energy technologies (LTE).¹⁰ The research used results from tests conducted in LTE's environmental chambers and in single-family homes that compared the operation of bimetallic thermostats with that of electronic thermostats and

⁹ Econoler, Évaluation du programme thermostats électroniques – Volet nouvelle construction au marché résidentiel, Final Report presented to Hydro-Québec, February 9, 2009.

¹⁰ Hydro-Québec – Laboratoire des technologies de l'énergie (LTE), Sommaire exécutif de rapports publiés par Hydro-Québec concernant les économies d'énergie dues aux thermostats électroniques, October 2004.

compared the consumption of houses with bimetallic thermostats with that of houses with electronic thermostats. The annual consumption for electric space heating was estimated through a billing analysis including 25,703 clients and 206,861 billing periods.

For the calculation of savings due to temperature setback, the savings per house resulted from a billing analysis regression which compared the consumption of houses with electronic thermostats and that of houses with programmable thermostats.

Since the information on the housing type was not available in last year's tracking sheet, the Evaluator chose to use the unitary savings value estimated for single-detached houses. This choice was conservative since single-detached houses represent a large portion of houses in the Nova Scotia market and since programmable thermostats installed in single-detached houses generate fewer savings than those installed in duplexes, triplexes or townhouses (221 kWh per year and 295 kWh per year respectively). In light of the above, Econoler estimated the total unitary savings value associated with the installation of a programmable thermostat at 221 kWh per year.

This latter value is still considered appropriate for estimating the savings generated by the programmable thermostats installed through the program.

4.2.3 Demand Savings

The demand savings of HEA are calculated using two different considerations. Firstly, Econoler calculated the demand savings for the program using a demand-to-energy ratio of 0.308 MW/GWh. This ratio was obtained from the adjusted 2012 program targets, by dividing the target peak demand savings (in MW) by the target energy savings (in GWh). The use of this ratio for demand savings calculations was also confirmed by ENSC.

Secondly, for the projects still approved under the EEH program, Econoler added the estimated amount of demand savings achieved through the installation of electric thermal storage (ETS) units. ETS units are systems that reduce electricity demand by storing heat during off-peak demand hours of the day and releasing it during on-peak hours. In the EEH program, three ETS measures were approved for implementation in residential buildings, namely ETS forced air furnaces, ETS central hydronic systems and ETS room units.

In 2011, Econoler revised the average demand savings used for each system and provided ENSC with the following annual demand savings for the installation of each type of ETS unit:

- > ETS forced air furnaces: 10 kW per project;
- > ETS room units: 4 kW per unit, up to 10 kW per project.

These savings were calculated by analyzing the installed heating capacity of a sample of 25 HOT2000 simulations. The results for the 25 D-audit models analyzed showed an average heating capacity of 12.5 kW. In addition to this maximum output heating capacity, Econoler considered a diversity factor of 80 percent in its ETS demand savings calculation. This value was estimated considering that the

installed heating systems in households usually have a higher capacity than the annual peak requirements (safety factor) and that the electric heating systems do not operate continuously but rather cycle over time. For the ETS units installed on forced air furnaces, Econoler therefore assumed the unitary peak demand savings to be 10 kW.

Regarding the ETS room units, Econoler decided to use a maximum unitary savings of 5 kW, considering that this type of system is likely to be installed in the largest rooms of the houses and thus would generate an important part of the potential demand savings of the buildings. Using the same diversity factor (80%), Econoler suggested using 4 kW per ETS room unit installed.

These savings values were still considered acceptable for 2012, so Econoler elected to keep them in its gross savings calculations.

4.2.4 Revised Gross Savings

Energy and demand savings for the program were revised to reflect the calibrated savings per EnerGuide rating point and the revised savings from prescriptive measures presented. For the calculation of savings at the generator level, Econoler used a line loss factor for the residential sector of 1.100, which takes into account transmission and distribution losses. This value was provided by NSPI.

Taking everything into account, the 2012 overall gross energy savings for HEA are estimated at 9.343 GWh at the meter and at 10.277 GWh at the generator respectively. Furthermore, the 2012 total gross peak demand savings for this program are respectively estimated at 3.082 MW at the meter and at 3.390 MW at the generator. The details of the total savings obtained for HEA are presented in the next table.

Table 24: Evaluation Results – Gross Energy and Demand Savings

Product Category	Savings per EnerGuide Point*	DWHR	Pipe Insulation	Tank Wraps	Program- mable Thermostats	Solar DHW Systems	ETS Forced Air Furnaces	ETS Room Units	Total
Energy Savings									
Number of Units	1,702	3	129	141	2,282	79	4	41	4,381
Unitary Energy Savings (kWh)	914	805	76	270	221	2,234	-	-	-
Total Gross Energy Savings – at Meter (GWh)	8.612	0.002	0.010	0.038	0.504	0.176	-	-	9.343
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Energy Savings – at Generator (GWh)	9.473	0.003	0.011	0.042	0.555	0.194	-	-	10.277
Demand Savings									
Unitary Demand Savings (kW)	-	-	-	-	-	-	10	4	-
Demand-to-Energy Ratio (MW/GWh)	0.308	0.308	0.308	0.308	0.308	0.308	-	-	-
Total Gross Demand Savings – at Meter (MW)	2.652	0.001	0.003	0.012	0.155	0.054	0.040	0.164	3.082
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Demand Savings – at Generator (MW)	2.918	0.001	0.003	0.013	0.171	0.060	0.044	0.180	3.390

* In the “Savings per EnerGuide Point” column, the number of units is in fact the number of participants for whom a D audit was conducted and for which the Evaluator calculated savings per EnerGuide point. The unitary savings value shown in this column is the savings per EnerGuide point figure calculated through this year’s impact evaluation.

4.3 INTERACTIVE EFFECTS

In a residence, interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements, such as heating and cooling. In the case of pipe insulation and hot water tank wraps installed through the old EEH program, interactive effects of -100 percent were considered during the heating period in electrically heated houses. This estimate is based on the fact that when there is no insulation, all the heat lost through the pipes and hot water tank is released into the room. It means that 100 percent of the energy released from the hot water is used for the heating load. Conversely, during the cooling period, interactive effects are estimated at +100 percent in houses that use air conditioning. Based on the heating and cooling degree days for the region of Halifax,¹¹ Econoler considered an eight-month period of heating and a two-month period of cooling in the interactive effects calculation.

The table below presents the details for the calculation of interactive effects for water pipe insulation and hot water tank wraps. The table shows the average percentage of electric heating in the participants' houses¹² and the proportion of residences in Nova Scotia that use air conditioning units or systems.¹³ This calculation resulted in a weighted interactive effects factor of -28.1 percent.

Table 25: Interactive Effects Factor for Pipe Insulation and Hot Water Tank Wraps

Parameters	% of Residences	Interactive Effects During Heating Period	Interactive Effects During Cooling Period
Electric Baseboard Heating With Air Conditioning	$33\% \times 18\% = 5.9\%$	$-100\% \times 8/12 = -67\%$	$+100\% \times 2/12 = +17\%$
Electric ASHP or GSHP Heating With Air Conditioning	$53\% \times 18\% = 9.5\%$	$-25\% \times 8/12 = -17\%$	$+100\% \times 2/12 = +17\%$
Electric Baseboard Heating Without Air Conditioning	$33\% \times 82\% = 27.1\%$	$-100\% \times 8/12 = -67\%$	$0\% \times 2/12 = 0\%$
Electric ASHP or GSHP Heating Without Air Conditioning	$53\% \times 82\% = 43.5\%$	$-25\% \times 8/12 = -17\%$	$0\% \times 2/12 = 0\%$
No Electric Heating With Air Conditioning	$14\% \times 18\% = 2.5\%$	$0\% \times 8/12 = 0\%$	$+100\% \times 2/12 = +17\%$
No Electric Heating Without Air Conditioning	$14\% \times 82\% = 11.5\%$	$0\% \times 8/12 = 0\%$	$0\% \times 2/12 = 0\%$
Weighted Interactive Effects Factor	100%	-31.1%	3.0%
		-28.1%	

For all other products installed, interactive effects were considered to be negligible.

¹¹ RETScreen International, Normalized climate data for Halifax International Airport, Natural Resources Canada, 1997-2010.

¹² From the 2012 tracking sheet.

¹³ Statistics Canada (CANSIM), Households having air conditioning, Nova Scotia, 2009.

4.4 NET-TO-GROSS RATIO

The NTGR evaluation of the program is based on a self-report approach which relies on a series of questions designed to measure the influence of the program on participants' decision to implement program-eligible energy efficiency measures. These questions were included in the participant survey.

This section presents the methodology used to transform responses to NTGR survey questions into a NTGR. For the program, the NTGR includes the assessment of two distortion effects: free-ridership and internal spillover. Once each effect is quantified, the NTGR is calculated based on the equation below.

$$NTGR = (1 - \% \text{ free-ridership} + \% \text{ internal spillover})$$

4.4.1 Free-Ridership

In the case of HEA, free-ridership can occur when participants would have still implemented the energy efficiency measures in the absence of the program. The free-ridership level for this program was measured through participant surveys. The questionnaire included six questions that intended to assess:

- > whether participants had any plans to implement energy efficiency measures before participating in the program;
- > the probability that participants would have implemented the same energy efficiency measures if they had not participated in the program;
- > the probability that participants would have installed standard equipment instead of energy-efficient equipment if they had not participated in the program;
- > the probability that participants would have implemented the same energy efficiency measures but at a later date if they had not participated in the program;
- > the probability that participants would have paid the full cost of the energy efficiency measures implemented through the program if it had not been in place; and
- > the influence of the program on participants' decision to implement energy efficiency measures.

Each group of questions was transposed into a level of program attribution, which was used to calculate the global free-ridership level for each participant. The algorithm behind this calculation is presented in Appendix VII.

Using this approach, survey results revealed a free-ridership level of 30 percent for the program. This free-ridership level is similar to that obtained during last year's evaluation, i.e., 31 percent. This year's free-ridership level was first weighted considering the proportion of HEA and EEH participants from the survey and then adjusted according to the savings found in the final tracking sheet for each program. This result shows that HEA and EEH influenced 70 percent of the energy efficiency measures implemented in 2012.

4.4.2 Internal Spillover

The participant survey was also used to assess internal spillover. In the case of HEA, internal spillover can occur when participants, following their previous participation, implement additional energy efficiency measures that were recommended in their initial energy assessment. When such was the case, additional questions were used to identify the additional energy efficiency measures implemented and to verify their validity by asking whether participants benefited from rebates from other ENSC programs. Subsequently, other questions were asked to quantify the level of influence the program had on their decision to implement these additional measures. Depending on the level of influence obtained during the survey, a portion of the savings related to the additional measures was attributed to the program.

The level of internal spillover was calculated for each participant according to the equation below. The energy savings (kWh) associated with the additional energy efficiency measures are estimated using the savings estimations provided in the tracking sheet.

$$\%SO = \frac{kWh \text{ associated with the additional measures} \times \text{attribution level}}{kWh \text{ associated with the program participation}}$$

The 2011 evaluation captured an internal spillover level of 1 percent for this program. This year, the impact evaluation did not reveal any internal spillover. Only three participants out of the 80 surveyed declared having implemented additional energy efficiency measures in their house following their previous participation in the program. Moreover, the energy savings associated with these additional measures were calculated and ended up being negligible. Therefore, for the 2012 program impact evaluation, Econoler does not consider any internal spillover level in its calculations.

4.4.3 NTGR Calculation

Using the free-ridership level established and considering that the internal spillover is nil, the NTGR value for the program is estimated at 0.70. This value is applied to the gross savings.

4.5 NET SAVINGS

The net savings for the program were estimated using the interactive effects factors and the NTGR above. The equation below was used to calculate the net savings.

$$\text{Net savings} = \text{Gross Evaluation Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

This equation was used for both demand and energy savings. The results obtained are presented in the following table.

Table 26: Evaluation Results – Net Energy and Demand Savings

Product Category	Savings per EnerGuide Point	DWHR	Pipe Insulation	Tank Wraps	Program- mable Thermostats	Solar DHW	ETS Forced Air Furnaces	ETS Room Units	Total
Energy Savings									
Total Gross Energy Savings – at Meter (GWh)	8.612	0.002	0.010	0.038	0.504	0.176	-	-	9.343
Interactive Effects Factor	0%	0%	-28.1%	-28.1%	0%	0%	-	-	-
NTGR	0.70	0.70	0.70	0.70	0.70	0.70	-	-	-
Total Net Energy Savings (GWh) – at Meter	6.028	0.002	0.005	0.019	0.353	0.124	-	-	6.531
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	-	-	-
Total Net Energy Savings (GWh) – at Generator	6.631	0.002	0.005	0.021	0.388	0.136	-	-	7.184
Demand Savings									
Total Gross Demand Savings – at Meter (MW)	2.652	0.001	0.003	0.012	0.155	0.054	0.040	0.164	3.082
Interactive Effects Factor	0%	0%	-28.1%	-28.1%	0%	0%	0%	0%	-
NTGR	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
Total Net Demand Savings (MW) – at Meter	1.857	0.001	0.002	0.006	0.109	0.038	0.028	0.115	2.154
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Net Demand Savings (MW) – at Generator	2.042	0.001	0.002	0.006	0.120	0.042	0.031	0.126	2.370

The Evaluator compared the net energy savings values calculated in the previous table with HEA tracked net savings for 2012. The next table details the final evaluated and tracked impacts for 2012.

Table 27: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	9.177 GWh	9.177 GWh	0.70	6.424 GWh
Evaluation Results	10.277 GWh	10.262 GWh	0.70	7.184 GWh
Demand Savings				
Tracked Savings from ENSC	3.051 MW	3.051 MW	0.70	2.136 MW
Evaluation Results	3.399 MW	3.161 MW	0.70	2.370 MW

The net savings tracked by ENSC were compared with the evaluated savings for 2012. Both the energy and demand savings calculated for this evaluation are higher than the tracked savings, by 12 percent and 11 percent respectively. For the energy savings, this difference can be explained mainly by the adjustment made to the gross energy savings per EnerGuide point, from 817 kWh to 914 kWh saved per EnerGuide point. This adjustment came from a review of more than 500 participants and a calibration on the savings from a billing analysis of 172 participants. This approach used a much bigger sample size than that used in 2011 and is more precise. Furthermore, since the energy savings per EnerGuide point was only calculated from the heating consumption reduction, solar DHW systems and DHW tank wraps were accounted as prescriptive measures, whereas ENSC considered those measure included in the savings per EnerGuide point.

With regard to net demand savings, the Evaluator made a small adjustment to ENSC's tracked savings by taking into account the unitary peak demand savings related to the installation of ETS systems.

CONCLUSION

The 2012 evaluation of HEA demonstrated that the program underwent a series of changes that altered its design and implementation. In addition to the withdrawal of the federal government from the program, modifications were made to the former EEH program concerning the types of measures eligible for rebates. Indeed, all former measures related to mechanical heating systems were removed from the list of rebated measures and transferred into Fuel Substitution, as well as other programs such as Instant Savings and Solar. HEA now focuses on insulation measures related to the building envelope.

The Evaluator found major improvements to the program since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving little time to follow up on all the process and impact recommendations before the new evaluation window, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Moreover, additional efforts were made in program promotion and communication.

Furthermore, one of the recommendations from the 2011 evaluation report was to strengthen the relationship between the DAs and ENSC by notifying the DAs in advance of any major modifications to the program or consulting with them on potential measures to be included in the program. The interviews revealed that there is still improvement to be made in terms of communication.

A great majority of the partners reported the near absence of collaboration and support from NRCan to the program after the training activities. Moreover, EAs talked about the issues regarding the current management of the HOT2000 software by NRCan. They reported that the software still contained several deficiencies and that NRCan should grant more human resources to finally fix this issue.

When asked about the program marketing and outreach activities, the majority of the program partners stated that they were happy with this year's improvement and proposed continuing aggressive ongoing marketing with a consistent message. For additional improvement, offering more information on the measures provided through the program still came out as one of the main recommendations suggested by program participants surveyed through this year's evaluation.

The program totalled 1,839 participants for the year 2012, which is an increase compared to last year (1,494 participants in 2011). The evaluation revealed that HEA generated net energy savings of 7.184 GWh and demand savings of 2.370 MW at the generator in 2012, compared to 4.805 GWh and 1.543 MW in 2011. Econoler estimated the gross savings of HEA in 2012 through a comparative analysis of information available in the tracking sheet, a billing calibration with 172 participants and the review and proper adjustment of prescriptive measure savings from the old EEH program. Moreover, Econoler took into consideration the free-ridership and internal spillover measured as part of the participant survey. It is to be noted though that no internal spillover was found in 2012.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Strengthen the relationship with the DAs: The interviews with the DAs revealed that there is still improvement to be made in terms of communication between ENSC and the DAs. These improvements include notifying the DAs in advance of any major modifications to the program or consulting with them on potential measures to be included in the program. On this matter, the PM agrees that any modification to the program along with its justification should be communicated to the DAs in advance, so they can be better prepared to support the program. The Evaluator strongly supports an open and constant communication channel as well as strong cooperation between ENSC and the DAs. Therefore, Econoler encourages any means of communication that would allow information to be better transferred between the two parties. The launch by ENSC in 2013 of a Trade Allies Internet portal is a step in the right direction towards better communication with the DAs.
	2. Consider the possibility of providing technical support for HOT2000: A great majority of the EAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies, and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee or employing an external expert to provide HOT2000 expertise to the EAs when needed. This expert would also be necessary for the HOT2000 simulation review presented in the following recommendation.

Executive Summary	3. Perform a continuous HOT2000 simulation review process: The review of 25 HOT2000 simulations proved that there was a high variability in the quality provided by the EAs. Most of the errors found were recurrent and attributable to the same EAs. While some of these issues were trivial, others substantially changed the EnerGuide rating being simulated by the software. Therefore, the Evaluator considers that a small sampling, with a focus on negative and low EnerGuide rating projects, should be reviewed by ENSC each year. This would help find and address potential errors in the on-site data collection and building simulations. Positive and negative feedback could then be given to the EAs, with a view to continuously improving their work. This HOT2000 simulation review process could also allow ENSC to identify any needs for additional training among the EAs.
Program Manual	4. Document major changes in the Document Revision section: In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual. For example, this section should briefly describe the retirement of NRCan incentives, any new incentive mechanism and the removal of ductless mini-split heat pumps from the list of eligible measures. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.
	5. Be consistent in program name formulation across all residential programs: ENSC increases focus on serving customers through a one-window service approach and is therefore planning to market all residential activities as services instead of programs. So far, this change has already been implemented for HEA, Low Income Homeowner Service (LIHS) and Multi-Unit Residential Buildings (MURB), which are now presented as services. The Evaluator recommends that consistency be maintained in the program names in internal and external documents (e.g., on the ENSC website). All activities should therefore be named only as a service or as a program, thus avoiding the confusion caused by two sets of names in the same portfolio. In a view to offer a one-window service approach, the program portfolio names should be planned carefully and globally, and not one program at a time. This latter approach would ensure that participants have all the necessary information to understand ENSC's offer, starting with the names of the different services. It would also prevent confusion among participants as to the difference between a service and a program, especially given that several programs already changed names a few times in the past.

Evaluation Plan	6. Adapt the evaluation plan template to meet program needs: Since HEA is an assessment program with specific savings for each recommended measure, the program Base Case (section 3) could be simplified by eliminating all lines in the table containing N/A. The table could start with the gross savings for each measure with the source of calculation and then keep only the lines that will be used to calculate the net savings (last line of the table) such as the different distortion effects, installation rates, etc. This would simplify the table.
Program Charts	7. Provide partners and participants with simplified process charts: The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well designed. Moreover, the partners should be given copies of their process chart. After all, since these charts are intended for the partners and the participants, they must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version date should be indicated in each chart.
Marketing and Outreach Activities	8. Make the performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.
Tracking Sheet	9. Add the utility account number: For the impact evaluation of HEA, a HOT2000 calibration is required to calibrate the energy consumption obtained from the simulations. A comparison between simulated and real consumption is performed to establish the final savings per EnerGuide point. For 2013, ENSC indicates that the waiver signed by participants was changed so that this information will be provided by the homeowner and made available in the tracking sheet.

Tracking Sheet	10. Add the percentage of electric heating: In 2011, the electricity savings were calculated by the Evaluator based on the percentage of space heating load delivered by electricity. This information was available from the EDSM form filled out by participants. For 2012, EDSM forms were filled out by only a portion of participants, so ENSC uses 100 percent when the main heating system is supplied by electricity and 0 percent when it is supplied by other fuel. For 2013, ENSC indicates that the waiver signed by participants was changed so that this information will be provided by the service organizations and made available in the tracking sheet. 11. Set limitations for entries and develop a validation process: To ensure that correct values are entered in the tracking sheet, a validation process should be developed by ENSC. This will ensure that values such as negative building envelope savings are not taken into account for the tracked gross savings, for example. 12. Track gross savings and net savings separately: ENSC should firstly calculate the gross savings for electrically and non-electrically heated houses. Secondly, based on these savings, the net savings can be determined using the net-to-gross ratio and the line loss factor for electrically heated houses.
On-Site Visits	13. Explain the values and content of the EnerGuide report: As mentioned before, the quality of the EnerGuide reports reviewed was very high. That being said, it is important that the EAs explain the values and content of these reports while still on-site. Usually, EnerGuide reports get sent to the homeowners in the weeks following the assessment. If clients are not informed of the potential benefits of the report, they may end up not even reading it. Therefore, EAs should always carry with them an example of an EnerGuide report, so they can show homeowners all the valuable information it contains, such as the EnerGuide rating, the air leakage rate, the equivalent leakage area, the list of recommended upgrades and all the many charts explaining energy consumption.

On-Site Visits	14. Improve EAs' knowledge of indoor air quality and moisture problems: NRCan guidelines specifically mention that it is the responsibility of an EA to determine if any actual or potential indoor air quality, health and safety, or ventilation issues exist in the home at the time of the initial evaluation. For instance, one of the houses assessed during the on-site visit process clearly exhibits evidence of air quality issues. However, the EA did not mention it in the report or even verbally to the homeowner. It is important to notify the client of any air moisture problems before the renovation work begins so that the problem can be addressed before new insulation material is installed in the walls and ceilings. In such cases, the EA should be able to provide the homeowner with a few basic guidelines on how to deal with indoor air quality issues. The "Energy Advisor Workshop" document published by NRCan and the Canada Mortgage and Housing Corporation (CMHC) website are two sources where the advisor and the homeowner can find valuable information about indoor air quality.
	15. Stress the importance of proper ventilation in airtight houses: In older houses, the function of the blower door test is to help identify air leakage areas. Newer homes are typically built to be very airtight. Consequently, the value of the blower door test is not so much to determine space heating cost reduction but rather to find out if the house is sufficiently ventilated. It is important that the EAs inform the owners of airtight houses that the blower door test results will be used to perform a calculation to determine whether the house requires additional mechanical ventilation. They should also let the homeowner know that the results of this test will appear in the EnerGuide report. Furthermore, EAs often recommend the installation of a heat recovery ventilator (HRV) among the proposed building upgrades. It is a good opportunity while on-site to give a few guidelines to the homeowner about HRVs, such as how they prevent many air quality and moisture issues in houses that are airtight.

APPENDIX II – INTERVIEW GUIDE WITH DELIVERY AGENTS

Program name: Home Energy Assessment

How to complete this form

This is a Word document that integrates some form features. To enter your answers, simply position your cursor on the shaded sections and begin typing. Since this is a form, you cannot write anywhere else in the document. For the boxes, just click on the one next to your answer. Click again to uncheck it.

Please complete this form within the next 48 hours, save the file and send it back to us at mlecuyer@econoler.com.

Thank you!

Part I: General Questions

Please indicate your company name.

Q1a. How would you describe your role(s) as an ENSC energy efficiency program partner?

Q1b. How long have you held that role/those roles (specify months or years)?

Q2a. How would you qualify your participation process in this program?

- ☐ Simple
☐ Complex

Q2b. If you checked “Complex,” please indicate which parts of your involvement or participation process have been the most complex.

Q3. On a scale from 1 to 10, where 1 is very poor and 10 is excellent, please rate your satisfaction in regard to the:

Aspects of the program	Score 1 = very poor 10 = excellent	Reason If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Program marketing and outreach activities		
Relationship with ENSC staff		
Relationship with other partners		
Other Service Organizations		
Natural Resources Canada		

Part II: Questions Specific to the Home Energy Assessment Program

Q4a. Regarding program on-course modifications, (change in eligible measures and amounts of rebates, program name change, end of federal component of the EnerGuide program etc.) do you feel they:

- ☐ Are easily adapted into the way you work
- ☐ Require minor changes in the way you work
- ☐ Require major changes in the way you work
- ☐ Not applicable/No program on-course modifications

Q4b. If you answered “Require major changes in the way you work,” would you say those major changes have caused problems in the way the program is managed or delivered?

- ☐ Yes
- ☐ No

Q4c. If you answered “Yes,” what have those problems been?

Q5. What is your opinion on the choice to focus the program only on insulation measures?

Q6. In your opinion, what are the main barriers to the delivery of the program, in order of importance?

Q7a. Approximately how many complaints have you received from participants thus far in 2012?

Number of complaints:

Q7b. What was the complaint/were the complaints about?

Q8. What suggestions do you have to improve program performance?

Q9. More precisely, what suggestions do you have concerning program marketing and outreach activities?

Thank you very much for your time and co-operation.

Your answers will be treated in strict confidence—no names will ever be mentioned in the evaluation report. Our hope is that these results will contribute to improving program performance. You may be contacted by phone if we need to clarify your answers.

Date	
Your name	
Area code and phone number	
Email	

APPENDIX III – INTERVIEW GUIDE WITH ENERGY ADVISORS

ENERGY ADVISOR INTERVIEW GUIDE EFFICIENCY NOVA SCOTIA HEA PROGRAM

September 28, 2012

INTRODUCTION

Hello, my name is _____, from Econoler. I am calling on behalf of Efficiency Nova Scotia Corporation for the Home Energy Assessment program.

[TO BE READ IF NECESSARY]

The program was formerly known as the “EnerGuide for Existing houses” program. Throughout the interview, I will refer to it as the “Home Energy Assessment” program.

IDENTIFICATION AND SCREENING OF RESPONDENT

I1. According to our records, you acted as a partner in the Home Energy Assessment program from Efficiency Nova Scotia in 2012. Econoler has been mandated by Efficiency Nova Scotia to conduct an evaluation of this program. We have a few questions about your involvement in the program.

Confidentiality

Please note that your responses will be kept strictly confidential and that we will not share the information you provide with any other party in a way that could identify your individual or corporate responses.

Recording of the Interview

Please note that the interview will be recorded for transcription purposes only. The recording will remain strictly confidential.

SECTION IN – INVOLVEMENT

The first questions will be about your involvement in the Home Energy Assessment program.

IN1. How would you describe your role(s) in the Home Energy Assessment program?

IN1a. How long have you held that role (specify months or years)?

IN2. How would you qualify your participation process in this program?

☐ Simple

☐ Complex

IN2a. If “Complex”, can you mention which parts of your involvement or participation process have been the most complex?

IN3. On a scale from 1 to 10 (where 1 is very poor and 10 is excellent), how would you rate your satisfaction in regard to the...?

Aspects of the program	Score 1=very poor 10=excellent	Reason If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Program marketing and outreach activities		
Relationship with ENSC staff		
Relationship with other program partners		
Your training as an energy advisor directly or indirectly from NRCan		
Performance or accuracy of the HOT 2000 software		

SECTION A – ASSESSMENT PROCESS

I will now ask you questions about the assessment process.

A1. Do you believe the EnerGuide methodology or approach is appropriate in the context of the program, or does it need to be altered to better suit the assessments you conduct as part of the Home Energy Assessment program?

[Ensure that the assessment protocol is explained to clients, that photographs of the house are taken and that the blower door test protocol is followed.]

A2. Are there any steps of the assessment process that are typically unnecessary or irrelevant, or that could be dropped?

A3. Conversely, are there any steps missing from the assessment process or any information that is not gathered before, during or after the assessment process, but that would be useful?

A4. Have you noticed some elements of the assessment process or protocol that are not well-understood by participants? If so, which ones?

[Ensure that additional information material, such as the booklet “Keep the Heat in”, is indeed distributed to clients.]

A5a. Do you think participants should be more informed...

- About the assessment process? ☐ Yes ☐ No
- About energy efficiency in general? ☐ Yes ☐ No
- About the impact the implemented measures will have? ☐ Yes ☐ No

A5b. [IF ANSWERED YES] How do you think participants should be more informed?

SECTION PM – PROGRAM AND MEASURES

The next questions will concern the measures promoted by the Home Energy Assessment program.

PM1a. The program now promotes only insulation measures to reduce heat loss in homes. Do you feel this program modification...

- ☐ Was easily adapted into the way you work?
- ☐ Required minor changes in the way you work?
- ☐ Required major changes in the way you work?
- ☐ Does not apply/No program on-course modifications

PM1b. Are there any energy efficiency upgrades that are not covered by the program that you would like to have covered through the program? If so, which ones?

PM2. Are there any program measures that are recommended but rarely implemented by participants? If so, which ones?

PM2a. What are the barriers to implementing those measures?

PM2b. What could be done to make sure participants implement all the measures that are recommended through the assessment report?

SECTION R – RECOMMENDATIONS

The last questions will allow us to help ENSC improve the Home Energy Assessment program.

R1. In your opinion, what are the main barriers to the delivery of that program by order of importance?

R2. Approximately how many complaints from participants have you received so far in 2012? NOT THE SO

Number of complaints

R2a. What was/were the complaint(s) about?

R3. What suggestions do you have to improve the program?

R4. More precisely, what suggestions do you have concerning the program marketing and outreach activities?

END: Those are all the questions I have for you today. Do you have anything to add regarding the program or this interview?

I thank you very much for your collaboration and the time you took to answer our questions.

APPENDIX IV – ON-SITE VISIT PROTOCOL

The others on-site visit protocols for Home Energy Assessment are attached in PDF format to this report.

AUDIT OF THE HEA PROGRAM / D and E EVALUATION

QUALITY ASSURANCE GRID (D Audit)

RELEVANCE AND ACCURACY OF OBSERVATIONS AND RECOMMENDATIONS MADE BY ADVISOR

The advisor made an effort to collect as much information as possible about the house components	/ 5
The advisor understood the different sections of the house and recorded each one with its specificities rather than oversimplifying	/ 5
The advisor's measurements of insulation levels and types were precise and accurate	/ 5
The advisor recorded the right number and type of windows and doors	/ 5
The advisor understands ventilation issues and the "house as a system " concept	/ 5
The advisor assumptions and recommendations about the heating system are accurate	/ 5
The advisor recommended the right type of insulation for the right purpose	/ 5
The advisor has a clear understanding of the "building envelope" concept and does not confuse parts of the house that are inside the envelope with those that are outside.	/ 5
The advisor did not forget to recommend any important improvement	/ 5
The advisor succeeded in establishing the recommendations that will have the strongest impact on the house energy consumption	/ 5
The advisor identified any abnormal moisture and air quality issues present in the house	/ 5
The advisor noted the presence or absence of exhaust fans (bathroom, kitchen, etc.) and verified if they function properly	/ 5
The advisor performed the Combustion Spillage Test as required due to the presence of a fuel burning appliance in the house	/ 5
The advisor carried with him the proper and functional equipment to successfully perform the assessment	/ 5
BLOWER DOOR TEST : the advisor succeeded in preparing the house for a proper blower door test	/ 5
BLOWER DOOR TEST : the advisor installed the blower door test equipment properly (manometer, pressure gages,)	/ 5
BLOWER DOOR TEST : the advisor identified the main air leakage areas	/ 5

ABILITY OF THE ADVISOR TO CONVEY HIS OBSERVATIONS TO THE CLIENT

The advisor explained his views in simple language which the client can easily understand	/ 5
The advisor made an effort to convince the client to undertake the recommended renovations	/ 5
The advisor has the ability to listen to the client concerns and to answer his/her questions	/ 5
The advisor was polite and made the client feel comfortable	/ 5
At the beginning of the evaluation, the advisor gave a clear summary of the energy assessment process to inform the client of what to expect	/ 5
The advisor explained what the ENERGUIDE RATING is	/ 5
The advisor explained what is included in the ENERGUIDE REPORT	/ 5
During the blower door test, the advisor showed the client the main air leakage areas and gave basic tips on how to seal them	/ 5
The advisor asked the client about his intentions, his concerns	/ 5
The advisor gathered information about the building's past renovations or issues, past moisture or air quality issues, etc	/ 5
The advisor explained the requirements and eligibility for grants to the client to ensure that the client knew what kind of grants he could expect and what information he needs to provide to receive the grants.	/ 5
The advisor made sure that the client understood the impact that air sealing reduction could have on the ventilation and moisture level and/or on combustion back spillage	/ 5
If applicable, the advisor explained the combustion spillage test result and gave advice on how to avoid combustion spillage	/ 5
The advisor explained the basics of mechanical and natural ventilation and stack effect	/ 5
The advisor contacted the client for the pre-assessment phone interview prior to going to the evaluation	/ 5
The advisor avoided recommending any particular contractor or brand.	/ 5
The advisor took into account the renovation work already planned by the owner	/ 5
The advisor gave a sense of priorities to his recommendations so that the client understood which of these will have the biggest impact.	/ 5
The advisor made an effort to convince the client of the importance of reading the report and that he is available to answer questions about the report	/ 5
The advisor indicated the effects that air leakage could have on energy bills and also on moisture issues such as intra-wall condensation	/ 5
The advisor submitted the report and etiquette to the client within 14 days	/ 5
SAFETY : the advisor made sure that all safety precautions were taken during the assessment	/ 5
The advisor respected the client's property, did not damage or dirty the house	/ 5

QUALITY AND PRECISION OF THE COMPUTER SIMULATION AND ENERGUIDE RATING

The data that was input in the HOT2000 simulation is consistent with the actual real measurements of the house	
The ENERGUIDE RATING given to the house is accurate	/ 5
The ENERGUIDE REPORT that was produced is accurate and contains the texts that are consistent with the recommendations	/ 5
BLOWER DOOR TEST : the advisor input all of the required data	/ 5
The total volume of the house was calculated accurately	/ 5
The walls and attic dimensions and insulation levels entered in the program are accurate	/ 5
The advisor took into account the different sections of the house without oversimplifying the modelization	/ 5
The energy consumption calculated is within the 3 percent acceptable	/ 5
Windows and doors were modeled correctly (right number, right elevations, etc.)	/ 5
The space heating and cooling, the hot water heating, as well as the ventilation systems type and efficiencies data is accurate	/ 5
The advisor used effective insulation values over nominal values for a more accurate modelization	/ 5
The advisor selected the proper foundation type(s) and took into account the different sections.	/ 5
The advisor made sure that the recommendations in the report are relevant and specifically apply to the building in question.	/ 5
The advisor submitted the basic required date-stamped pictures with his file, in the proper format and quality required	/ 5

FINAL RATING		

FILE NUMBER: _____

EVALUATOR: _____

ENERGY ADVISOR: _____

DATE OF AUDIT: _____

SERVICE ORGANISATION: _____

GENERAL NOTES:

DESCRIPTION OF THE AUDIT:

STRONG POINTS:

ASPECTS TO IMPROVE:

Although the advisor mention

FINAL COMMENT:

QUALITY ASSURANCE GRID (E Audit)

RELEVANCE AND ACCURACY OF THE INFORMATION COLLECTED BY THE ADVISOR

The advisor made a complete list of all of the relevant retrofits that were performed	/5
The advisor collected all of the relevant invoices and pictures to clearly identify what changes were made to the house efficiency	/5
The advisor made an effort to determine if the renovations done were done correctly and would not create moisture or air quality problems	/5
The advisor made an effort to verify, with his own eyes, the changes listed by the homeowner and not to rely only on client claims	/5
The advisor took all of the required pictures and ensured they were clear, of good quality and well named	/5
The advisor measurements of insulation retrofit(s) were accurate	/5
The advisor noted any changes that were made to the heating system since the first assessment	/5
Where insulation retrofits level vary throughout the house , the advisor noted the difference between these different sections and did not oversimplify the data collected	/5
The advisor identified any abnormal moisture and air quality issues present in the house	/5
Blower door test : the advisor took all the necessary steps to prepare the house for a proper blower door test	/5
Blower door test: the advisor installed all the equipment properly, including the manometer settings and the pressure gages	/5
Blower door test : the advisor conclusions about the air leakage rate are accurate	/5
Combustion spillage test : the advisor correctly performed the combustion spillage test	/5

ABILITY OF THE ADVISOR TO CONVEY HIS OBSERVATIONS TO THE CLIENT

At the beginning of the assessment, the advisor gave a clear summary of the energy assessment process so that the client knows what to expect.	/5
The advisor explained his views in simple language which the client could understand	/5
The advisor was polite and made the client feel comfortable	/5
The advisor was attentive to the client concerns and provided answers to his/her questions	/5
The advisor explained the requirements and eligibility in regards to grant applications	/5
The advisor made sure that the client signed all of the proper forms including the NRCAN Grant Application and the authorization form	/5
The advisor informed the client that he would receive a final rating and the importance of keeping it	/5
Blower door test : the client was informed of the new air leakage results	
Blower door test : the client was informed on the impact that the air sealing reduction could have on ventilation, moisture, and gas spillage issues	/5
If applicable, the advisor informed the client about the risk of combustion gas spillage and recommended the installation of a carbon monoxide detector	/5
The advisor encouraged the client to keep upgrading the efficiency of the house	/5
The advisor submitted the final etiquette to the client within 14 days	/5

QUALITY AND PRECISION OF THE COMPUTER SIMULATION AND ENERGUIDE RATING

The data that was input in the HOT2000 simulation is consistent with the actual measurements of the house	/5
The ENERGUIDE RATING given to the house is accurate	/5
The ENERGUIDE ETIQUETTE that was produced is accurate	/5
BLOWER DOOR TEST : the advisor correctly input all of the new data	/5
The combustion spillage test was readjusted with new results	/5
The advisor used effective insulation values over nominal values for a more accurate modelization	/5
When applicable, The advisor took into account the different sections of the house without oversimplifying his modelization	/5
The energy consumption calculated is within the 3 percent acceptable	/5

OTHERS

The advisor carried with him the proper functional equipment to successfully perform the assessment	/5
The advisor submitted the basic required date-stamped pictures with his file, in the proper format and quality required	/5
SAFETY : the advisor made sure that all safety precautions were followed during the assessment	/5
The advisor submitted a complete data form for the purpose of quality assurance	/5
The advisor left the house as clean as when he entered.	/5

Final Rating		

APPENDIX V – DEMOGRAPHICS

The profile of the program participants interviewed for the survey is presented in the following tables.

Most participants resided in homes that were single-family detached (88%).

Table 28: Type of Residence

Type of Residence	2011	2012
<i>Sample Size</i>	<i>70</i>	<i>80</i>
Single-family detached	94%	88%
Semi-detached	3%	8%
Mobile home or house trailer	--	3%
Townhouse or duplex	1%	--
Apartment with more than five stories	1%	--
Row house	--	--
Apartment with fewer than five stories	--	--
Don't know/Refused	--	2%

The majority of participants were in homes with at least 3 bedrooms (82%).

Table 29: Number of Bedrooms

Numbers of Bedrooms	2011	2012
<i>Sample Size</i>	<i>70</i>	<i>80</i>
1	--	3%
2	9%	15%
3	59%	43%
4 or more	33%	39%
Don't know	--	1%

Just over one-half of the participants were in households with 1 to 2 full-time residents (53%).

Table 30: Number of Full-Time Residents

Full-Time Residents	2011	2012
<i>Sample Size</i>	70	80
1	13%	8%
2	44%	45%
3	16%	23%
4	17%	16%
5 or more	10%	8%
Don't know	--	1%
Average*	2.7	2.8
*Don't know/Refused excluded from calculation		

One-third of the participants had a household income of \$80,000 or more (35%).

Table 31: Annual Income

	2011	2012
<i>Sample Size</i>	70	80
Less than \$15,000	--	--
\$15,000 to \$24,999	1%	6%
\$25,000 to \$34,999	9%	3%
\$35,000 to \$49,999	14%	18%
\$50,000 to \$69,999	11%	18%
\$70,000 to \$79,999	13%	3%
\$80,000 or more	41%	35%
Refused	10%	19%

Just under one-half of the respondents were 55 years of age or older (45%), and a further one-quarter were between the ages of 45 and 54 (23%).

Table 32: Respondent Age

Respondent Age	2011	2012
<i>Sample Size</i>	<i>70</i>	<i>80</i>
18 to 24	1%	--
25 to 34	7%	18%
35 to 44	23%	14%
45 to 54	26%	23%
55 to 64	26%	30%
65 or older	17%	15%
Refused	--	1%

Over one-half of the respondents had a university degree (55%), while two in ten had a college diploma (20%).

Table 33: Education

Education	2011	2012
<i>Sample Size</i>	<i>70</i>	<i>80</i>
Less than high school	1%	3%
High school graduate	19%	15%
Trade certificate	3%	4%
College diploma	17%	20%
University diploma	54%	55%
Others	3%	1%
Don't know	3%	3%

Two-thirds of the respondents were male (64%), and one-third were female (36%).

Table 34: Gender

Gender	2011	2012
<i>Sample Size</i>	<i>70</i>	<i>80</i>
Male	53%	64%
Female	47%	36%

APPENDIX VI – PARTICIPANT SURVEY QUESTIONNAIRE

Participant survey

Home Energy Assessment/EnerGuide for Existing Houses

October 19, 2012

INSTRUCTION

QUESTION WORDING SHOULD BE ADAPTED ACCORDING TO TRACKING SHEET COLUMN “PROGRAM”

- EGH=ENERGUIDE FOR EXISTING HOUSES PROGRAM
- HEA=HOME ENERGY ASSESSEMENT SERVICE

Hello may I please speak with [INSERT NAME]?

- 1 Yes [GO TO INTRODUCTION]
- 2 No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

INTRODUCTION

Hello, my name is _____ and I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you or your household recently participated in Efficiency Nova Scotia Corporation’s [Home Energy Assessment service/EnerGuide for Existing Houses Program]. We would appreciate your collaboration in answering questions related to your participation in this [service/program]. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve the [service/program]. The survey will take about fifteen minutes. Is this a good time for you?

Verification and Recall (V Series)

V1. We understand you participated in the [Home Energy Assessment service/EnerGuide for Existing Houses Program]. Is that correct?

1. Yes [CONTINUE]
2. No [PROMPT: “Are you sure? Someone would have come to your house to evaluate the energy efficiency of your home and sent you a report telling you about upgrades you could make to your home to improve its energy efficiency. They might have talked about the possibility of you getting rebates to cover some of the cost of these upgrades.” RECODE AS “YES” IF THE PROMPT WORKS; IF RESPONDENT STILL SAYS NO: “Is there someone else in the household who would know about having

participated in the [Home Energy Assessment service/EnerGuide for Existing Houses program]?”]

1. __ Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
2. __ No [THANKS & TERMINATE]

98. Don't know [PROMPT IF NOT ALREADY READ TO RESPONDENT: “Someone would have come to your house to evaluate the energy efficiency of your home and sent you a report telling you about upgrades you could make to your home to improve its energy efficiency. They might have talked about the possibility of you getting rebates to cover some of the cost of these upgrades.” RECODE AS “YES” IF THE PROMPT WORKS; IF RESPONDENT STILL SAYS DON'T KNOW: “Is there someone else in the household who would know about having participated in the [Home Energy Assessment service/EnerGuide for Existing Houses program]?”]

1. __ Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
2. __ No [THANK & TERMINATE]

99. Refused [THANK AND TERMINATE]

[IF REFUSED, ASK “Can we schedule a more convenient time for you to conduct this survey?”]

[SCHEDULED, IF NECESSARY, FOR: _____]

**[Service/Program] Notoriety and Reasons for Participating
(P Series)**

P1. How did you learn about the [Home Energy Assessment service/EnerGuide for Existing Houses program]? [DO NOT READ. ACCEPT MULTIPLE RESPONSES]

1. (Efficiency Nova Scotia Website)
2. (Internet Ad)
3. (Radio Ad)
4. (Newspaper Ad or Story)
5. (Program Delivery Agent: ACAP Cape Breton)
6. (Program Delivery Agent: Amerispec Home Inspection Services)
7. (Program Delivery Agent: Clean Nova Scotia)
8. (Program Delivery Agent: Ridge Energy)
9. (Program Delivery Agent: Sustainable Housing & Education Consultants)
10. (Program Delivery Agent: Trinity Inspection Services)
11. (From a contractor)
12. (Word of mouth -- neighbour, friend, co-worker, family member, etc.)
13. (TeamBuy)

- 14. (Facebook)
- 15. (Home shows)
- 16. (Building supply dealer/store)
- 17. (Television)
- 18. (Previous/past participant)
- 96. (Other) [SPECIFY _____]
- 98. (Don't know)
- 99. (Refused)

P2. Now I'm going to ask you to think back to when you decided to schedule an energy efficiency evaluation and participate in the [Home Energy Assessment service/EnerGuide for Existing Houses program]. What was the SINGLE most important reason you were interested in having your home evaluated by an EnerGuide Energy Advisor? (DO NOT READ – ACCEPT ONE RESPONSE)

- 1. (To save on energy costs/bills)
- 2. (I was thinking about/planning to get energy efficient upgrades anyway)
- 3. (To find out how energy efficient my home was/to get my home evaluated)
- 4. (To get expert's advice about what upgrades to get/how to make home more energy efficient)
- 5. (To save energy—not further specified whether for cost, environment)
- 6. (To help the environment)
- 7. (Rebates)
- 96. (Other) [SPECIFY _____])
- 98. (Don't know) [GO TO P4]
- 99. (Refused) [GO TO P4]

P3. Were there any other reasons? [DO NOT READ. ACCEPT MULTIPLE RESPONSES] [SAME LIST AS IN P2 ABOVE]

- 97. No other reasons

P4. Before participating, did you have any concerns about taking part in the [service/program]?

- 1. (Yes)
- 2. (No)
- 98. (Don't know)
- 99. (Refused)

P5. [IF P4 = 1] What were those concerns? PROBE: Anything else? [DO NOT READ. ACCEPT ALL RESPONSES]

1. (That my home would be very inefficient)
2. (That improvements would cost a lot)
3. (Rebates would be too low / insufficient)
4. (That the assessment wouldn't find anything / my home was too efficient)
5. (Wouldn't like what they recommended)
6. (Wouldn't like what I installed)
7. (The process would take too long)
96. (Other) [SPECIFY _____]
98. Don't know
99. Refused

Satisfaction with [Service/Program] (S Series)

S1. Thinking of your OVERALL experience with the [Home Energy Assessment service/EnerGuide for Existing Houses Program] up to this point, including any services received or energy efficient upgrades installed, how satisfied are you overall with the [service/program]? Would you say you are very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied? [CODE ONE ONLY]

1. Very satisfied
2. Satisfied
3. Neither satisfied nor dissatisfied
4. Dissatisfied
5. Very dissatisfied
98. (Don't know)
99. (Refused)

S2. [IF S1 = 3 OR 4 OR 5] You indicated that you were not satisfied with the [service/program] overall. What was the SINGLE most important reason you were not satisfied with the [service/program] overall? [PROBE FOR SPECIFIC REASON. ACCEPT ONE RESPONSE. DO NOT READ]

1. (The first or final energy assessment took too long)
2. (It was difficult or long to schedule an appointment with the evaluator)
3. (The cost of the evaluation was too high)
4. (The rebate received was too small)
5. (I did not agree with the recommendations that were made)
6. (I found the energy evaluator to be unpleasant)
7. (I did not get the final EnerGuide rating I was expecting)
8. (Problems with the pre- or post-retrofit report)

9. (The time period given to complete the upgrades is too short)
10. (Unpleasant experience with office staff of Service Organization or Service Provider (delivery agent))
96. (Other) [SPECIFY _____])
98. (Don't know) [GO TO S4]
99. (Refused) [GO TO S4]
- S3. Were there any other reasons you were dissatisfied? [PROBE FOR SPECIFIC REASON. ACCEPT MULTIPLE RESPONSES][SAME LIST AS S2 ABOVE][DO NOT READ]
- 97 No other reasons
- S4. Now I'm going to ask you about your experience with specific aspects of the [Home Energy Assessment service/EnerGuide for Existing Houses Program]. For each one, please tell me if you are very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied with your experience with that specific aspect of the [service/program]. [DO NOT RANDOMIZE - CODE ONE ONLY PER ASPECT]

	Very satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very dissatisfied	DK/Ref
a. The First Energy Audit Overall (This was the first audit of your home's energy use that identified ways to make it more energy efficient)	1	2	3	4	5	98/99
b. Scheduling and timing of the first audit	1	2	3	4	5	98/99
c. Courteousness of Energy Advisor	1	2	3	4	5	98/99
d. Information provided by Energy Advisor	1	2	3	4	5	98/99
e. The report you received about your home's current energy use and recommendations for energy efficient upgrades	1	2	3	4	5	98/99
f. The Final Energy Audit Overall (This was the final audit of your home's energy use to confirm the energy efficient upgrades that you had installed.)	1	2	3	4	5	98/99
g. Scheduling and timing of the final audit	1	2	3	4	5	98/99
h. The rebates provided by the [service/program] overall	1	2	3	4	5	98/99

j. The energy efficiency upgrades installed in your home	1	2	3	4	5	98/99
l. Courteousness of office staff of your Service Provider or Service Organization	1	2	3	4	5	98/99
m. Delays allowed to complete your upgrades	1	2	3	4	5	98/99

Verification of Actions Taken (VR Series)

VR1. I am going to read you a list of upgrades that may have been recommended by the Energy Advisor for your home. For each one, can you please tell me if that upgrade was recommended for your home? [DO NOT ROTATE - CODE ONE ONLY PER STATEMENT]
 [1 = YES, RECOMMENDED, 2 = NO, NOT RECOMMENDED, 98 = DON'T KNOW / DON'T REMEMBER, 99 = REFUSED] [READ]

- a. High efficiency air to air (or air source) heat pump with electric backup
- b. High efficiency air to air (or air source) heat pump with NON electric backup
- c. High efficiency ground source (or geothermal) heat pump
- d. Electric Thermal Storage (ETS) room units
- e. Electric Thermal Storage (ETS) hot air furnace
- f. Electric Thermal Storage (ETS) central hydronic system
- g. Electronic programmable thermostats
- h. Drain water heat recovery
- i. Solar domestic water heating system
- j. High efficiency ductless mini split heat pump
- k. Electric water heater tank insulation
- l. Electric water heater exposed pipe insulation
- m. Ceiling Insulation
- n. Exterior Wall Insulation
- o. Exposed Floor Insulation
- p. Basement Insulation
- q. Crawlspace Insulation
- r. Draft proofing
- s. Windows/Doors/Skylights

[ASK VR2a-b IF ANY ITEM IN VR1a THRU s=1 ("Yes, recommended")]

VR2a. [IF **MORE THAN ONE** ITEM IN VR1a-s=YES, READ:] Through the [service/program], have you implemented at least one, all or none of the energy efficiency recommendations, meaning

that you received a rebate or incentive for installing the upgrades? Have you... [READ. ACCEPT ONE RESPONSE]

1. Implemented at least one upgrade
2. Implemented all the upgrades
3. Or Not implemented any upgrades
98. (Don't know)
99. (Refused)

VR2b. [IF **ONLY ONE** ITEM IN VR1a-s=YES, READ:] Through the [service/program], have you implemented this energy efficiency recommendation, meaning that you received a rebate or incentive for installing the upgrade? Have you... [READ. ACCEPT ONE RESPONSE]

1. Yes, Implemented the upgrade
2. No, Not implemented the upgrade
98. (Don't know)
99. (Refused)

[ASK VR3 IF VR2a=1 ("YES, IMPLEMENTED AT LEAST ONE UPGRADE")]

VR3. Which of the following recommendations have you implemented under the [service/program]?
[ASK FOR EACH ITEM IN VR1a thru s = 1]

[1 = YES, IMPLEMENTED, 2 = NO, NOT IMPLEMENTED, 98 = DON'T KNOW / DON'T REMEMBER, 99 = REFUSED] [READ]

- a. High efficiency air to air (or air source) heat pump with electric backup
- b. High efficiency air to air (or air source) heat pump with NON electric backup
- c. High efficiency ground source (or geothermal) heat pump
- d. Electric Thermal Storage (ETS) room units
- e. Electric Thermal Storage (ETS) hot air furnace
- f. Electric Thermal Storage (ETS) central hydronic system
- g. Electronic programmable thermostats
- h. Drain water heat recovery
- i. Solar domestic water heating system
- j. High efficiency ductless mini split heat pump
- k. Electric water heater tank insulation
- l. Electric water heater exposed pipe insulation
- m. Ceiling Insulation
- n. Exterior Wall Insulation
- o. Exposed Floor Insulation
- p. Basement Insulation
- q. Crawlspace Insulation
- r. Draft proofing

s. Windows/Doors/Skylights

[ASK IF VR2a=1 ("Yes, implemented at least one upgrade"), OR IF VR2A=2 (YES, implemented all the upgrades) OR VR2b=1 (Yes, Implemented the upgrade)]

VR5. Did you do the work yourself or did you hire a professional contractor to complete the recommended upgrades you decided to implement? [DO NOT READ. CHOOSE ONLY ONE ANSWER]

1. (I did the work myself)
2. (I hired a contractor to complete the upgrades)
3. (Some upgrades were implemented by me and other ones by a contractor/Mix of both)
98. (Don't know)
99. (Refused)

[ASK IF VR3j=YES AND IF TRACKING SHEET COLUMN "PROGRAM" INDICATES: EGH]

VR4. If there had been no rebate, would you have decided to implement a high efficiency ductless mini split heat pump anyway?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

Spillover (SO Series)

SKIP PATTERN APPLIES TO ENTIRE SO SECTION: ASK IF VR2a=3 ("No, have not implemented any upgrades" OR IF VR2b=2 ("No, not implemented the upgrade") OR IF ANY POSED ITEM IN VR3a thru s=2 "No, not implemented"

You mentioned in a previous answer that there were some recommended upgrades that you decided not to install through the [service/program].

SO1. **Since the time that you participated** in the [Home Energy Assessment service/EnerGuide for Existing Houses Program], have you implemented one or more of the recommended upgrades on your own?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[IF SO1=1]

SO2. Which upgrades have you implemented on your own after participating in the [Home Energy Assessment service/EnerGuide for Existing Houses Program]? [READ, ACCEPT MULTIPLE]

[IF VR2a=1 (Yes, implemented at least one upgrade): LIST OF EACH ITEM IN VR1a thru s=1 ("Yes, recommended") AND VR3a thru s=2("No, not implemented")]

OR

[IF VR2a=3 (No, have not implemented any upgrades): LIST OF EACH ITEM IN VR1a thru s=1 ("Yes, recommended")]

OR

[IF VR2b=2 (No, not implemented the upgrade): LIST OF ITEM IN VR1a thru s=1("Yes, recommended")]

96. Other energy-efficient measures? [Please specify_____]

98. (Don't know)

99. (Refused)

[IF SO1=1]

SO3. Have the energy efficiency upgrades you implemented outside of the [Home Energy Assessment service/EnerGuide for Existing Houses Program] received financing or rebates from other *Efficiency Nova Scotia* programs?

1. Yes [Go to NP1]

2. No

98. (Don't know) [Go to NP1]

99. (Refused) [Go to NP1]

[IF SO3 = 2]

SO4. How influential was your experience with the [service/program] on your decision to implement some or all of the measures that you installed on your own after participating in the [Home Energy Assessment service/EnerGuide for Existing Houses program]? Please give your answer on a scale of 0 to 10, where 0 indicates that the [Home Energy Assessment service/EnerGuide for Existing Houses program] "had no influence at all on your decision to implement additional energy efficiency upgrades" and 10 indicates that the [service/program] was "extremely influential in your decision to implement additional energy efficiency upgrades." [RECORD RESPONSE 0-10, 98 = Don't know, 99 = REFUSED] [DO NOT ACCEPT A RANGE]

Reasons for Non-Participation [NP Series]

[ASK IF VR2a=1 OR 3 OR IF VR2b=2]

NP1. You mentioned in a previous answer that there were some recommended upgrades that you decided not to install. What is the SINGLE most important reason you decided not to install these recommended upgrades through the [service/program]? [PROBE FOR SPECIFIC REASONS; ACCEPT ONE] [DO NOT READ]

1. (Too busy)
2. (Too expensive)
3. (Didn't have the financial means)
4. (Payback too long)
5. (Didn't think I really needed it)
6. (Rebate not big enough)
7. (Wanted to install other upgrades that weren't covered)
8. (Plan to install in the future)
96. (Other: [SPECIFY: _____])
98. (Don't know) GO TO FR1
99. (Refused) GO TO FR1

[ASK IF Vr2a=1 OR V2a=3 OR VR2b=2]

NP2. Are there any other reasons you decided not to install these recommended measures in your home through the [service/program]? [PROBE FOR SPECIFIC REASONS; MULTIPLE RESPONSE; SAME LIST AS SM1 ABOVE] [DO NOT READ]

- 97 No other reasons

[ASK ALL]

Free-Ridership [FR Series]

In addition to the recommended measures which we have just discussed, the [service/program] could have implemented other energy-efficient upgrades to your home. Now I'm going to ask you to think of all the energy-efficient upgrades that were implemented to your home under the [service/program].

FR1. **BEFORE participating** in the [Home Energy Assessment service/EnerGuide for Existing Houses Program], did you have plans to implement the specific energy-efficient upgrades that were implemented through the [service/program]?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[IF FR1=YES]

FR1a. I just want to make sure I understand - **Before** you decided to participate in the [Home Energy Assessment service/EnerGuide for Existing Houses Program], you had already made the decision to implement the energy efficiency upgrades you implemented through the [service/program]?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the [Home Energy Assessment service/EnerGuide for Existing Houses program].

If you had not participated in the [Home Energy Assessment service/EnerGuide for Existing Houses program], what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action." [AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT, In the absence of the [service/program], would you have . . . : DO NOT ACCEPT A RANGE – ASK FR2 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FR2a. . . . implemented exactly the same energy efficiency upgrades that you implemented through the [service/program]?

___ Response ___ 98 Don't Know ___ 99 Refused

FR2b. . . . implemented standard equipment instead of energy-efficient equipment?

___ Response ___ 98 Don't Know ___ 99 Refused

FR2c. . . . implemented the exactly same energy efficiency upgrades that you implemented through the [service/program], *but at a later date*?

___ Response ___ 98 Don't Know ___ 99 Refused

[IF FR2c > 5, THEN ASK:]

FR2cc. [DO NOT ASK FR2cc IF DON'T KNOW OR REFUSED IN Q.FR2c] You indicated in your response to a previous question that if the [Home Energy Assessment service/EnerGuide for Existing Houses program] had not been available there was an X in 10 likelihood that you would have implemented the exactly same upgrades with the same energy-efficient upgrades that you implemented through the [service/program], *but at a later date*. Approximately how many months later would you have implemented these upgrades? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. _____ months later
2. (Never)
3. (At the same time)
98. (Don't Know)
99. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2cc ANSWER IN MONTHS, READ]:

Would it have been within...

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

[DO NOT ASK IF NO TO ALL OF VR3]

FR3. Efficiency Nova Scotia gave you a rebate for the energy efficiency upgrades you implemented in your home. If you had not received the rebate from Efficiency Nova Scotia, would you have paid for the full cost of the energy efficiency upgrades you implemented? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Paid” and a 10 indicating that you “Definitely **Would Have** Paid.” [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

____ Response ____98 Don't Know ____99 Refused

FR4. Next, I'm going to ask you to rate the importance of the [service/program] as well as other factors that might have influenced your decision to implement the energy efficiency upgrades you implemented through the [service/program]? Using a scale from 0 to 10 where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of each of the following in your decision to implement the energy efficiency upgrades you implemented through the [service/program]. DO NOT ACCEPT A RANGE

Factor (READ AND RANDOMIZE)	Responses
a. The [service/program] incentive	___ Response ___98 Don't Know ___99 Refused
b. Information or advice provided by the [service/program]	___ Response ___98 Don't Know ___99 Refused
c. Information or advice from the energy audit	___ Response ___98 Don't Know ___99 Refused
d. The EnerGuide Label and designation itself	___ Response ___98 Don't Know ___99 Refused
e. Previous experience with the EnerGuide for Existing Houses program, or a similar program either from Efficiency Nova Scotia or Nova Scotia Power	___ Response ___98 Don't Know ___99 Refused

Impact of Measures on Comfort Level [IM Series]

IM1. As a result of the energy efficiency measures implemented through the [service/program], has there been any change in the comfort levels inside your house for you or other occupants?

1. Yes
2. No
98. (Don't know)
99. (Refused)

IM2. [IF IM1 = 1] What has been the change in comfort levels for you or other occupants in your house as a result of the energy efficiency measures implemented through the [service/program]? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]

1. (Provided even temperatures throughout the home)
2. (Made it more convenient to control temperature automatically, day or night)
3. (Noticeably fewer drafts throughout home)
4. (House is warmer)
5. (Reduced cost of energy)
6. (More comfortable temperature throughout the home)
7. (House is less humid)
8. (House is cooler in summer)
9. (Easier to heat)
96. (Other [SPECIFY_____])
98. (Don't know)
99. (Refused)

Recommendations for Program Improvements [R Series]

R1. Do you have any recommendations for improving the [Home Energy Assessment service/EnerGuide for Existing Houses Program]? Probe: Anything else? [DO NOT READ. ACCEPT MULTIPLE]

1. (Offer more products/measures eligible to rebates) [GO TO R3]
2. (Offer more information on the products/measures recommended)
3. (Complete the first or final audit sooner)
4. (Increase the period given to complete the upgrades)
5. (Improve communication)
6. (Advertise the program more or in a better way)
7. (Make initial of final report clearer)
8. (Increase rebates/give bigger rebates)
9. (More information to accompany my rebate/incentive cheque)
10. (No recommendation)
96. (Other [SPECIFY_____])
98. (Don't know)
99. (Refused)

- R2. Are there any energy efficiency upgrades that were not covered by the [service/program] that you would like to have had covered through the [service/program]?
1. (Yes)
 2. (No)
 98. (Don't know)
 99. (Refused)
- R3. [IF R1=1 OR IF R2=1] Which energy efficiency upgrades would you like to have covered by the [service/program]? PROBE: Anything else? [PROBE FOR SPECIFIC UPGRADES; ACCEPT MULTIPLE]
1. _____
 2. _____
 3. _____
 97. Don't know
 98. Refused
- R4a. [GO TO R4B IF R1=9] Would you have liked more information to accompany your rebate or incentive cheque?
1. (Yes) [GO TO R4B]
 2. (No) [GO TO D1]
 98. (Don't know) [GO TO D1]
 99. (Refused) [GO TO D1]
- R4b. [IF R1 = 9 OR IF R4A=1] What type of additional information would you have liked to receive with your rebate or incentive cheque? [ENTER ANSWER. 98=DON'T KNOW. 99= REFUSED]

Demographic Characteristics [D Series]

[ASK ALL RESPONDENTS]

These final questions are asked for statistical purposes only. The information collected is strictly confidential.

- D1. What type of residence do you live in? [READ RESPONSES 1-7, SELECT ONE RESPONSE]
1. Detached single-family home
 2. Semi-detached house
 3. Mobile home or house trailer
 4. Townhouse or duplex which share adjacent walls
 5. Row house (Single story apartment building)
 6. Apartment building that have fewer than five stories
 7. Apartment building that have five or more stories
 96. (Other [SPECIFY: _____])
 98. (Don't know)
 99. (Refused)

- D2. How many bedrooms are in your home? [98=DK; Enter zero for a studio apartment with no bedrooms]
- D5. Is your home occupied year round, or is it a seasonal home?
1. Year round residence
 2. Seasonal / vacation home
 96. (Other Specify _____)
 98. (Don't Know)
 99. (Refused)
- D6. Including yourself, how many people live in this residence on a full-time basis?
- Number of people: _____
- D7. What is your age group? Are you... [READ]
1. 18 to 24
 2. 25 to 34
 3. 35 to 44
 4. 45 to 54
 5. 55 to 64
 6. 65 or over
 99. (Refused)
- D8. What is the highest grade of schooling completed by the head of your household? [DO NOT READ]
1. (Less than high school graduation certificate)
 2. (High school graduation certificate and/or some post-secondary)
 3. (Trades certificate or diploma)
 4. (College certificate or diploma)
 5. (University certificate or diploma)
 98. (Don't know)
 99. (Refused)

D9. Which of the following income categories best describes your total annual household income before taxes in 2011? Stop me when I reach the right category. [READ LIST; SELECT ONE RESPONSE]

1. Less than \$15,000
2. \$15,000 - \$24,999
3. \$25,000 - \$34,999
4. \$35,000 - \$49,999
5. \$50,000 - \$69,999
6. \$70,000 - \$79,999
7. \$80,000 or more
98. (Don't know)
99. (Refused)

D10. [DO NOT READ] Gender:

1. Male
2. Female

END: Those are all the questions I have for you. Thank and terminate.

APPENDIX VII – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

FR2a. If you had not participated in the program, what is the likelihood that you would have implemented exactly the same energy efficiency upgrades that you implemented through the program? (Scale 0 to 10)	FR2a = Answer x 10%
FR2b. If you had not participated in the program, what is the likelihood that you would have implemented standard equipment instead of energy-efficient equipment? (Scale 0 to 10)	FR2b = (10 – Answer) x 10%
PA1 Score:	MEAN VALUE OF: (FR2a ; FR2b)
FR1. Before participating in the program, did you have plans to implement the specific energy efficiency upgrades that were implemented through the program?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just to make sure - Before you decided to participate in the program, you had already made the decision to implement the energy efficiency upgrades that you implemented through the program?	IF 1. Yes: FR1 = 100% IF 2 OR 9 : FR1 = 0%
FR3. If you had not received the rebate from ENSC, would you have paid for the full cost of the energy efficiency upgrades you implemented? ? (Scale 0 to 10)	FR3 = Answer x 10%
PA2 Score:	IF FR1 = 0% : FR3 / 2 IF FR1 = 100% : FR3
FR4. Level of influence (Scale 0 to 10) Factors a, b, c and e = Program factors Factors d = Non Program factors	FR4_P = SUM(a; b; c; e) FR4_NP = FR4d
PA3 Score:	100% - [FR4_P/(FR4_P+FR4_NP)]
FR2c. If you had not participated in the program, what is the likelihood that you would have implemented the energy efficiency upgrades that you implemented through the program but at a later date ? (Scale 0 to 10)	IF FR2c > 5 : ASK FR2cc Otherwise: PA4 = EMPTY
FR2cc. Approximately how many months later would you have implemented these upgrades? 1. Less than 6 months? 2. 6 months to less than 1 year later? 3. 1 to less than 2 years later? 4. 2 to less than 3 years later? 5. 3 to less than 4 years later? 6. 4 or more years later? 7. (Never) 9. (Don't know / Refused)	IF 1. : FR2cc = 100% IF 2. : FR2cc = 50% IF 3. : FR2cc = 25% IF 4. : FR2cc = 0% IF 5. : FR2cc = 0% IF 6. : FR2cc = 0% IF 7. : FR2cc = 0% IF 9. : FR2cc = 0%
PA4 Score:	FR2cc
Final Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)
Inconsistency Test #1	IF ABS(FR2a – FR2b) ≥ 30%: PA1 = MIN OF (FR2a ; FR2b)
Inconsistency Test #2	IF FR3 ≥ 70% AND IF (FR2a OR FR2b < 70%: PA2 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)



Notes on the On-Site Evaluation (D)

Quality assurance

Appendix 1

Audit file number _____
Name of the advisor _____
Service Organization _____

ENSP Program : _____
QA done by: _____
Date of Audit : _____

☐ =task performed well ☐ task not completed ☐ Not/Applicable

Introduction ☐ required equipment ☐ program presentation ☐ client concerns ☐ building history

Remarks: _____

Foundation 1 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture ☐ rim joist
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Foundation 2 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture ☐ rim joist
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Walls type 1 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Walls type 2 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Attic 1 ☐ insulation values ☐ attic ventilation ☐ vapor barrier ☐ signs of moisture ☐ mask,gloves
☐ information to client ☐ recommendations to client ☐ required pictures ☐ ducting in attic

Remarks: _____

Attic 2 ☐ insulation values ☐ attic ventilation ☐ vapor barrier ☐ signs of moisture ☐ mask,gloves
☐ information to client ☐ recommendations to client ☐ required pictures ☐ ducting in attic

Remarks: _____

Windows/doors ☐ correct count ☐ types ☐ insulation value ☐ condensation ☐ air leakage
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Notes on the On-Site Evaluation (D)

Quality assurance

Appendix 1

Audit file number _____
Name of the advisor _____
Service Organization _____

ENSProgram : _____
QA done by: _____
Date of Audit : _____

Main Heating ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Main Heating ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Air cooling ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

DHW ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Ventilation ☐ Basic inspection ☐ info on plate ☐ air quality issues ☐ efficiency ☐ exhaust fans
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Blower Door Test ☐ equipment set-up ☐ preparation for test ☐ Readings (8X) ☐ identification of air leaks
☐ information to client ☐ recommendations to client ☐ required pictures ☐ comb.spillage test

Remarks: _____

Energide Report ☐ ACH and ELA explained ☐ ENERGUIDE Rating ☐ texts ☐ priorities
☐ recommendations ☐ Energide Label

Remarks: _____

Grants ☐ general info ☐ requirements and eligibility ☐ deadline ☐ amounts info

Remarks: _____

Others ☐ Data collection sheet ☐ air quality and ventilation explanations ☐ house-as-a-system

Remarks: _____

Notes on the HOT2000 Simulation

Quality assurance

Appendix 2

Audit file number _____
Name of the advisor _____
Service organisation _____

QA done by _____
Date of audit _____

Check boxes where errors were identified

General information

☐ Name and address ☐ Fuel Cost and Weather Libraries ☐ Specifications

Remarks: _____

Ceiling 1

☐ Code ☐ Area ☐ Slope ☐ Compression

Remarks: _____

Ceiling 2

☐ Code ☐ Area ☐ Slope ☐ Compression

Remarks: _____

Wall 1

☐ Code ☐ height ☐ Perimeter

Remarks: _____

Wall 2

☐ Code ☐ height ☐ Perimeter

Remarks: _____

Windows & Doors

☐ Number ☐ Orientation ☐ Code ☐ Dimension

Remarks: _____

Foundation 1

☐ Type ☐ Area ☐ Perimeter ☐ Total Height ☐ Depth BG ☐ Code
☐ code of floor above foundation ☐ rim joist code ☐ rim joist measurements

Remarks: _____

Foundation 2

☐ Type ☐ Area ☐ Perimeter ☐ Total Height ☐ Depth BG ☐ Code
☐ code of floor above foundation ☐ rim joist code ☐ rim joist measurements

Remarks: _____

Air leakage

☐ Temperatures ☐ Pressures ☐ Readings (8) ☐ Volume ☐ combustion spillage test

Remarks: _____

Notes on the HOT2000 Simulation

Audit file number
Name of the advisor
Service organisation

QA done by
Date of audit

Check boxes where errors were identified

Ventilation ☐ Type ☐ CFM Rates ☐ Model

Remarks

Main Heating ☐ Type ☐ Efficiency ☐ Fans ☐ Model

Remarks:

Secondary Heating ☐ Type ☐ Efficiency ☐ Model

Remarks:

Cooling ☐ Type ☐ Efficiency ☐ Model

Remarks:

DHW ☐ Type ☐ Efficiency ☐ Model

Remarks:

Recommendations ☐ Report texts ☐ List of Upgrades

Remarks:

Other Remarks

Final Comment

FUEL SUBSTITUTION

IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

February 26, 2013



ECONOLER

ACRONYMS

ASHP	Air Source Heat Pump
CATI	Computer-Assisted Telephone Interviewing
CRA	Corporate Research Associates
DA	Delivery Agent
DHW	Domestic Hot Water
DWHR	Drain Water Heat Recovery
EER	Energy Efficiency Ratio
ENSC	Efficiency Nova Scotia Corporation
HDD	Heating Degree Day
HEA	Home Energy Assessment
HSPF	Heating Seasonal Performance Factors
NG	Natural Gas
NTGR	Net-to-Gross Ratio
NRCan	Natural Resources Canada
NSPI	Nova Scotia Power Inc.
OPA	Ontario Power Authority
PM	Program Manager
PRISM	Princeton Scorekeeping Method
SEER	Seasonal Energy Efficiency Ratio

DEFINITIONS

Base Case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Energy Efficiency Ratio	A ratio calculated by dividing the cooling capacity (in Btu/h) by the power input (in watts) at a given set of rating conditions.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.

Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Spillover (internal)	Percentage of savings attributable to participants who continue to implement the energy efficiency measures introduced by a program after participating in it once, without participating in the program a second time.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Fuel Substitution, which is a component of the Existing Houses program. The 2012 evaluation was based on interviews with the Program Manager (PM), eight on-site visits and a telephone survey of 75 participants. A study specifically on ductless mini-split heat pumps was also conducted as part of the 2012 evaluation in order to evaluate the relevance of reintroducing ductless mini-split heat pumps in one of Efficiency Nova Scotia Corporation's (ENSC) residential programs.

PROGRAM COMPONENT OVERVIEW

Fuel Substitution began in April 2011 and ran as a pilot until the end of that year. January 2012 saw the completion of the pilot phase and the launch of Fuel Substitution by ENSC.

Fuel Substitution encourages homeowners to reduce the level of electricity they use for home heating, domestic hot water (DHW) and/or larger appliances (ranges and dryers). It allows homeowners to either substitute their electric space heating with another heating source, such as a wood or pellet stove, or completely remove their electric space heating/DHW system and replace it with a new heating source.

Since the beginning of Fuel Substitution in 2011, ENSC has offered incentives for the following equipment:

- > wood and pellet stoves;
- > wood and pellet furnaces or boilers; and
- > natural gas space and DHW heating systems.

In 2012, heat pumps, gas area heaters, drain water heat recovery (DWHR) systems, gas ranges and gas dryers have been added to the list of eligible products. Similarly, propane was added as an alternative fuel source for the program. Additional rebates are available to homes where the electric system is completely removed and replaced with a new distribution system.

Fuel Substitution aimed to achieve net electricity savings of 2.7 GWh and demand savings of 1.2 MW for 2012.

KEY FINDINGS

The evaluation of Fuel Substitution demonstrated that the transition from a pilot to a full program in 2012 was successful. The program totalled 282 participants for the year 2012, which is similar to previous year (296 participants in 2011). In terms of net energy savings, the program generated 1.549 GWh, while the 2011 figure was 1.570 GWh.

Awareness

The survey results showed that 41 percent of participants learned about the program at the store where they purchased their new equipment, which indicates the importance of retailers in program promotion. The results also showed the impact of the Fuel Substitution marketing efforts and outreach activities: 32 percent of customers learned about the program through these. The 2012 Fuel Substitution marketing campaign included a province-wide radio and print campaign, networking with residential heating retailers, information packages handed out at various home shows throughout the province, direct mailings sent by Heritage Gas to Nova Scotians who reside alongside a gas line and social media such as Facebook and Twitter. Noteworthy is that the 2011 recommendation concerning the addition of upstream advertising has been successfully implemented. The purpose of this recommendation was to influence decision making among homeowners who have not already decided to replace or substitute their equipment.

Satisfaction

Satisfaction with the program was very high among participants. Indeed, nearly all respondents were satisfied with the program overall and its various aspects. The participation in the program was considered easy by the large majority of participants. Moreover, all participants responded that they would recommend Fuel Substitution to a family member or a friend.

Program Energy Savings

To calculate the net savings of Fuel Substitution in 2012, Econoler reviewed the gross savings estimated by ENSC by means of a billing analysis and a literature review. Moreover, Econoler took into consideration the free-ridership and spillover measured in the participant survey. Through this approach, a free-ridership level of 32 percent and a spillover of 1 percent were identified. Compared to the 2011 free-ridership level of 42 percent, the 2012 free-ridership level shows a substantial drop which could be explained by the increase of marketing efforts and outreach activities aimed to influence decision-making among homeowners who have not yet decided to replace or substitute their equipment. Indeed, the 2011 survey results indicated that most participants had learned about the program at the store where they purchased their new equipment. As for 2012, the survey results revealed that more participants were influenced by the program during the decision-making process, i.e. before going to the store, which was probably the result of increasing marketing efforts and outreach activities.

Table 1: Distortion Effects and Net-to-Gross Ratio

	2012
Free-Ridership Level	32%
Spillover Level	1%
Net-to-Gross Ratio	0.69

The evaluation revealed that Fuel Substitution generated net energy savings of 1.549 GWh and demand savings of 0.857 MW at the generator in 2012.

Table 2: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	NTGR	Net Savings
Energy Savings			
Tracked Savings from ENSC	2.592 GWh	0.58	1.503 GWh
Evaluation Results	2.245 GWh	0.69	1.549 GWh
Demand Savings			
Tracked Savings from ENSC	1.212 MW	0.58	0.703 MW
Evaluation Results	1.243 MW	0.69	0.857 MW

The net values calculated were compared to the program tracked savings for 2012. The net energy savings calculated for Fuel Substitution are 3 percent higher than those calculated from the tracking sheet. This can be explained by the increase in the NTGR calculated for this evaluation in comparison to the one applied in the tracking sheet, which was based on the 2011 evaluation. The free-ridership level evaluated for the program in 2012 is lower than the one evaluated in 2011, probably due to the increase of marketing efforts and outreach activities. However, the unitary savings values for the two most popular products, wood and pellet stoves, were lowered after the billing analysis, which also had a considerable impact on the energy savings.

RECOMMENDATIONS

Econoler finds that the program is well designed and works at a satisfactory level. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- Fuel-R1. Continue marketing efforts and outreach activities:** In 2011, the Evaluator recommended the addition of upstream advertising in program strategy. This recommendation has been successfully implemented since survey results indicated that one-third of customers learned about the program through ENSC advertising. The Evaluator recommends continuing marketing efforts and outreach activities as they contribute to lowering the free-ridership level by influencing decision making among homeowners who have not already decided to replace or substitute their equipment. They can also help increase the number of participants.
- Fuel-R2. Consider reintroducing a rebate on high quality, high efficiency ductless mini-split heat pumps:** According to distributors, there is a need for ENSC to once again provide a rebate on ductless mini-split heat pumps to encourage the installation of quality ductless mini-split heat pumps. Furthermore, distributors would like to see only heat pumps that achieve a specific minimum level of efficiency being covered through the program. The program review has determined that the Tier 2 ENERGY STAR rating is increasingly becoming a prerequisite for ductless mini-split heat pump rebates, going beyond regular and Tier 1 ENERGY STAR-qualified ductless mini-split heat pumps. The possibility of offering a rebate meeting these criteria would most likely enhance the quality of ductless mini-split heat pumps sold in the Nova Scotian residential market (see Section 3.5 for more details).
- Fuel-R3. Consider conducting calibrated simulations with real participants who installed a wood or pellet stove:** Wood and pellet stoves are by far the largest contributors of the achieved savings for Fuel Substitution. Together, they accounted for about 78 percent of the energy savings in 2012 and 90 percent of the energy savings in 2011. For this year's evaluation, Econoler revised only the average heating consumption for participants, which is one of the main parameters used in the unitary savings calculations of seven eligible products. This revision allowed for a more precise calculation of savings. However, for the two main products of the program, i.e. wood and pellet stoves, ENSC should consider reviewing the unitary savings values by conducting simulations with real participants and calibrating these simulations with their billing data. With these simulations, it would also be possible to review the demand savings value, based on the load profile.

1 COMPONENT DESCRIPTION

Fuel Substitution began in April 2011 and ran as a pilot until the end of the year 2011. Starting in January 2012, the pilot phase was completed, and Fuel Substitution was launched by Efficiency Nova Scotia Corporation (ENSC).

Fuel Substitution targets all existing homes across Nova Scotia that primarily use electricity for creating heat. It encourages homeowners to reduce the level of electricity they use for home heating, domestic hot water (DHW) and/or larger appliances (ranges and dryers). It allows homeowners to either substitute their electric space heating with another heating source, such as a wood or pellet stove, or completely remove their electric space heating/DHW system and replace it with a new heating source.

Since the beginning of Fuel Substitution in 2011, ENSC has offered incentives for the following equipment:

- > wood and pellet stoves;
- > wood and pellet furnaces or boilers; and
- > natural gas space and DHW heating systems.

In 2012, heat pumps, gas area heaters, drain water heat recovery (DWHR) systems, gas ranges and gas dryers have been added to the list of eligible products. Similarly, propane was added as an alternative fuel source for the program. Additional rebates are available to homes where the electric system is completely removed and replaced with a new distribution system.

Since the fall of 2012, participants could either choose the rebate option or the zero interest financing option to complete the upgrades. Moreover, Heritage Gas offers additional rebates for customers who wish to convert to natural gas.

If they wish to participate in the program, homeowners apply to ENSC directly by filling out a pre-approval application form. Then, the program manager gets in touch with them to verify their eligibility. Eligibility considerations are mainly related to heating source (electricity) and electrical energy consumption but can also vary depending on the type of equipment installed under the program. When approved, applicants have up to four months to install equipment and complete the rebate application submission to ENSC. The timeline for participants who choose the financing option is two months.

ENSC manages and administers the program internally. The marketing strategy involves a province-wide media campaign that includes advertisements in all the major newspapers and on all major radio stations.

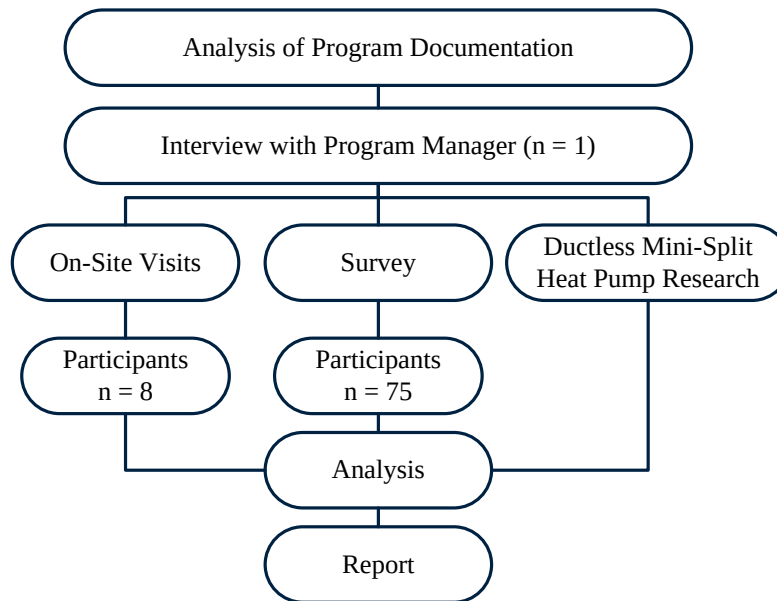
The program aims to achieve net electricity savings of 2.7 GWh and demand savings of 1.2 MW for 2012. Savings generated by Fuel Substitution are accounted for under the Existing Houses program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for Fuel Substitution. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was obtained primarily from the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews respectively in July and August 2012 with the Program Manager (PM). These interviews were intended, among other things, to follow-up on the 2011 evaluation recommendations regarding process issues, as well as to understand the main changes that occurred in the program delivery in 2012. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 On-Site Visits

In October and November 2012, eight on-site visits were conducted in households that participated in Fuel Substitution. They were conducted by Econoler's subcontractor, Equilibrium Engineering. These visits were used to validate the new equipment installed, collect information on the previous heating and hot water systems, as well as gather data on the usage of the different energy sources available at the site.

Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix III.

2.2.4 Participant Survey

A telephone survey with a total of 75 participants was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in October 2012 using the computer-assisted telephone interviewing (CATI) technology. The average length of the survey was 12 minutes.

The participant survey was meant to generate feedback on the following aspects of Fuel Substitution:

- > spillover and free-ridership;
- > program awareness;
- > participant motivations and barriers;
- > satisfaction with the program; and
- > recommendations for improvements.

The demographic profile of the survey respondents and the survey questionnaire are shown in Appendices IV and V respectively. The table below shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2012 and 2011 telephone surveys.

Table 3: Sample Size and Sampling Error

Survey	Population	Sample Size (n)	Sampling Error at 90% Confidence Interval
2012 Participants	282 ¹	75	±8.2%
2011 Participants	296 ²	28	±14.8%

2.2.5 Ductless Mini-Split Heat Pump Research

A study specifically on ductless mini-split heat pumps was conducted as part of the 2012 evaluation. ENSC contracted Econoler to assess the ductless mini-split heat pump market following the elimination of the incentive for this equipment by ENSC in the EnerGuide for Houses / Home Energy Assessment program (HEA) during 2012. Econoler looked at this matter in order to evaluate the relevance of reintroducing rebates for ductless mini-split heat pumps in one of ENSC's residential programs.

To complete this analysis, the Evaluator used three different activities:

- > a review of the different existing residential programs related to ductless mini-split heat pumps across North America;
- > interviews with five ductless mini-split heat pump distributors in Nova Scotia; and
- > a survey conducted with participants from HEA who have implemented ductless mini-split heat pumps.

The protocol used for the interviews with distributors is presented in Appendix II for reference.

¹ The population of Fuel Substitution participants for the 2012 survey was 158 at the time the survey was being conducted.

² The population of Fuel Substitution participants for the 2011 survey was 64 at the time the survey was being conducted.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

In 2011, Econoler performed a comprehensive process evaluation of this pilot program. The program manual and website, the application forms, the logic model and program theory were among the program elements examined in the process evaluation. The PM was interviewed along with participants. The 2011 approach generated a series of recommendations to improve the program performance and management.

The 2012 process evaluation is a continuation of the 2011 evaluation and covers the following aspects:

- > follow-up on the 2011 evaluation recommendations regarding process issues;
- > new and/or updated program documentation including program modifications since the last evaluation;
- > program tracking sheet; and
- > program participants' perspectives on process issues.

Recommendations and follow-ups regarding impact evaluation (energy or demand) will be reflected in the Impact Evaluation section of this report.

3.2 PROGRAM DOCUMENT ANALYSIS AND INTERVIEW WITH THE PROGRAM MANAGER

The following section describes the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interview with the program manager. It also covers the follow-up on recommendations from last year in each applicable section.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory, in which all the information about the program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program, based on a template provided by the Evaluator.

In 2012, the Evaluator noted that the program memory has been included in the program manual along with its various Appendices. The Evaluator is also pleased to report that Fuel Substitution now has an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff, as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The program manual is intended to capture information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The Fuel Substitution program manual is now presented in a standardized template which applies to all ENSC programs and includes the same table of contents with 10 sections. This is a considerable improvement from the 2011 format and follows one of the Evaluator's major recommendations.

With this new format, most recommendations regarding the program manual, such as documenting important assumptions or practices, providing a base case and the parameters used to estimate program objectives, are now covered in the program manual and its attached files and Appendices.

The following table compares the program manual content of 2011 to the new 2012 version. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 4: Program Manual Content – Fuel Substitution

Program Manual Content	2011	2012
Document revisions	✓	✓
Program description (including nature or type of program)	✓	✓
Program justification	⚠	✓
Program objectives	✓	✓
Incentives	✓	✓
Eligibility criteria	✓	✓
Program partners and their roles	N/A	N/A
Program barriers	✓	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	⚠	✓
Details about the savings calculations and types of measure	⚠	✓
Annual budget	✓	✓
Cost-effectiveness test results	✓	✓
Market study or technical study supporting program elements or assumptions	✓	✓
Marketing plan	⚠	✓
Evaluation plan	⊘	✓
Program theory	⊘	✓
Logic model	⊘	✓
Program process flow chart	✓	✓
Partner or participant process flow chart	N/A	✓
Program forms	✓	✓
✓ Information included in the program manual ⚠ Information partially included in the program manual ⊘ No Information		

The new version of the program manual is a considerable improvement from the 2011 version. For additional improvements, the Evaluator has a few minor recommendations.

- > **Document the major characteristics of the program:** In the program manual, there is no mention of the incentives offered by Heritage Gas to customers who convert to natural gas. This information, as well as the role of Heritage Gas in the program, should be explained in the program manual.
- > **Document major changes in the Document Revision section:** In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual, such as the transformation of the pilot to a full program and the option to finance the project instead of receiving an incentive. Moreover as ENSC transforms this program into a service that promotes green energy sources such as heat pumps and biomass, the transformation should be mentioned in a new version of the program manual. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program's logic model. Econoler is currently working with ENSC to make sure that each program's updated logic model reflects the current program strategy, and the performance indicators established based on the program theory. The programs' logic models will all be finalized and included in the programs' manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the Evaluator's recommended template for an evaluation plan, which is included as an Appendix of the Fuel Substitution program manual. The program manager provided positive feedback on this important tool that complements the program manual and makes it possible to evaluate the program.

The addition of the evaluation plan to the program documentation is a great improvement from last year. For additional improvements, the Evaluator recommends the following:

- > **Adapt the evaluation plan template to meet program needs:** In the program base case, some programs, such as Fuel Substitution, have many measures to describe from baseline to net savings. The table structure for this section can be changed if there are too many N/A slots. If some parameters are not applicable to the measures (for example Baseline Energy Efficiency Level) the line for that variable can be deleted from the table.

3.2.4 Program Charts

The program now also has two process charts, one for the participant and the other for the program manager. These charts were recommended in the 2011 evaluation and are very informative for any new staff responsible for the program as well as for program participants.

Econoler has the following recommendation on the program charts:

- **Post a simplified participant process chart on the website:** The Evaluator recommends developing a simplified participant process chart and posting it on the program website (in the “How to Participate” section), which is comprehensive, clear and well designed. After all, since this chart is intended for the participants, it must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version date should be indicated in the chart.

3.2.5 Marketing and Outreach Activities

Due to the restructuring of the residential sector, to avoid program silos and to provide a one-window approach for participants, an integrated marketing plan has been drawn up and is being implemented for this sector. Indeed, ENSC is moving away from program-specific marketing towards a more all-inclusive approach, which offers a full suite of energy-saving services and rebates for the customer. Over the last year, a focus was put on developing a customer-centric approach:

- **Facebook:** Launched in September 2011, the Facebook page is being followed by over 28,000 people, which is a great accomplishment considering that there are fewer than 500,000 potential followers in Nova Scotia. It provides followers with energy saving tips and informs them about special offers, ways to meet with energy-efficiency representatives in person and energy-efficiency contests they can enter. It encourages followers to access all the energy-efficiency services to which they are eligible.
- **New Website:** ENSC's new website will feature robust categorization (allowing the user to find specific content in a variety of ways), as well as a state-of-the-art predictive index. These combined features will make it easier for the user to locate specific services and for the website to suggest other appropriate services based on the user's needs and online behavioral pattern.
- **Email Marketing:** Email addresses for e-newsletter communication are collected at various points of contact: home shows, retail in-store engagement events, program application forms and inbound calls.
- **Customer Relationship Management:** The back-end of the residential services is being re-equipped to fit the customer-centric approach. The systems undergoing development will allow ENSC to call up customer history and provide thoughtful advice on future energy savings, whether through personal contact, direct mail, or online communication.

In addition to the overall residential marketing strategy, Fuel Substitution also has a specific approach. The marketing and outreach activities of the program include a full province-wide radio and print campaign, networking with residential heating retailers, information packages to be handed out at various home shows throughout the province, direct mail sent by Heritage Gas to Nova Scotians who reside alongside a gas line and social media such as Facebook and Twitter. Thus, the Evaluator noticed that the 2011 recommendation concerning the addition of upstream advertising in order to influence decision making among homeowners who have not already decided to replace or substitute their equipment has been implemented.

As for the recommendation to consider partnerships for program extension, ENSC considered that it is easier to let participants choose their own contractors than to do business with a delivery agent (DA). The Evaluator considers this argument valid since it protects ENSC from any wrongdoing by a contractor recommended by a DA or by ENSC.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice, because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

The Evaluator has the following recommendation on the marketing plan:

- > **Make the performance indicators more quantitative:** To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

3.3 TRACKING SHEET

Econoler reviewed the content of ENSC's tracking sheet for Fuel Substitution. The tracking sheet for 2012 is complete, clear and useful. It provides a quick way to monitor the status and achieved savings of all projects. There are three important tabs included in the tracking sheet:

- > the 2012 Application tab, which provides a complete summary of each application submitted to the program;
- > the 2012 Rebates tab, which provides information on the savings achieved for all participants who applied for a rebate in 2012; and
- > the 2012 Financing tab, which provides information on each application submitted, as well as on the savings achieved for participants who completed a project under the financing option in 2012.

All fields necessary for program administration and program evaluation are present in these tabs. Each project has a unique identification number that allows navigation between the different tabs.

The information included in the 2012 Application tab corresponds to the information collected in the program pre-approval application. It regroups information on all customers who applied to participate in the program, even if the project was not approved or if the installation is not completed yet. As for the 2012 Rebates and 2012 Financing tabs, they contain information only for participants who have completed their installation.

The 2012 Application tab lists both applicant and project information. All information necessary to conduct field activities (survey and on-site visits) is available in this tab. Most fields were filled out correctly; only a few details were missing. The utility account number, which was useful in obtaining electrical consumption data from Nova Scotia Power Inc. (NSPI) for the billing analysis, is available for 93 percent of the applicants. The rate code was missing for a larger number of participants (only available for 42 percent of applicants), but this situation should be improved in the future since ENSC has started to collect rate codes at the end of 2012 on a new version of the application form. Moreover, this information is not necessary since, considering the program theory, it is assumed that participants belong to the residential customer rate class. However, it would be useful to validate that this criterion is respected. Also, technical information, such as the existing energy source for heating and domestic hot water, the model number of the equipment installed and information on electric backup, are available in the Application tab.

The 2012 Rebates tab presents the units installed for each participant who completed a project in 2012, as well as the related tracked savings. Both gross energy and demand savings are calculated in this tab, using the unitary savings values defined for each type of equipment installed. Most of these unitary savings values were reviewed by Econoler in the 2011 evaluation report of ENSC's Fuel Substitution pilot. For the new products introduced to the program in 2012, ENSC estimated their

unitary savings value based on data consumption and energy savings found in the literature. Net savings are then calculated by using the net-to-gross ratio (NTGR) estimated by Econoler in 2011.

The 2012 Financing tab contains similar information as in the 2012 Rebates tab, but for customers who applied for a zero interest loan instead of the rebate offered through the program. The major difference with this tab is that, for administration purposes, it contains all applications made for the financing stream, not only the completed projects. In addition to the information on the equipment installed and the resulting savings, the tab presents applicant information relative to their financing application process.

Econoler's review of the tracking sheet showed that ENSC took into consideration the Evaluator's recommendations from last year's evaluation. Indeed, Econoler notes a major improvement from last year on how the information is complete and clearly presented. Moreover, the tracking sheet now shows the project status. The 2012 Application tab indicates whether a project is approved or not, and the projects listed in the other tabs are those that are completed and for which savings were claimed. This information facilitated the selection of projects for the on-site visits.

In light of these observations, the Evaluator concludes that the 2012 tracking sheet for Fuel Substitution is complete, consistent and easy to work with.

3.4 PARTICIPANT PERSPECTIVES

3.4.1 Program Awareness

Participants found out about the program in a number of ways. The main way was at the store where they purchased their new equipment (41%), which indicates the importance of retailers in program promotion. Survey results also showed the impact of the Fuel Substitution marketing efforts and outreach activities. Indeed, ENSC advertising was an important source of program promotion, with approximately one-third of customers learning about the program through it (32%), which includes newspaper (13%), television (7%), home show (5%), radio (4%) and the ENSC website (4%). Finally, about one quarter heard about the program through the Internet in general (24%), and about two in ten through word of mouth (17%).

Table 5: Sources of Program Awareness

Sources of Program Awareness	2011	2012
<i>Sample Size*</i>	28	75
The store where you purchased your new equipment	50%	41%
Internet—unspecified	14%	24%
Co-worker, family, friend or word of mouth	29%	17%
Newspaper	--	13%
Television	--	7%
At home show	--	5%
Radio	--	4%
On the ENSC website	14%	4%
Email/mailling from Heritage Gas	4%	4%
Print brochure	4%	4%
Others	14%	5%
Don't know	--	3%
*Multiple responses		

3.4.2 Motivations and Barriers to Participation

The main reason for participating in the program was to save on energy costs (with 81% having given this response as their most important motivation), followed by about one in 10 for better comfort (8%). There were a variety of answers from participants about their secondary motivations including having a back-up heating source, wanting a wood stove or liking wood heat, or helping the environment.

Communications should continue emphasizing to customers the opportunities to save on energy bills since it is by far the biggest motivation for participating in the program.

Table 6: Reasons for Participating

Reasons for Participating	2011		2012	
	Most Important Motivation	Second Most Important Motivation*	Most Important Motivation	Second Most Important Motivation*
<i>Sample Size</i>	28	28	75	75
Save on energy costs/bills	86%	11%	81%	15%
For better comfort	--	7%	8%	12%
To have a backup heating source	11%	14%	4%	8%
To make home more energy efficient	--	11%	1%	1%
To help the environment	--	7%	1%	3%
Wanted wood stove/Like wood heat	--	--	--	7%
Others	4%	14%	4%	5%
Nothing	--	14%	--	43%
Don't know	--	25%	--	8%
Refused	--	4%	--	--
*Multiple responses				

In terms of who had the most influence on the decision for purchases made through the program, participants mentioned themselves most often (29%), followed by co-workers, family or friends (20%). The store where the equipment was purchased was an influence for just over one in 10 respondents (13%). Thus, results indicate that stores are a good source of program awareness, but do not necessarily influence the decision making (see Section 3.4.1).

Table 7: Purchase Influencer

Who Influenced Equipment Bought Through the Program	2012
<i>Sample Size</i>	75
Participant made decision	29%
Co-worker, family, friend or word of mouth	20%
The store where you purchased your new equipment	13%
An Installer	7%
Information online	3%
Others	11%
Don't know/refused	17%
*Multiple responses	

A small number of participants (11%) reported having concerns prior to taking part in the program.

Table 8: Concerns with Program Prior to Taking Part

Concerns with Program Prior to Taking Part	2011	2012
<i>Sample Size</i>	28	75
Yes	4%	11%
No	96%	89%

Of the eight respondents who had concerns, three felt they might not be eligible; a similar number believed the improvements would cost a lot or that the new heating system would be inefficient.

Table 9: Specific Concerns with Program

Specific Concerns with Program*	2012
<i>Sample Size**</i>	8
That I wouldn't be eligible/qualify	3
That improvement would cost a lot	3
That the new heating system would be inefficient	3
That the process would take too long	1
That rebates would be too low/insufficient	1
*Base: Respondents who said they had concerns	
**Multiple responses	

Only a small number of respondents felt there were challenges or barriers when installing equipment or new energy sources. Specifically, just over one in 10 respondents (13%) reported that there had been challenges or barriers.

Of the 10 respondents who reported challenges, three identified a lack of technical knowledge, while two mentioned difficulty in finding good wood to burn or in having the equipment installed before the deadline. One respondent mentioned that the energy-efficient equipment did not meet payback requirements, there was a lack of financing, the paperwork or process required too much work and there was a lack of information to make an informed decision.

Table 10: Challenges Faced in Installing the New Equipment

Challenges or Barriers Faced in Installing the New Equipment or the New Energy Source	2011	2012
<i>Sample Size</i>	28	75
Yes	11%	13%
No	89%	87%

3.4.3 Program Influence

Survey respondents were asked questions about the influence of the program on their decision to replace their heating system with another heating source. According to their responses, the program rebate was most important in influencing their decision (mean of 7.8 out of 10). Information or advice about the program (mean of 6.1) as well as program promotion on the Internet, radio or newspaper (mean of 5.8) were considered modestly important.

Table 11: Importance of Program in Influencing Decision

Importance of Program in Influencing Decision to Replace Heating System with Another Heating Source	2011	2012
<i>Sample Size</i>	28	75
Mean (0=Not at all important, 10=Extremely important)*		
Program rebate	7.5	7.8
Information on the program provided by the salesperson**	6.8	6.1
Program promotion on the Internet, radio or newspaper	n/a	5.8
Previous experience with a similar program either from ENSC or NSP	2.9	4.2
*Mean excludes responses of 'Refused' and 'Don't know'		
**Question wording in 2011: Information or advice provided through the program		

3.4.4 Program Impact

Three quarters of respondents reported that there had been an improvement in their interest in energy efficiency (75% having given a rating of 5 or 4, where 5 is "considerable improvement") since participating in the program. A similar number reported that there had been improvement in their knowledge of energy efficiency (71%).

Table 12: Improvements since Participating in Program

Improvements since Participating in Program	2011		2012	
	<i>Sample Size*</i>	<i>Satisfied**</i>	<i>Sample Size*</i>	<i>Satisfied**</i>
Interest in energy efficiency	28	75%	75	75%
Knowledge of energy efficiency	28	57%	75	71%
*Don't know removed from calculations				
**Percentage of respondents who gave a rating of 5 or 4 on a scale where 5 = 'Considerable improvement' and 1 = 'No improvement'				

3.4.5 Satisfaction with the Program

Nearly all respondents were satisfied (92%) with the program overall and over three-quarters (77%) reported a very high level of satisfaction. Of note, none offered a rating of 'not at all satisfied.'

Table 13: Satisfaction with Overall Experience

Satisfaction with Overall Experience	2011	2012
<i>Sample Size*</i>	28	75
5 - Very satisfied	89%	77%
4	7%	15%
3	4%	7%
2	--	1%
1 – Not at all satisfied	--	--
*Don't know removed from calculations		

Among the small number of respondents who were dissatisfied (n=6), reasons for this dissatisfaction were poor communication, the time it took to receive the incentive amount, or that the incentive amount was too small.

Table 14: Reasons Not Satisfied with Program

Reasons Not Satisfied with Program*	Most Important Reason	Other Reasons
<i>Sample Size</i>	6	6
Poor communication	2	--
Too long to receive the incentive amount/rebate	2	1
Incentive amount (rebate) is too small	1	1
Other	1	--
None/No other reasons	--	4
*Base: Number of respondents who gave a rating of 1, 2 or 3 on a scale where 5= 'Very satisfied' and 1 = 'Not at all satisfied'		

Respondents were highly satisfied with various aspects of Fuel Substitution. Nearly all were satisfied with the interaction and communication with ENSC staff (96%), the program application, forms and associated paperwork (96%), the systems installed in the home (95%), the time required to receive the rebate or incentive (94%), the initial confirmation of eligibility (93%), and the rebate or incentive amount (85%).

Table 15: Satisfaction with Program Aspects

Aspect of Program	2011		2012	
	Sample Size*	Satisfied**	Sample Size*	Satisfied**
Interaction and communication with ENSC staff	28	100%	74	96%
Program application, forms and associated paperwork	28	96%	74	96%
The system installed in your home***	28	100%	73	95%
Time required to receive rebate or incentive	28	96%	72	94%
Initial confirmation of eligibility	27	100%	73	93%
Rebate or incentive amounts	28	93%	73	85%
*Don't know removed from calculations **Percentage of respondents who gave a rating of 5 or 4 on a scale where 5 = 'Very satisfied' and 1 = 'Not at all satisfied' ***Question wording in 2011: The measure implemented in your home				

The process to participate in the program was considered easy by the majority of participants. Indeed, nearly all participants found the participation process easy (91% offering a rating of '5' or '4' where 5 is very easy).

Table 16: Application Process

Program Application Process	2012
Sample Size*	75
5 - Very easy	64%
4	27%
3	7%
2	1%
1 - Very difficult	1%
*Don't know removed from calculations	

Those who found participation in the program difficult offered a number of reasons for this opinion. Two participants noted that the paperwork or the process was time-consuming or required too much work. Two participants mentioned that they had general lack of awareness of the program. For instance, in one participant's words, "You had to find out about the program for yourself, so putting it all together is time consuming."

In addition, two participants had issues with the installation, and a similar number mentioned poor communication. One participant noted that they experienced a delay in receiving the rebate.

Table 17: Causes for Program Application Difficulty

Causes for Program Application Difficulty*	2012
<i>Sample Size**</i>	7
Paperwork/process was time consuming/required too much work	2
Lack of awareness of program	2
Installation	2
Poor communication	2
Delay to receive the rebate	1
*Base: Respondents who had difficulty with participation (a rating of 1, 2 or 3 on a scale where 5 = 'Very easy' and 1 = 'Very difficult')	
**Multiple responses	

All participants would recommend the program to a family member or friend. This result is a strong indicator of satisfaction.

Table 18: Value of the Program

Would Recommend the Program to a Family Member or Friend	2011	2012
<i>Sample Size</i>	28	75
Yes	100%	100%
No	--	--

3.4.6 Participant Recommendations for Improvements

Respondents were asked if they had any recommendations for improving the program. Just over one in 10 would like to see the rebate amount increased (13%), while approximately one in 10 would like improved communication (9%), better program advertising (8%) or simplification of the application, forms and associated paperwork (7%). Over one half of respondents (52%) did not offer recommendations as to how the program could be improved.

Table 19: Recommendations to Improve Program

Recommendations to Improve program	2011	2012
<i>Sample Size*</i>	28	75
Increase rebate amount	7%	13%
Improve communication	7%	9%
Advertise the program more or in a better way	18%	8%
Simplify program application, forms and associated paperwork	4%	7%
Offer more equipment to be installed/measures eligible to rebates	4%	5%
Offer more information on the products/measures recommended	--	5%
Others	11%	11%
No recommendations	54%	52%
Don't know	7%	1%
*Multiple responses		

Those who indicated they would like additional equipment available for rebates were asked to indicate which ones. These two respondents mentioned natural gas and solar power.

3.5 DUCTLESS MINI-SPLIT HEAT PUMP RESEARCH

Review of the Ductless Mini-Split Heat Pump Incentive under ENSC's Portfolio

Up until 2012, ductless mini-split heat pumps were eligible for a financial rebate through ENSC's EnerGuide for Existing Houses. As of April 1, 2012, ENSC incentives related to heating and cooling equipment systems, except for ductless mini-split heat pumps, were transferred into Fuel Substitution (for homes offsetting electric heating). ENSC continues to recommend the implementation of such equipment under some of its residential programs, although without the rebate.

Incentives associated with ductless mini-split heat pumps were discontinued, as a result of a market study requested by ENSC that assessed a high level of free-ridership for this prescriptive measure. Econoler looked at this matter in the 2012 evaluation in order to assess the relevance of reintroducing ductless mini-split heat pumps into one of ENSC's residential programs.

The Evaluator thus performed an analysis based on three different activities:

- > a review of the different existing residential programs related to ductless mini-split heat pumps across North America;
- > interviews with five ductless mini-split heat pump distributors in Nova Scotia; and
- > a survey conducted with participants from Home Energy Assessment (HEA) who have implemented ductless mini-split heat pumps while they were still rebated through the program.

The Evaluator decided to include the results of this analysis into the Fuel Substitution report as it is believed that if ductless mini-split heat pumps were to be reintegrated into one of ENSC's programs, it would most likely be in this one.

Existing Programs Review

The Evaluator conducted an exhaustive analysis on the existing residential incentive programs which include ductless mini-split heat pumps. This review was meant to learn more about the programs promoting this energy efficient product across Canada and United States. In Canada, British Columbia is currently the only province providing financial incentives for the installation of ductless mini-split heat pumps. However, in the United States, several organizations are offering incentive programs for ductless mini-split heat pumps in states such as Oregon, Rhode Island, Massachusetts, Connecticut and California.

The common eligibility criteria found in most of the programs was Tier 2 ENERGY STAR-rated equipment meeting the efficiency levels (SEER, EER and HSPF) required by the label. The research also showed that most of the baselines used for comparison were electric baseboards, furnaces or wall heaters. In two cases, the baseline was standard ductless mini-split heat pumps that do not meet the ENERGY STAR requirements. Conversely, homes with existing heat pumps, gas furnaces or gas boilers are not eligible for most of the programs.

Finally, the only program report including an evaluation of the free-ridership level for ductless mini-split heat pumps was from Rhode Island National Grid and assessed it at around 15 percent.

The different results from the existing program review are outlined in the following table.

Table 20: Results from Existing Program Review

Organization	Baseline	Eligibility criteria	Free-ridership
LiveSmart British Columbia ³	Electric baseboards	ENERGY STAR-rated ductless mini-split heat pump or LiveSmart qualified inverter-based systems	--
Energy trust of Oregon ⁴	Standard electric furnace or electric baseboard heater	Homes that use electricity for space heating. Homes with existing heat pumps, gas furnaces or boilers do not qualify.	--
Rhode Island National Grid ⁵	Ducted central air-conditioning system with SEER = 13, EER = 11 and HSPF = 7.6 ⁶	Tier 2 ENERGY STAR-rated ductless mini-split heat pump system	15% ⁷
Mass Save ⁸	Non-ENERGY STAR-rated ductless mini-split heat pump ⁹	Tier 2 ENERGY STAR-rated ductless mini-split heat pump system	--
Connecticut Light & Power ¹⁰	Electric baseboards and wall heaters	Tier 2 ENERGY STAR-rated ductless mini-split heat pump system	--
California Pacific Power ¹¹	Electric baseboards	Minimum ratings of SEER ≥ 16 and HSPF ≥ 9	--
Notes: SEER: Seasonal Energy Efficiency Ratio EER: Energy Efficiency Ratio HSPF: Heating Seasonal Performance Factors Tier 2: SEER ≥ 14.5, EER ≥ 12 and HSPF ≥ 8 ¹²			

³ LiveSmart BC, Important Notes for Contractors and Trades People, July 14, 2011, pp.11-12.

⁴ Energy Trust of Oregon, "Ductless Heat Pumps: Warm Up to Savings," Web, October 15, 2012, <<http://energytrust.org/residential/incentives/heating-and-cooling/ductless-heat-pumps>>.

⁵ Gas Networks, "Rhode Island Residential Cooling Program from National Grid," Web, November 13, 2012, <www.gasnetworks.com>.

⁶ National Grid, "Rhode Island Technical Reference Manual for Estimating Savings from Energy Efficiency Measures", 2012 Program Year, November 2011, pp.80-81.

⁷ From Market Research for the Rhode Island, Massachusetts and Connecticut Residential HVAC Market, December 2002

⁸ Mass Save, "2010 MA Cool Smart Residential Rebate Application," Web, November 13, 2012, <<http://www.masssave.com>>.

⁹ Mass Save, "Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures", 2011 Program Year – Plan Version, October 2011, pp.57-59.

¹⁰ Connecticut Light & Power, "Ductless Heat Pump System," Web, October 16, 2012, <www.clp.com/Home/SaveEnergy/DuctlessHeatPumpSystem.aspx>.

¹¹ Pacific Power, "Ductless Heat Pump: Home Energy Savings," Web, October 16, 2012, <www.homeenergysavings.net/California/hvac/ductless.html>.

¹² ENERGY STAR, "ENERGY STAR Program Requirements for Air Source Heat Pump and Central Air Conditioner Equipment – Eligibility Criteria," Version 4.0, Web, November 12, 2012, <www.energystar.gov>.

Interviews with Distributors of Ductless Mini-Split Heat Pumps

The distributors of heating systems contacted during the interview process were asked to speak, among other things, about the impact on the market of the elimination of the ductless mini-split heat pumps rebate by ENSC, about standard practice on the market regarding heating systems, and about their position on hypothetical reintegration of a rebate on ductless mini-split heat pumps by ENSC into one of their programs.

Impact of the elimination of the ENSC rebate

Distributors found sales of ductless mini-split heat pumps steady following the elimination of the rebate on this equipment. Several distributors noted that they saw a continued interest in ductless mini-split heat pumps due to ENSC's previous financial offering under HEA. Indeed, this reason, combined with positive word of mouth, accounted for distributors not seeing a drop in sales after the April 1st deadline for the ENSC rebate on ductless mini-split heat pumps.

Another factor that could explain the steadiness in ductless mini-split heat pumps sales is that most distributors considered the installation of ductless mini-split heat pumps as a standard practice in the market for heating systems, because there are few options as energy-efficient as these heat pumps. Indeed, most distributors felt that there are almost no energy-efficient alternatives to ductless mini-split heat pumps in the market, except electric-thermal storage units (which are no more efficient than electric baseboard) and solar energy.

Distributors had mixed opinions, however, on whether the recommendations made to customers as part of their participation in ENSC's residential programs had an impact on sales of ductless mini-split heat pumps. Some distributors knew their customers had been asking about the product as a result of one of ENSC's programs. However, in other cases, distributors felt it was general word of mouth that helped maintain sales of ductless mini-split heat pumps rather than the recommendations.

Reintegration of a ductless mini-split heat pump rebate into ENSC programs

All distributors felt that ENSC should again include a rebate on ductless mini-split heat pumps within one of its residential programs. This opinion was largely due to the feeling that customers are now choosing products at a lower cost, and therefore choosing lower-quality heat pump options in the absence of the ductless mini-split heat pump rebate. Low-quality heat pumps in Nova Scotia are a concern to distributors since they could lead to problems in the future. More specifically, this concern with regard to quality and cost is translated into many 'fly-by-night' organizations taking advantage of this opportunity by offering low-cost heat pumps that are not installed by a certified installer and not providing additional servicing for the heat pumps once installed. The end result is customers with improperly installed heat pumps and no one willing to provide after-market service. This, in the opinion of the distributors interviewed, is resulting in low confidence in this energy-efficient heating solution, and indeed in some customers removing the measure from their home.

To prevent that, it was recommended by distributors that ENSC assess whether there could be additional information provided to customers regarding heat pumps, in terms of what qualities to look for, and to ensure the installation is completed by a certified professional. This would involve educating consumers about the various types of ductless mini-split heat pumps and the importance of ensuring that their installer is certified and provides after-market service.

Survey with Participants from Home Energy Assessment

Since ductless mini-split heat pumps were once rebated under HEA, but are now only recommended under the audit reports, a question was added to the HEA participant survey in order to assess the percentage of participants who would have implemented ductless mini-split heat pumps following the recommendation even without the rebate. The survey results showed that 46 percent of the participants would not have implemented their ductless mini-split heat pump without the rebate. This result does not indicate what the level of free-ridership would have been for ductless mini-split heat pumps. Furthermore, since only 13 participants responded to this question, this percentage needs to be used with caution and should not stand as a single figure. Nonetheless, this result shows that the rebate seems to have had an influence on the purchase of ductless mini-split heat pumps instead of conventional heating systems for a portion of the participants. What remains unknown is the quality of equipment participants would have implemented without the ENSC rebate.

Recommendation

Upon the review of existing programs that include a rebate on ductless mini-split heat pumps, the feedback from distributors in Nova Scotia and the results from the HEA participant survey, the Evaluator has the following recommendation.

- **Consider reintroducing a rebate on high quality, high efficiency ductless mini-split heat pumps:** According to distributors, there is a need for ENSC to once again provide a rebate on ductless mini-split heat pumps, but not for the reasons that were previously considered. Specifically, it appears as though residents in Nova Scotia continued to have a high level of interest in ductless mini-split heat pumps, even with the removal of the ENSC rebate, and to install this equipment to be more energy-efficient. Indeed, the previous incentive under HEA created awareness for ductless mini-split heat pumps and helped generate positive word of mouth. This made the product well-known on the market, but an incentive needs to be provided to encourage the installation of quality ductless mini-split heat pumps. Therefore, it was felt by distributors that with ENSC providing a rebate, there would be greater interest from the public in paying for higher quality heat pumps.

Furthermore, distributors would like to see only heat pumps that achieve a specific minimum level of efficiency being covered through the program. The program review has determined that the Tier 2 ENERGY STAR rating is increasingly becoming a prerequisite for ductless mini-split heat pump rebates, going beyond regular and Tier 1 ENERGY STAR-qualified ductless mini-split

heat pumps. The possibility of offering a rebate meeting these criteria would most likely enhance the quality of ductless mini-split heat pumps sold in the Nova Scotian residential market.

Note that this analysis was not meant to determine the level of free-ridership that would be observed following the reintegration of ductless mini-split heat pumps in one of ENSC's programs. However, it can be said that adding specific eligibility criteria, such as those mentioned above, would help lower free-ridership.

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The purpose of the impact evaluation is to determine the gross and net savings of the program for 2012. Both energy and demand savings were considered in this evaluation. To do so, the following parameters were analyzed by Econoler:

- > unitary demand and energy savings values for each type of equipment installed;
- > free-ridership; and
- > spillover.

The impact evaluation was mainly based on a review of the parameters used for estimating the unitary savings values of each type of equipment installed, eight on-site visits and a survey with 75 participants.

Most unitary savings values used by ENSC are based on two reports: one from Dunskey Energy Consulting and the other from Navigant Consulting. The first step of the impact evaluation was to review the parameters behind each unitary savings value and validate if these values are appropriate. Then, as recommended in the 2011 evaluation of Fuel Substitution, a billing analysis was conducted to validate a key parameter used in the unitary savings calculations: the annual electric consumption used for heating before the installation of the new equipment. This validation allowed reviewing the unitary savings values in accordance with the real electric heating consumption of residential customers who participate in Fuel Substitution.

For new products introduced to the program in 2012, ENSC estimated their unitary savings value based on data consumption and energy savings found in the literature. Therefore, Econoler reviewed the source of data and the parameters used in ENSC's estimates to validate the accuracy of each unitary savings value.

Moreover, on-site visits were performed for the most important categories of equipment installed. On-site visits were used to verify the type of new equipment installed in participants' household, as well as to collect information on the usage of different energy sources. The data collected during this activity were used to validate the information presented in the tracking sheet.

Finally, the participant survey provided information to calculate the NTGR for this program, including free-ridership and internal spillover. The NTGR was used to calculate program net savings.

It should be noted that five types of equipment were not installed by any participant in 2012, but Econoler also reviewed their unitary savings values in this impact evaluation.¹³

4.1.1 On-Site Visit Sampling and Protocol

Sampling Methodology

Eight on-site visits were conducted under the 2012 evaluation of Fuel Substitution. The sampling was established from the tracking sheet provided by ENSC on September 2012. This list included 137 participants for 2012 with 140 units installed, since 3 participants had each installed 2 different units. Table 21 presents the number of units installed and their tracked energy savings, for each type of equipment.

Table 21: Total Number of Units and Tracked Savings Used for On-Site Visit Sampling¹⁴

Type of Equipment Installed	Wood Stove	Pellet Stove	Wood Furnace or Boiler	Central NG Heating System	Gas DHW Heating System	Gas Area Heaters	Air Source Heat Pumps	Total
Total Number of Units Installed	68	55	1	1	11	2	2	140
Tracked Savings (MWh)	0.326	0.241	0.010	0.010	0.034	0.003	0.009	0.633
% of Total Savings	51%	38%	2%	2%	5%	1%	1%	100%

Most units installed were wood stove and pellet stove. However, the Evaluator planned eight on-site visits to ensure that at least one unit from the other types of equipment would be verified, despite these representing very few installations.

Sites were selected randomly within each type of equipment. A list of preferred regions located within a 2-hour drive radius from larger regional centres (Halifax and Dartmouth) was established for site selection.

¹³ Pellet furnace or boiler, natural gas boiler (multifamily dwellings), hybrid wood central furnace or boiler, propane furnace and geothermal heat pump were not installed in 2012.

¹⁴ As of September 2012.

On-Site Visit Protocols

On-site visits were used to verify the type of new units installed, as well as to collect information on the usage of different energy sources. An on-site visit protocol listing the information to be collected for each site was developed for this program. For each site, the type and characteristics of the heating or domestic hot water systems, as well as the heat source, were collected.

4.2 GROSS SAVINGS

The gross energy and demand savings were computed based on a review of the unitary savings values and the total number of each type of equipment installed presented in the program tracking sheet.

The tracking sheet provided for 2012 contained a total of 282 participants (278 from the rebate option and 4 from the financing option) who had installed a total of 291 units. For each type of equipment installed, a unitary savings value was defined by ENSC. For this year's evaluation, Econoler reviewed these unitary savings values by conducting a billing analysis to validate the annual electricity consumption used for heating and a literature review to evaluate the unitary savings values used for the types of equipment that are not calculated from this annual electricity consumption.

4.2.1 Unitary Savings Values Review Based on Billing Analysis

Tracked Savings

For the following types of equipment, ENSC uses unitary savings values obtained from building simulation modelling and engineering calculations:

- > wood and pellet stoves;
- > wood and pellet furnaces or boilers;
- > natural gas space or DHW heating systems;
- > propane furnaces or DHW heating systems.

These values were estimated by the firm Dunskey Energy Consulting,¹⁵ using gross savings values established by Navigant Consulting¹⁶ and adjusted to account for the electricity requirement to operate non-electric heating and hot water systems. The energy and demand savings estimates provided by Navigant Consulting were calculated using whole building simulation modelling with the eQuest tool, as well as engineering estimates from various sources. The annual electricity consumption value for heating in existing homes in Nova Scotia was estimated by Navigant Consulting to be 17,269 kWh, while the peak demand value for heating was estimated at 8.57 kW in winter time.

¹⁵ Dunskey Energy Consulting, Residential Fuel Substitution Pilot Program, Final report, December 2010.

¹⁶ Navigant Consulting, 2011 to 2019 Fuel Substitution Potential Analysis, February 2010.

Where appropriate, savings values provided by Navigant Consulting were adjusted by Dunskey using HOT2000 simulations. The following assumptions were among those used by Dunskey when applicable:

- > an electricity requirement of 290 kWh per year to operate furnaces;
- > an electricity requirement of 700 kWh per year to operate pellet stoves; and
- > 30 percent of the energy used by hybrid wood heating systems is electricity.

In some instances, similar products with similar savings, such as wood furnace and wood boiler, were combined into one type of equipment for simplification and to reduce the number of different products. In these cases, the energy and demand savings values correspond to the averages of the values calculated by Dunskey for a wood furnace and a wood boiler.

Table 22 summarizes the unitary energy and demand savings values used in the tracking sheet for these products and the details on how each value was obtained. Savings were established for systems installed in single-family dwellings, except in one case.

Table 22: Tracked Unitary Savings Values from the 2011 Evaluation Report

Category of Equipment	Old Annual Electric Consumption for Heating (kWh/year)	New Annual Electric Consumption for Backup/Fans/Pumps (kWh/year)	Energy Savings Value (kWh/year)	Adjusted Energy Savings Value (kWh/year)	Old Annual Electric Demand for Heating (kW/year)	New Annual Electric Demand for Backup/Fans/Pumps (kW/year)	Demand Savings Value (kW/year)	Adjusted Demand Savings Value (kW/year)
Wood Stove	17,269	3,461	13,808	8,259 ¹⁷	8.57	3.61	4.96	4.00 ¹⁷
Pellet Stove	17,269	3,522	13,746	7,559 ¹⁸	8.57	3.61	4.96	4.00 ¹⁸
Pellet Furnace or Boiler	17,269	835	16,433	-	8.57	0.82	7.75	-
NG Combo Boiler	-	-	11,926	22,206 ¹⁹	-	-	10.34	-
Combo Pellet Boiler	-	-	11,926	22,206 ¹⁹	-	-	10.34	-
Wood Furnace or Boiler	17,269	836	16,433	16,433	8.57	0.82	7.75	-
	17,269	467	16,802	16,512 ²⁰	8.57	1.00	7.57	-
	Mean		16,617	16,473	Mean		7.66	-
NG Boiler (Multi-Family Dwellings)	43,288	752	42,535	-	-	-	47.53	-

¹⁷ Navigant savings estimate reduced by Dunskey Consulting based on HOT2000 simulations.

¹⁸ Navigant savings estimate reduced by Dunskey Consulting based on HOT2000 simulations and an electricity requirement of 700 kWh per year to operate pellet stoves.

¹⁹ Navigant savings estimate increased by Dunskey Consulting based on HOT2000 simulations, mainly to take into account savings on DHW heating.

²⁰ Navigant savings estimate adjusted for an electricity requirement of 290 kWh per year to operate furnaces.

Category of Equipment	Old Annual Electric Consumption for Heating (kWh/year)	New Annual Electric Consumption for Backup/Fans/Pumps (kWh/year)	Energy Savings Value (kWh/year)	Adjusted Energy Savings Value (kWh/year)	Old Annual Electric Demand for Heating (kW/year)	New Annual Electric Demand for Backup/Fans/Pumps (kW/year)	Demand Savings Value (kW/year)	Adjusted Demand Savings Value (kW/year)
Hybrid Wood Central Furnace or Boiler	17,269	835	16,433	11,503 ²¹	8.57	0.82	7.75	-
	17,269	467	16,802	11,471 ²²	8.57	1.00	7.57	-
	Mean		16,617	11,487	Mean		7.66	-
Central NG Heating System	17,269	467	16,802	16,512 ²³	8.57	1.00	7.57	-
	17,269	427	16,842	16,842	8.57	0.82	7.75	-
	Mean		16,822	16,677	Mean		7.66	-
Propane Furnace	17,269	467	16,802	-	8.57	2.85	7.57	-
Gas Tankless DHW System	-	-	5,364	-	-	-	0.63	-
Gas Tanked DHW System	-	-	5,376	-	-	-	0.63	-

²¹ Navigant savings estimate adjusted to take into account that 30% of the energy used by hybrid wood heating systems is electricity.

²² Navigant savings estimate adjusted to take into account that 30% of the energy used by hybrid wood heating systems is electricity and for an electricity requirement of 290 kWh per year to operate furnaces.

²³ Navigant savings estimate adjusted for an electricity requirement of 290 kWh per year to operate furnaces.

Revised Savings

The unitary savings values used for all these types of equipment were reviewed in the 2011 evaluation report of the Fuel Substitution pilot²⁴ and led to a recommendation on conducting a billing analysis to review the average heating consumption value used in the unitary savings calculations.

Econoler followed this recommendation for this year's impact evaluation. A billing analysis was performed with consumption data of 235 NSPI customers. These customers corresponded to 2011 and 2012 Fuel Substitution approved applicants for which the NSPI account number was available and that used 100 percent of electricity for heating. Therefore, by conducting a billing analysis on these specific customers, the Evaluator was able to review the average heating consumption value, the main parameter of the unitary savings calculations, with a value that is representative of homes who participate in Fuel Substitution.

The regression model used for the billing analysis follows the Princeton Scorekeeping Method (PRISM). This standard statistical method calculates a regression specific to each customer instead of analyzing the data as a whole. The linear regression model of the daily electricity consumption is expressed by the following equation:

$$\text{CONS} = A + B \times \text{HDD}$$

Where:

CONS = Average daily consumption;

A = Daily base consumption constant;

B = Unitary consumption coefficient per Heating Degree Day (HDD);

HDD = Average daily HDDs.²⁵

The daily base consumption constant represents the everyday electric consumption not related to the outdoor temperature (i.e. the HDDs). Examples of equipment that are part of the daily base consumption are lights, appliances, DHW and electronic devices. On the other hand, the unitary consumption coefficient is defined as the electric consumption that varies according to the outdoor temperature.

To review the average heating consumption value used in the unitary savings calculations, i.e. the electric consumption used for heating before the replacement of equipment, Econoler targeted the billing data corresponding to periods that occurred before the approval date recorded in the tracking

²⁴ Propane was added as an alternative fuel source for the program in 2012. However, the unitary savings values for propane furnaces and propane tankless DHW systems estimated by Dunsky Energy Consulting were reviewed in the 2011 evaluation report of the Fuel Substitution Pilot.

²⁵ For a given day, the number of HDDs corresponds to the number of degrees Celsius below a critical threshold heating needs, 18 °C in this case. When the outside temperature for a given day is greater than or equal to this threshold, the number of HDDs is set to "0" for that day.

sheet. Thus, the initial sample of 235 customers was reduced to 217 customers to include only those who had three or more billing periods available before the replacement of their space heating unit.

Subsequently, the pre-replacement consumption data were analyzed using the linear regression model presented above. For each customer, the values of the constant A and the coefficient B of the regression model were estimated. Further to this analysis, other customers were rejected for the following reasons:

- > non-significant correlation of the unitary consumption coefficient with the HDD;
- > negative unitary consumption coefficient;
- > negative daily base consumption constant; and
- > coefficient of determination (R^2)²⁶ below 0.75.

Therefore, 159 customers could be retained for the final analysis. Once the annual electric heating consumption was identified for each customer, the values furthest from the mean were validated. Following this validation, two extreme values (one above the average and the other below the average) were rejected because of evidence suggesting that these houses did not meet the general program criteria of being a single family home used year-round.

In the end, the average annual electric heating consumption obtained for the group of 157 customers amounts to 14,600 kWh, which is 15 percent less than the value of 17,269 kWh estimated by Navigant Consulting. This new value is more representative of the real average heating consumption of households participating in the program.

In light of these results, the unitary savings values of the single family space heating units were adjusted to reflect the real annual electric heating consumption of the participating homes, before the replacement of their space heating unit. The demand savings remained the same as in 2011 since the billing analysis did not provide any information to adjust these values. The revised unitary savings values are presented in Table 23.

For the multi-family, combo or DHW heating systems, the Evaluator kept the same unitary savings values as those reviewed in the 2011 evaluation report. The unitary savings values for these systems are not based on the main annual electric heating consumption value of 17,269 kWh but rather on other values specific to their use (i.e. for DHW heating, for both space heating and DHW heating or for multi-family space heating). Since these products represent only 14 percent of gross savings (in comparison to 78 percent for wood and pellet stoves), Econoler did no further research to validate their specific consumption and therefore consider their unitary savings values appropriate.

²⁶ The coefficient of determination, R^2 , measures the proportion of the variations in the dependent variable that are explained by the regression model. A R^2 value approaching 1 indicates a strong correlation. As mentioned in the 2012 International Performance Measurement and Verification Protocol, though there is no universal standard for a minimum acceptable R^2 value, 0.75 is often considered a reasonable indicator of a good causal relationship amongst the energy and independent variables.

Table 23: Revised Unitary Savings Values Based on the Billing Analysis

Category of Equipment	Annual Electric Consumption for Heating (kWh/year)	New Annual Electric Consumption for Backup/Fans/Pumps (kWh/year)	Revised Energy Savings Value (kWh/year)	Tracked Energy Savings Value (kWh/year)	Demand Savings Value (kW/year)
Wood Stove	14,600	7,617	6,983	8,259	4.00
Pellet Stove	14,600	8,209	6,391	7,559	4.00
Pellet Furnace or Boiler	14,600	835	13,765	16,433	7.75
NG Combo Boiler	-	-	22,206	22,206	10.34
Combo Pellet Boiler	-	-	22,206	22,206	10.34
Wood Furnace or Boiler	14,600	836	13,764	16,433	7.57
	14,600	757	13,843	16,512	7.75
	Mean		13,804	16,473	7.66
NG Boiler (Multi-Family Dwellings)	43,288	752	42,535	42,535	47.53
Hybrid Wood Central Furnace or Boiler	14,600	4,875	9,725	11,503	7.75
	14,600	4,902	9,698	11,471	7.57
	Mean		9,712	11,487	7.66
Central NG Heating System	14,600	757	13,843	16,512	7.57
	14,600	427	14,173	16,842	7.75
	Mean		14,008	16,677	7.66
Propane Furnace	14,600	467	14,133	16,802	7.57
Gas Tankless DHW System	-	-	5,364	5,364	0.63
Gas Tanked DHW System	-	-	5,376	5,376	0.63

4.2.2 Unitary Savings Values Review Based on a Literature Review

Tracked Savings

In 2012, the following types of equipment were added to the program:

- > geothermal heat pump;
- > ducted central air source heat pump;
- > gas area heater;
- > DWHR;
- > gas range; and
- > gas dryer.

ENSC estimated the unitary savings values of these new products based on different assumptions found in the literature.

For geothermal and ducted central air source heat pumps, ENSC uses unitary savings values estimated by Summit Blue Consulting for the 2010 EnerGuide for New Houses Program,²⁷ using a simulation tool. The estimated savings are respectively 12,863 kWh and 7,559 kWh. For both products, Summit Blue Consulting assumed an annual electricity consumption used for heating of 18,400 kWh.

For gas area heaters, the unitary savings values were estimated by ENSC using the hypothesis that wood stoves and gas area heaters have the same level of savings, but for different capacities. Therefore, ENSC used the unitary savings value of wood stoves to estimate the unitary savings value of gas area heaters based on the following:

- > Most EPA-certified wood stoves have heating output ranges that go from 45,000 to 75,000 Btu/h, and the unitary savings value used by ENSC for this equipment is 8,259 kWh.
- > For the gas area heaters, the capacity (in Btu/h) generally ranges from about 10,000 to 30,000 Btu/h. If the average wood stove has a heating output of around 55,000 Btu/h and gets an 8,259 kWh credit, then an average gas heater of 20,000 Btu/h would have a proportional kWh savings of 3,000 kWh.

For DWHR, ENSC uses a unitary savings value of 816 kWh. This value was revised by Econoler during the 2011 evaluation of EnerGuide for Existing Houses. It is based on the 2011 Ontario Power Authority (OPA) Prescriptive Measures and Assumptions report.²⁸

²⁷ Summit Blue Consulting, Excel File: "2010 EnerGuide for New Houses Program," 2010.

²⁸ Ontario Power Authority (OPA), "2011 Quasi Prescriptive Measures and Assumptions," Release Version 1, December 2010, pages 97-98.

Finally, for gas ranges and gas dryers, the unitary savings values of 750 kWh and 900 kWh used by ENSC are based on the replacement of old electric equipment manufactured in 2001. The savings values come from the National Energy Use Database of Natural Resources Canada (NRCAN).²⁹

In the tracking sheet, no demand savings were considered for any of these products.

Revised Savings

Geothermal and Ducted Central Air Source Heat Pumps

Econoler reviewed the unitary savings values used for geothermal and ducted central air source heat pumps based on studies and evaluation reports.

For geothermal heat pumps, Econoler revised the unitary savings value estimated at 12,863 kWh to 14,330 kWh. This value comes from Hydro-Québec's residential geothermal evaluation report.³⁰ It is based on a billing analysis conducted on post-implementation and engineering calculations. Savings from both heating and cooling were considered in this evaluation. Since the climate of the province of Quebec is very similar to that of Nova Scotia and the majority of the participants studied used electric baseboard heating before the replacement, Econoler considers this value appropriate. However, Hydro-Québec did not evaluate demand savings. Therefore, Econoler estimated demand savings for geothermal heat pumps based on the proportion of savings for a central natural gas heating system. This resulted in demand savings totaling 7.84 kW. For this year's evaluation, no participants installed geothermal heat pumps, but if this product becomes more popular in the future, it would be appropriate to review this value.

For ducted air source heat pumps, Econoler based its review on the 2011 OPA Quasi-Prescriptive Measures and Assumptions report.³¹ In this report, the OPA developed a regression analysis to estimate the consumption of air source heat pumps based on the region and the efficiency of the heat pump. To estimate the average consumption of the ducted air source heat pumps installed through the program, Econoler used a capacity of 3 tons,³² the average heating seasonal performance factor and seasonal energy efficiency ratio calculated with the ENERGY STAR air source heat pump qualified product list, as well as the weather location factor established for the region of Ottawa, which has a similar climate to Halifax. Thus, an average consumption of 7,524 kWh was found for a typical energy-efficient ducted air source heat pump. Using the electric heating consumption obtained from the billing analysis, an annual unitary savings totalling 7,076 kWh resulted:

²⁹ Natural Resources Canada, Average annual energy consumption of new major appliances (in kWh/year) based on year of manufacture, NRCAN Website: <http://oee.nrcan.gc.ca/equipment/appliance/7718>.

³⁰ Hydro-Québec, "Rapport d'évaluation Programme: Géothermie – Marché résidentiel," Années 2007 à 2009, Rapport final, 25 mars 2011.

³¹ Ontario Power Authority (OPA), "2011 Quasi-Prescriptive Measures and Assumptions," Release Version 1, December 2010, pages 221 to 224.

³² This value seems to be a typical capacity for air source heat pumps installed in single-family homes. It is used in the ENERGY STAR savings calculator and by Mass Save in the Massachusetts Technical Reference Manual.

$$\text{Annual Unitary Savings} = 14,600 \frac{\text{kWh}}{\text{year}} - 7,524 \frac{\text{kWh}}{\text{year}} = 7,076 \frac{\text{kWh}}{\text{year}}$$

For demand savings, Econoler used the value obtained for wood stoves, i.e. 4.0 kW. Econoler considers that it is appropriate to use this value since the savings calculation for both products are based on the same annual electric consumption and that the electric backup consumption after replacement is similar for both products.

Gas Area Heater

To estimate the unitary savings value for gas area heaters, ENSC took the unitary savings value established for wood stoves and calculated a unitary savings value based on the proportion of the capacity installed for each type of equipment.

Since no relevant study or evaluation report could be found to review this unitary savings value, Econoler decided to validate the approach used by ENSC. Knowing that only five participants installed a gas area heater in 2012 and that this product is no longer offered in 2013, Econoler considers the calculation made by ENSC appropriate. Indeed, the assumptions behind the calculations make sense and the average capacity assumed for the wood stove (55,000 Btu/h) and for the gas area heater (20,000 Btu/h) are representative of what is found on the market. However, Econoler revised the unitary savings value obtained from this calculation to take into account the adjustment made for wood stoves. Since the unitary savings value for wood stove is now 6,983 kWh, the unitary savings value for gas area heater became 2,539 kWh:

$$\text{Annual Unitary Savings} = 6,983 \frac{\text{kWh}}{\text{year}} \times \frac{20,000 \text{ BTU}}{55,000 \text{ BTU}} = 2,539 \frac{\text{kWh}}{\text{year}}$$

For demand savings, Econoler used the same approach. Therefore, demand savings of 1.45 kW will be used for this year's evaluation.

DWHR

For DWHR, ENSC uses a unitary savings value of 816 kWh. This value was revised by Econoler during the 2011 evaluation of EnerGuide for Existing Houses. To do so, the Evaluator consulted the 2011 OPA report,³³ which contains a unitary savings analysis for DWHR systems for residential uses. This analysis was made for DWHR pipe of 60 percent effectiveness to be installed in houses with a single electric water heater. Econoler considers that the assumptions used by the OPA are still appropriate and therefore no changes were made to the energy savings value.

³³ Ontario Power Authority (OPA), "2011 Prescriptive Measures and Assumptions," Release Version 1, March 2011, pages 548 to 550.

The OPA also considers winter peak demand savings of 0.15 kW, which will also be used in this year's impact evaluation.

Gas Range and Gas Dryer

The unitary savings values used for gas ranges and gas dryers are based on the replacement of old equipment manufactured in 2001. The consumption values come from NRCan's National Energy Use Database. Econoler considers this approach appropriate since we do not have any information on the age of the old electric appliances replaced but it can be assumed that they are over 10 years old since these appliances have a long useful lifetime.

Demand savings for these types of equipment are quite small and information on such savings is difficult to find. Since only three participants installed these appliances through the program in 2012, Econoler did not consider any demand savings for these types of equipment.

The table below presents the revised unitary energy and demand savings values based on the literature review in comparison with the unitary energy and demand savings values used in the tracking sheet.

Table 24: Revised Unitary Savings Values Based on the Literature Review

Category of Equipment	Tracked Energy Savings Value (kWh/year)	Revised Energy Savings Value (kWh/year)	Tracked Demand Savings Value (kW/year)	Revised Demand Savings Value (kW/year)
Geothermal Heat Pump	12,863	14,330	0	7.84
Ducted Central Air Source Heat Pump	7,559	7,076	0	4.00
Gas Area Heater	3,000	2,539	0	1.45
DWHR	816	816	0	0.15
Gas Range	750	750	0	0
Gas Dryer	900	900	0	0

4.2.3 On-Site Visit Results

The information collected during the eight on-site visits was used to validate the installation of the new units installed, as well as collecting information on the source of energy used by the previous space or DHW heating systems. The on-site visits confirmed that the units for which a rebate was claimed through Fuel Substitution were installed and used as the main source of heating. Moreover, the on-site visits also confirmed that all participants were offsetting electric consumption and they showed that the information found in the tracking sheet was accurate. Therefore, no correction factor was established based on the site visit results.

4.2.4 Revised Gross Savings

The annual gross savings for each category of equipment installed through Fuel Substitution are presented in Table 25. They were calculated using the unitary savings values reviewed in this report. Overall, total gross energy and demand savings amount to 2.041 GWh and 1.130 MW at the meter. Gross savings at generator level are also estimated in Table 25, using a line loss factor between the meter and the generator of 1.100. This value was provided by NSPI for residential dwellings. Using that factor, the total gross energy and demand savings at the generator are estimated at 2.245 GWh and 1.243 MW.

Table 25: Evaluation Results – Gross Energy and Demand Savings

Category of Product	Wood Stove	Pellet Stove	NG Combo Boiler	Wood Furnace or Boiler	Central NG Heating	Gas Tankless DHW	Gas Tanked DHW	Gas Area Heater	Ducted Central ASHP	DWHR	Gas Range	Gas Dryer	Total
Energy Savings													
Number of Units	126	112	8	6	1	14	8	5	5	1	3	2	291
Unitary Savings (kWh)	6,983	6,391	22,206	13,804	14,008	5,364	5,376	2,539	7,076	816	750	900	-
Total Gross Energy Savings – at Meter (GWh)	0.880	0.716	0.178	0.083	0.014	0.075	0.043	0.013	0.035	0.001	0.002	0.002	2.041
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Gross Energy Savings – at Generator (GWh)	0.968	0.787	0.195	0.091	0.015	0.083	0.047	0.014	0.039	0.001	0.002	0.002	2.245
Demand Savings													
Unitary Demand savings (kW)	4.00	4.00	10.34	7.66	7.66	0.63	0.63	1.45	4.00	0.15	0	0	-
Total Gross Demand Savings – at Meter (MW)	0.504	0.448	0.083	0.046	0.008	0.009	0.005	0.007	0.020	0.000	0	0	1.130
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Gross Demand Savings – at Generator (MW)	0.554	0.493	0.091	0.051	0.008	0.010	0.006	0.008	0.022	0.000	0	0	1.243

4.3 NET-TO-GROSS RATIO

The NTGR evaluation of the program is based on a self-report approach which relies on a series of questions designed to measure the influence of the program on customers' decisions to reduce the level of electricity that is used for home heating, domestic hot water (DHW) and/or larger appliances (ranges and dryers). These questions were included in the participant survey.

This section presents the methodology used to transform responses to survey questions into a NTGR. For Fuel Substitution, the NTGR includes the assessment of two distortion effects: free-ridership and spillover. Once each effect is quantified, the NTGR is calculated based on the equation below:

$$\text{Net-to-gross ratio} = (1 - \% \text{ free-ridership} + \% \text{ spillover})$$

4.3.1 Free-Ridership

Free-ridership can occur when participants declare that they would still have replaced or substituted their electric space heating or DHW heater system in the absence of the program. The telephone survey included eight free-ridership questions divided into four groups that attempted to assess:

- > the probability that the customer would have purchased, replaced or substituted their electric systems with the same source of energy or system in the absence of the program;
- > the probability that the participant would have paid the full cost of the project in the absence of the program;
- > the factors, other than the program, that might have affected the customer's decision; and
- > the temporal sequence of the program and the customer's decision.

Each group of questions is transposed into a level of program attribution which is used to calculate the global free-ridership level for each participant. The algorithm behind this calculation is presented in Appendix VI.

Using this approach, survey results revealed a free-ridership level of 32 percent for the program. Compared to the 2011 free-ridership level of 42 percent, this result shows a substantial drop which could be explained by the increase of marketing efforts and outreach activities aimed to influence decision making among homeowners who have not already decided to replace or substitute their equipment.

4.3.2 Spillover

For Fuel Substitution, internal spillover can occur when participants who installed a natural gas space or DHW heating system and, following or during their participation, were influenced by the program to also replace other electric equipment with new equipment using natural gas. For instance, since the program only rebates one gas area heater per participant, spillover can occur when a participant buys

more than one eligible gas heater because they have been influenced by the program. Additional purchases of gas ranges or gas dryers after participation in the program may also be claimed as spillover if they were due to the influence of the program and if the participant did not receive any rebate for it. The survey included a question to ensure that the participant did not receive any rebate for the additional products purchased.

Therefore, the internal spillover was measured through the participant survey for participants who switched from electricity to natural gas. Of the 75 participants surveyed, 6 converted to natural gas. Of these 6 participants who represented potential spillover, one indicated having installed an additional natural gas appliance following or during participation in the program. This additional purchase corresponds to energy savings attributable to the program totalling 20.41 MWh, resulting in a spillover level representing 1 percent of total energy savings for the program.

4.3.3 NTGR Result

Based on the free-ridership and spillover levels obtained, the NTGR for the Program is 0.69.

4.4 NET SAVINGS

Net savings for the Program were estimated using the NTGR value obtained above. The equation below was used to calculate demand and energy net savings.

$$\text{Net Savings} = \text{Gross Evaluation Savings} \times \text{NTGR}$$

This equation was used for both demand and energy savings. Overall, the total net energy savings amount to 1.408 GWh at the meter and 1.549 GWh at the generator; the total net demand savings amount to 0.779 MW at the meter and 0.857 MW at the generator. The results obtained are presented below.

Table 26: Evaluation Results – Revised Net Demand Savings

Category of Product	Wood Stove	Pellet Stove	NG Combo Boiler	Wood Furnace or Boiler	Central NG Heating	Gas Tankless DHW	Gas Tanked DHW	Gas Area Heater	Ducted Central ASHP	DWHR	Gas Range	Gas Dryer	Total
Energy Savings													
Total gross energy savings – at meter (GWh)	0.880	0.716	0.178	0.083	0.014	0.075	0.043	0.013	0.035	0.001	0.002	0.002	2.041
NTGR	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Total Net Energy Savings (GWh) – at Meter	0.607	0.494	0.123	0.057	0.010	0.052	0.030	0.009	0.024	0.001	0.002	0.001	1.408
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Net Energy Savings (GWh) – at Generator	0.668	0.543	0.135	0.063	0.011	0.057	0.033	0.010	0.027	0.001	0.002	0.001	1.549
Demand Savings													
Total gross Demand savings – at meter (MW)	0.504	0.448	0.083	0.046	0.008	0.009	0.005	0.007	0.020	0.000	0	0	1.130
NTGR	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Total Net Demand Savings (MW) – at Meter	0.348	0.309	0.057	0.032	0.005	0.006	0.003	0.005	0.014	0.000	0	0	0.779
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Net Demand Savings (MW) – at Generator	0.383	0.340	0.063	0.035	0.006	0.007	0.004	0.006	0.015	0.000	0	0	0.857

The table below presents comparisons between the energy savings established by this evaluation and those calculated in the 2012 tracking sheet.

Table 27: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	NTGR	Net Savings
Energy Savings			
Tracked Savings from ENSC	2.592 GWh	0.58	1.503 GWh
Evaluation Results	2.245 GWh	0.69	1.549 GWh
Demand Savings			
Tracked Savings from ENSC	1.212 MW	0.58	0.703 MW
Evaluation Results	1.243 MW	0.69	0.857 MW

The net values calculated were compared to the program tracked savings for 2012. The net energy savings calculated for Fuel Substitution are 3 percent higher than those calculated from the tracking sheet. This can be explained by the increase in the NTGR calculated for this evaluation in comparison to the one applied in the tracking sheet, which was based on the 2011 evaluation. Indeed, the free-ridership level evaluated for the program in 2012 is lower than the one evaluated in 2011, probably due to the increased marketing efforts and outreach activities. However, the unitary savings values for the two most popular products, wood and pellet stoves, were lowered after the billing analysis, which also had a considerable impact on the energy savings.

CONCLUSION

The 2012 evaluation of Fuel Substitution found that the transition from a pilot to a full-fledged program was successful. Participants expressed high levels of satisfaction with the program overall, as well as with its specific aspects. Furthermore, the Evaluator found major improvements in Fuel Substitution since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving little time to follow up on all the process and impact recommendations before the new evaluation window, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management such as the various process charts, the evaluation plan and a standardized program manual. Moreover, great efforts were made in increasing upstream program promotion in order to influence decision making among homeowners who have not already decided to replace or substitute their equipment.

ENSC's actions in increasing program promotion and communication contributed to the program awareness in 2012, as it was an important means through which participants learned about the program. This finding could explain the drop in free-ridership to 32 percent in 2012, from 42 percent in 2011, where no upstream advertising was done. However, it should be noted that retail stores continue to be the main source of program awareness as they were in 2011, but to a lesser extent.

The program totalled 282 participants for the year 2012, which is similar to the previous year (296 participants in 2011). The evaluation revealed that Fuel Substitution generated net energy savings of 1.549 GWh and demand savings of 0.857 MW at the generator in 2012, compared to 1.570 GWh and 0.785 MW in 2011. To calculate the net savings of Fuel Substitution in 2012, Econoler reviewed the gross savings used in the tracking sheet by conducting a billing analysis and a literature review. Moreover, Econoler took into consideration the free-ridership and the spillover measured in the participant survey.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Continue marketing efforts and outreach activities: In 2011, the Evaluator recommended the addition of upstream advertising in program strategy. This recommendation has been successfully implemented since survey results indicated that one-third of customers learned about the program through ENSC advertising. The Evaluator recommends continuing marketing efforts and outreach activities as they contribute to lowering the free-ridership level by influencing decision making among homeowners who have not already decided to replace or substitute their equipment. They can also help increase the number of participants.
	2. Consider reintroducing a rebate on ductless mini-split heat pumps for quality purposes: According to distributors, there is a need for ENSC to once again provide a rebate on ductless mini-split heat pumps to encourage the installation of quality ductless mini-split heat pumps. Furthermore, distributors would like to see only heat pumps that achieve a specific minimum level of efficiency being covered through the program. The program review has determined that the Tier 2 ENERGY STAR rating is increasingly becoming a prerequisite for ductless mini-split heat pump rebates, going beyond regular and Tier 1 ENERGY STAR-qualified ductless mini-split heat pumps. The possibility of offering a rebate meeting these criteria would most likely enhance the quality of ductless mini-split heat pumps sold in the Nova Scotian residential market (see Section 3.5 for more details).
	3. Consider conducting calibrated simulations with real participants who installed a wood or pellet stove: Wood and pellet stoves are by far the largest contributors of the achieved savings for Fuel Substitution. Together, they accounted for about 78 percent of the energy savings in 2012 and 90 percent of the energy savings in 2011. For this year's evaluation, Econoler revised only the average heating consumption for participants, which is one of the main parameters used in the unitary savings calculations of seven eligible products. This revision allowed for a more precise calculation of savings. However, for the two main products of the program, i.e. wood and pellet stoves, ENSC should consider reviewing the unitary savings values by conducting simulations with real participants and calibrating these simulations with their billing data. With these simulations, it would also be possible to review the demand savings value, based on the load profile.

Program Manual	4. Document the major characteristics of the program: In the program manual, there is no mention of the incentives offered by Heritage Gas to customers who convert to natural gas. This information, as well as the role of Heritage Gas in the program, should be explained in the program manual. 5. Document major changes in the Document Revision section: In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual, such as the transformation of the pilot to a full program and the option to finance the project instead of receiving an incentive. Moreover as ENSC transforms this program into a service that promotes green energy sources such as heat pumps and biomass, the transformation should be mentioned in a new version of the program manual. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.
Evaluation Plan	6. Adapt the evaluation plan template to meet program needs: In the program base case, some programs, such as Fuel Substitution, have many measures to describe from baseline to net savings. The table structure for this section can be changed if there are too many N/A slots. If some parameters are not applicable to the measures (for example Baseline Energy Efficiency Level) the line for that variable can be deleted from the table.
Program Charts	7. Post a simplified participant process chart on the website: The Evaluator recommends developing a simplified participant process chart and posting it on the program website (in the “How to Participate” section), which is comprehensive, clear and well designed. After all, since this chart is intended for the participants, it must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version date should be indicated in the chart.
Marketing and Outreach Activities	8. Make the performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

APPENDIX II – INTERVIEW GUIDE WITH DISTRIBUTORS

DISTRIBUTOR INTERVIEW GUIDE EFFICIENCY NOVA SCOTIA HEA PROGRAM

October 24, 2012

INTRODUCTION

Hello, may I speak with _____? Hello, my name is _____, from CRA (Corporate Research Associates). I am calling regarding our scheduled interview for Efficiency Nova Scotia Corporation's Home Energy Assessment program. Is now a good time to conduct the interview?

[TO BE READ IF NECESSARY]

The program was formerly known as the "EnerGuide for Existing houses" program. Throughout the interview, I will refer to it as the "Home Energy Assessment" program.

Thank you for taking the time to participate in this interview. CRA has been mandated by Efficiency Nova Scotia to conduct an evaluation of the Home Energy Assessment program. We have a few questions about this program and the residential market in general. It should take between 5 and 10 minutes to complete. Everything you say today will be kept confidential and anonymous; your comments will be combined with those of others that I interview as part of a detailed report. I'd like to record our interview today, is that okay? The recording will be used for research purposes only.

SECTION R – RECOMMENDATIONS

The first few questions will be specifically about the Home Energy Assessment program.

R1. How familiar are you with Efficiency Nova Scotia's Home Energy Assessment program?

R2. And how familiar are you with Efficiency Nova Scotia's EnerGuide for Existing Houses program?

R3. **(If familiar to either/both):** What do you know about the (insert name) program?

R4. If familiar: In your opinion, what are the main barriers to the delivery of Efficiency Nova Scotia's Home Energy Assessment program, by order of importance?

Answer:

R5. If familiar: Are there any energy efficiency upgrades that are not covered by Efficiency Nova Scotia's Home Energy Assessment program that you would like to have covered or that are being requested by your customers? If so, which ones?

☐ Yes

☐ No

Upgrades:

R6. If familiar: Do you have any suggestions to improve the program?

Answer:

R7. If familiar: More precisely, what suggestions do you have concerning program marketing and outreach activities?

Answer:

SECTION M – MARKET

I will now ask you questions about the residential market and the impact of Efficiency Nova Scotia's EnerGuide programs on the market.

[NOTE - TO BE READ IF NECESSARY: Efficiency Nova Scotia's EnerGuide programs are the Home Energy Assessment program, formally known as the EnerGuide for Existing Houses program, the Performance Plus program and the Low Income Homeowners program. EnerGuide programs let participants receive an EnerGuide rating, which indicates the level of efficiency of their house. The higher the rating, the more efficient the house is. Such programs include two audits. The first audit aims at recommending measures to participants. The second audit occurs once all measures have been implemented and allows the auditor to determine the EnerGuide rating of the house.]

M1. Has there been any impact of Efficiency Nova Scotia's EnerGuide programs on your sales? If yes: what was that impact?

Explain:

M2. Since April 1st, 2012, Efficiency Nova Scotia no longer finances the purchase of mini-split heat pumps through its programs. Mini-split heat pumps were once included in Efficiency Nova Scotia's EnerGuide programs but were withdrawn in order to prevent a high free-ridership level from participants for those products—in other words, to prevent financing the purchase of those products by participants who would have bought them anyway.

a. Has the installation of mini-split heat pumps become a standard practice in the market for heating systems?

☐ Yes

☐ No

Explain:

b. [IF ANSWERED NO] What is the standard practice in the market? What conventional heating systems are typically installed?

Explain:

M3. Who mainly purchases mini-split heat pumps? [PROBE: Homeowners, property management groups (multi-unit residential buildings), bulk residential sales, etc.)

M4. Even though the purchase and installation of mini-split heat pumps are not financed through Efficiency Nova Scotia's programs, their implementation is still recommended through some EnerGuide programs. Do you believe these recommendations influence the purchase of mini-split heat pumps?

☐ Yes

☐ No

Explain:

M5. Have you noticed a decrease in mini-split heat pump sales in 2012 since they are no longer financed by Efficiency Nova Scotia? If so, would you be able to quantify this decrease in percentage?

☐ Yes

☐ No

Percentage of decrease:

M6. Do you believe mini-split heat pumps should be reintegrated into one or more of Efficiency Nova Scotia's energy efficiency programs? Why?

☐ Yes

☐ No

Explain:

M7. If mini-split heat pumps were to be reintegrated into one of ENSC's energy efficiency programs, should a rebate be offered only for mini-split heat pumps with a certain level of efficiency? If so, what should be the minimum level of efficiency?

Answer:

M8. Approximately, what is the current retail price of mini-split heat pumps?

Answer:

M9. Are there more efficient alternatives to mini-split heat pumps on the market right now? If so, what are they?

☐ Yes

☐ No

Explain:

SECTION C – CONCLUSION

Well, this completes our interview. Before we conclude do you have any comments or suggestions or are there topics that we didn't address that you would like to talk about?

On behalf of Efficiency Nova Scotia, I thank you very much for your time. Your participation was truly helpful. Thank you again and have a nice day!

APPENDIX III – ON-SITE VISIT PROTOCOL

1 General Information

Date of visit: _____

Contact name in tracking sheet: _____

Person met during site visit: _____

ENSC project #: _____

Telephone: _____

Address: _____

2 Validation of installation

Validate tracking sheet information with participant:

Category of System Installed	From Tracking Sheet	On-Site Validation
Wood Stove		
Pellet Stove		
Wood Furnace or Boiler		
Central Natural Gas		
Natural Gas / Propane DHW		
Natural Gas / Propane Area Heaters		
Air Source Heat Pumps		

3 Project information

Home Heating System (i.e. All systems except Natural Gas Condensing DHW)

	From tracking sheet	Contact declaration
Date of installation:	N/A	
Main energy source for heating before conversion and approx. % of total heating of the building envelope provided (<i>electric, natural gas, etc.</i>):		
Type – Main heating system type before conversion (<i>boiler, heat pump, resistive heating, etc.</i>):		
Capacity – Main heating system before conversion (<i>ask the contact if they still have the equipment or some documentation</i>):	N/A	
AFUE – Main heating system before conversion (<i>ask the contact if they still have the equipment or some documentation</i>):	N/A	
Secondary energy source for heating before conversion and % of total heating of the building envelope provided (<i>electric, natural gas, etc.</i>):		
Type – Secondary heating system type before conversion (<i>boiler, heat pump, resistive heating, etc.</i>):		
Capacity – Secondary heating system before conversion (<i>ask the contact if they still have the equipment or some documentation</i>):	N/A	
AFUE – Secondary heating system before conversion (<i>ask the contact if they still have the equipment or some documentation</i>):	N/A	

	From tracking sheet	Site validation
Energy source for new equipment used for heating and % of total heating of the building envelope provided (<i>wood, natural gas, etc.</i>)	_____	_____
Type – New heating system installed (<i>boiler, furnace, etc.</i>)	_____	_____
AFUE – New heating system installed	N/A	_____
Model name/number - New heating system installed	_____	_____
Is the equipment ENERGY STAR® certified (YES/NO)?	N/A	_____
Is electric back-up still in use? If yes, what is the % anticipated usage?	_____	_____

Notes:

Water Heating System (i.e. Natural Gas / Propane DHW)

	From tracking sheet	Contact declaration
Date of installation:	_____	_____
Was this system replaced during the fuel substitution (YES/NO)?	_____	_____
Energy source used for water heating before conversion (<i>electric, natural gas, etc.</i>):	_____	_____
Type – Water heating system before conversion (<i>boiler, heat pump, etc.</i>):	_____	_____
Energy factor – Water heating system before conversion:	N/A	_____
Energy source installed for water heating, after conversion (<i>wood, natural gas, etc.</i>):	_____	_____
Type – Water heating system installed (<i>boiler, furnace, etc.</i>):	_____	_____
Model name/number of heating system installed:	_____	_____
Energy factor – Water heating system installed (<i>On-site observation or on-line with the model number</i>):	_____	_____
Is the equipment ENERGY STAR® certified (YES/NO)?	N/A	_____

Notes:

APPENDIX IV – DEMOGRAPHICS

The demographic profile of the program participants interviewed for the survey is presented in the following tables.

The majority of respondents resided in a detached single-family home (91%). Nearly one-half of the respondents had a home with three bedrooms (48%), and almost four in 10 had four or more bedrooms in their home (37%). Four in 10 (41%) respondents had two people in their household, while nearly one-half (47%) had three or more people in their household.

Table 28: Type of Residence

Type of Residence	2011	2012
<i>Sample Size</i>	28	75
Detached single-family home	86%	91%
Mobile home or house trailer	14%	5%
Townhouse or duplex which share adjacent walls	--	3%
Semi-detached house	--	1%
Number of Bedrooms	2011	2012
<i>Sample Size</i>	28	75
1	4%	--
2	18%	15%
3	68%	48%
4+	11%	37%
Number of people in household	2011	2012
<i>Sample Size</i>	28	75
1	11%	12%
2	57%	41%
3	14%	20%
4+	18%	27%

Four in 10 respondents were under the age of 45 (42%), while one-third were 55 years of age or older (35%). In terms of education, seven in 10 had a college (15%) or university (57%) degree.

Table 29: Age and Education

Age	2011	2012
<i>Sample Size</i>	28	75
18-24	--	--
25-34	29%	15%
35-44	14%	27%
45-54	21%	24%
55-64	21%	24%
65+	14%	11%
Education	2011	2012
<i>Sample Size</i>	28	75
Less than high school graduation certificate	11%	4%
High school graduation certificate and/or some post-secondary	21%	15%
Trade certificate	--	7%
College certificate or diploma	21%	15%
University certificate or diploma	39%	57%
Other	7%	--
Refused	--	3%

Six in 10 respondents had an annual household income of \$50,000 or more (59%).

Table 30: Income

Income	2011	2012
<i>Sample Size</i>	28	75
Less than \$15,000	--	--
\$15,000-\$24,999	--	7%
\$25,000-\$34,999	14%	9%
\$35,000-\$49,000	18%	12%
\$50,000-\$69,000	25%	13%
\$70,000-\$79,000	11%	7%
\$80,000 or more	25%	39%
Refused	7%	13%

Over one-half of the respondents were male (55%), while over four in 10 were female (45%).

Table 31: Gender

Gender	2011	2012
<i>Sample Size</i>	28	75
Male	57%	55%
Female	43%	45%

APPENDIX V – PARTICIPANT SURVEY QUESTIONNAIRE

Participant Survey Fuel Substitution Program October 9, 2012

Screening Questions

Could I speak with [INSERT NAME]?

1. Yes [GO TO INTRODUCTION]
2. No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

Introduction

Hello, my name is _____ from CRA (Corporate Research Associates). I am calling on behalf of the Fuel Substitution Program from Efficiency Nova Scotia Corporation (ENSC).

We are calling customers who used the program to substitute their electric space heating with another heating source such as a wood or pellet stove or gas area heater, or to completely remove electric space heating or domestic water heating from the home and replacing their systems with a new heating source in 2012. Are you the person in your household who was most involved and familiar with deciding about the program?

[IF NO, ASK TO SPEAK TO THE APPROPRIATE PERSON: “May I please speak to the person who knows the most about the heating system in your house?”]

[IF APPROPRIATE PERSON] We are trying to get feedback from customers about the Fuel Substitution Program to make the program better. Your responses will be kept strictly confidential—that is, your name will not be associated with any of your responses. This survey will take about 15 minutes of your time.

- V1. Our records indicate that your household participated in the Fuel Substitution Program. Is this correct?
1. Yes [CONTINUE]
 2. No, does not recall participating [PROBE: "Are you sure? According to our records, you would have received a rebate from Efficiency Nova Scotia for switching from electricity to a new energy source for space heating or domestic water heating or for installing new space heating or domestic water heating equipment."] [IF PERSIST AS NO, THANK, TERMINATE AND RECORD]
 9. Don't know/Refused [PROBE: "Are you the person who knows the most about the heating system in your house or your household participation to the Fuel Substitution/Switching Program?"] [IF NO, ASK TO SPEAK TO THE APROPRIATE PERSON AND RESTART AT INTRODUCTION. IF PERSISTS AS NO, THANK, TERMINATE AND RECORD.]

Program Awareness and Participation [P Series]

- P1. How did you learn about the Fuel Substitution Program? PROBE: Anything else? [DON'T READ; ALLOW MULTIPLE RESPONSES]
1. (Mailing/Email from Heritage Gas)
 2. (On the Heritage Gas website)
 3. (On the Efficiency Nova Scotia website)
 4. (Internet—unspecified)
 5. (At a Home show)
 6. (On the Radio)
 7. (In the Newspaper)
 8. (Print brochure)
 9. (Previous participant)
 10. (Co-worker, family, friend or word of mouth)
 11. (The store where you purchased your new equipment)
 96. (Other [SPECIFY _____])
 98. (Don't know)
 99. (Refused)

- P2. Now I'm going to ask you to think back to when you decided to supplement your electric space heating or completely replace it with another heating source and participate in the Fuel Substitution Program. What was the SINGLE most important reason you were interested in switching heating system or substituting heating source? [DO NOT READ]
1. (To save on energy/to save on energy costs)
 2. (For better comfort)
 3. (To make home more energy efficient)
 4. (To help the environment)
 5. (To have a backup heating source)
 96. (Other) [SPECIFY_____]
 98. (Don't know) [GO TO P4]
 99. (Refused) [GO TO P4]
- P3. Were there any other reasons? [SAME LIST AS IN P2] [DO NOT READ. ACCEPT MULTIPLE RESPONSES]
97. None/no other reasons
- P4. And who would you say had the most influence on you about purchasing the equipment bought through the Fuel Substitution Program? [DO NOT READ. PROBE FOR THE MAIN INFLUENCE] [ACCEPT ONE RESPONSE ONLY]
1. (An installer)
 2. (Co-worker, family, friend or word of mouth)
 3. (The store where you purchased your new equipment)
 4. (Program documentation/Print brochure)
 5. (Efficiency Nova Scotia Advisor)
 96. (Other) [SPECIFY_____]
 98. (Don't know)
 99. (Refused)
- P5. Before participating, did you have any concerns about taking part in the program?
1. (Yes)
 2. (No)
 98. (Don't know)
 99. (Refused)

- P6. [IF P5 = 1] What were those concerns? PROBE: Anything else? [DO NOT READ. ACCEPT ALL RESPONSES]
1. (That the new heating system would be inefficient)
 2. (That improvements would cost a lot)
 3. (Rebates would be too low / insufficient)
 4. (Wouldn't like what I installed)
 5. (The process would take too long)
 6. (My insurance would increase)
 96. (Other) [SPECIFY _____]
 98. Don't know
 99. Refused

Program Satisfaction [S Series]

- S1. Using a scale from 1 to 5, where 1='not at all satisfied' and 5='very satisfied', how would you rate your satisfaction with the Fuel Substitution Program OVERALL? [DO NOT ACCEPT A RANGE - RECORD NUMBER, 98 = Don't know/Don't recall, 99 = Refused]
- S2. [IF S1 = 1, 2 OR 3] You indicated that you were not satisfied with the program overall. What was the SINGLE most important reason you were not satisfied with the program overall? [PROBE FOR SPECIFIC REASON. DO NOT READ. ACCEPT ONE RESPONSE]
1. (Too difficult to complete the pre-approval application form)
 2. (Too long to get the pre-approval)
 3. (Program too hard to understand – too many conditions)
 4. (The incentive amount (rebate) is too small)
 5. (The rebate application form is too complicated to complete)
 6. (There are too many documents to submit along with the rebate application form)
 7. (It is too long to receive the incentive amount (rebate))
 8. (There are too many verifications from Efficiency Nova Scotia)
 96. (Other, [specify: _____])
 98. (Don't know)
 99. (Refused)

- S3. [IF S1 = 1, 2 OR 3] Were there any other reasons you were dissatisfied? [PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE; SAME LIST AS S2]
- 97 No other reasons
- S4. Now I'm going to ask you to think about each aspect of the Fuel Substitution Program. On a scale of 1 to 5, where 1='not at all satisfied' and 5='very satisfied', how satisfied were you with each aspect of the Fuel Substitution Program? If you did not have experience with one of the aspects please tell me. [DO NOT RANDOMIZE] [97 = Not Applicable, 98 = Don't know/Don't recall, 99 = Refused]
- a) Program application, forms and associated paperwork
 - b) Interaction and communication with Efficiency Nova Scotia staff
 - c) Initial confirmation of eligibility
 - d) Rebate or incentive amounts
 - e) Time required to receive rebate or incentive
 - f) The system installed in your home
- S5. Using a 5-point scale, where '1' is very difficult and '5' is very easy, how would you rate the process to participate in the program? [1-5 scale, 98 = Don't know/Don't recall, 99 = Refused]
- S6. [IF S5 = 1, 2 OR 3] What was difficult about participating in the program? [MULTIPLE RESPONSE – RECORD VERBATIM] Probe: Anything else?
97. (Record answer)
98. (Don't know)
99. (Refused)

Free-ridership [FR Series]

- FR1. Had you **already** considered replacing or substituting your space heating or domestic hot water system with another heating source **before** you heard about the Fuel Substitution Program?
- 1. Yes
 - 2. No
 - 98. (Don't know)
 - 99. (Refused)

[IF FR1=YES]

FR1a. **Before** you decided to participate in the Fuel Substitution Program, had you already made the decision to replace or substitute your space heating or domestic hot water system with another heating source?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Fuel Substitution Program.

If you had not participated in the Fuel Substitution Program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action." [AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT, In the absence of the Program, would you have . . . : DO NOT ACCEPT A RANGE – ASK FR2 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FR2a. . . . replaced or substituted your space heating or domestic hot water system with one that did not use electricity?

___ Response ___98 Don't Know ___99 Refused

FR2b. . . . replaced or substituted your old space heating or domestic hot water system with another one that uses electricity?

___ Response ___98 Don't Know ___99 Refused

FR2c. . . . replaced or substituted your space heating or domestic hot water system with one that did not use electricity , *but at a later date*?

___ Response ___98 Don't Know ___99 Refused

[IF FR2c > 5, THEN ASK]

FR2cc. DO NOT ASK FR2cc IF DON'T KNOW OR REFUSED IN Q.FR2c You indicated in your response to a previous question that if the Fuel Substitution Program had not been available there was an [FR2c] in 10 likelihood that you would have replaced or substituted your space heating or domestic hot water system with one that did not use electricity, *but at a later date*. Approximately how many months later would you have replaced or substituted your heating or domestic hot water system? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. _____ months later
2. (Never)
3. (At the same time)
97. (Don't Know)
98. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2cc ANSWER IN MONTHS, READ]:

Would it have been within

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FR3. Efficiency Nova Scotia paid you \$[ACTUAL REBATE] for your new space heating or domestic hot water system. If you had not received the rebate from Efficiency Nova Scotia, would you have made the same purchase? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not Have**” and a 10 indicating that you “Definitely **Would Have**.” [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

____ Response ____98 Don't Know ____99 Refused

FR4. Next, I'm going to ask you to rate the importance of factors that might have influenced your decision to replace or substitute your space heating or domestic hot water system to another heating source. Using a scale from 0 to 10, where 0 means “Not at all important” and 10 means “Extremely important”, please rate the importance of each of the following in your decision to replace your heating system to another heating source.

Factor (READ AND RANDOMIZE)	Responses – DO NOT ACCEPT A RANGE
a. The program rebate	___ Response ___98 Don't Know ___99 Refused
b. Information on the program provided by a salesperson	___ Response ___98 Don't Know ___99 Refused
c. Program promotion on the Internet, radio or newspaper	___ Response ___98 Don't Know ___99 Refused
d. Previous experience with a similar program either from Efficiency Nova Scotia or Nova Scotia Power	___ Response ___98 Don't Know ___99 Refused

Spillover [SP series]

[ASK IF, IN DATABASE, APPLYING FOR REBATES = NG COMBO BOILER, NG BOILER, CENTRAL NG, GAS TANKLESS DHW, GAS TANKED DHW, GAS AREA HEATER, GAS RANGE, GAS DRYER]

SO1. Now I'd like you to think about the time you participated in the Fuel Substitution Program to convert your heating system to gas. While or after converting your heating system to gas, did you buy additional equipment that uses gas? It could be a gas area heater, a gas range, a gas dryer...

1. Yes
2. No (GO TO IM1)
98. (Don't know) (GO TO IM1)
99. (Refused) (GO TO IM1)

[IF SO1 = 1]

SO2. What additional equipment that uses gas did you buy while or after converting your heating system to gas? PROBE: Anything else? [PROBE FOR SPECIFIC EQUIPMENT. DO NOT READ. ACCEPT MULTIPLE; 98 = DK, 99 = REFUSED]

1. (Gas area heater)
2. (Gas Range)
3. (Gas dryer)
96. (Other, specify _____)
98. (Don't know)
99. (Refused)

[IF SO1 = 1]

SO3. [DO NOT ASK IF 98 OR 99 IN SO2] When did you decide to buy this [INSERT RESPONSE FROM SO2] equipment? Was it... [READ RESPONSES IN ORDER – ALLOW MULTIPLE RESPONSES]

1. Before deciding to participate in the Fuel Substitution Program
2. When deciding to participate in the Fuel Substitution Program
3. After deciding to participate in the Fuel Substitution Program
98. DO NOT READ (Don't know)
99. DO NOT READ (Refused)

[IF SO1 = 1]

SO4. Before participating in the Fuel Substitution Program, was your house connected to the gas utility network?

1. Yes
2. No
98. (Don't know)
99. (Refused)

Impact of measures [IM Series]

IM1. Please indicate how each of the following has changed since participating in the Fuel Substitution Program? On a scale of 1 to 5, where 1 means "no improvement" and 5 means a "considerable improvement", how much has [READ EACH ONE] improved?

- a. Your interest in Energy efficiency
- b. Your knowledge of Energy efficiency
97. Refused
98. Don't know

Barriers to Action [B Series]

B1. Were there any challenges or barriers that you faced in implementing the new equipment or the new energy source rebated by the Fuel Substitution Program?

1. Yes
2. No
98. (Don't know)
99. (Refused)

- B2. [If B1 = 1 'Yes'] What were those challenges or barriers? PROBE: Anything else? [DO NOT READ. ACCEPT ALL RESPONSES]
1. (Concern that actual bill savings would be less than estimated)
 2. (Lack of information to make an informed decision)
 3. (Rebate/incentive was too little)
 4. (Paperwork/process required too much work)
 5. (Too little information about the program)
 6. (Cost savings not worth the effort of applying)
 7. (Approval takes too long)
 8. (Lack of financing)
 9. (Energy efficient equipment does not meet payback requirements)
 10. (Lack of technical knowledge)
 96. (Other barrier [Specify: _____])
 98. (Don't know)
 99. (Refused)

Value of the program to customers [VP Series]

- VP1. Would you recommend the Fuel Substitution Program to a family member or friend?
1. Yes
 2. No
 98. (Don't know)
 99. (Refused)
- VP2. [IF VP1 = 2 'NO'] Why not? [DO NOT READ – MULTIPLE RESPONSES]
1. (Is not worth the expenses)
 2. (No family members or friends that could be eligible)
 3. (Concern that actual bill savings would be less than estimated)
 4. (Lack of information to make an informed decision)
 5. (Incentive is too small)
 6. (Energy efficient equipment does not meet payback requirements)
 96. (Other [Specify: _____])
 98. (Don't know/Don't recall)
 99. (Refused)

Recommendations for Program Improvements [R Series]

- R1. Do you have any recommendations for improving the Fuel Substitution Program? PROBE: Anything else? [DO NOT READ. ACCEPT MULTIPLE]
1. (Offer more products/measures eligible to rebates)
 2. (Offer more information on the products/measures recommended)
 3. (Simplify program application, forms and associated paperwork)
 4. (Increase the rebate amount)
 5. (Increase the time given to complete the upgrades)
 6. (Improve communication)
 7. (Advertise the program more or in a better way)
 8. (No recommendation)
 96. (Other [SPECIFY _____])
 98. (Don't know)
 99. (Refused)
- R2. [IF R1=1] Which additional products or measures would you like to be eligible in the Fuel Substitution Program? [RECORD VERBATIM. ACCEPT MULTIPLE]
96. (Record answer)
 97. (Don't know)
 98. (Refused)

Demographics [D Series]

[ASK ALL RESPONDENTS]

These final questions are asked for statistical purposes only. The information collected is strictly confidential.

- D1. What type of residence do you live in? [READ RESPONSES 1-5, then 96; SELECT ONE RESPONSE]
1. Detached single-family home
 2. Semi-detached house
 3. Mobile home or house trailer
 4. Townhouse or duplex which share adjacent walls
 5. Row house
 96. Other [SPECIFY: _____]
 98. (Don't know)
 99. (Refused)

- D2. How many bedrooms are in your home? [98=DK; Enter zero for a studio apartment with no bedrooms]
- D6. Including yourself, how many people live in this residence on a full-time basis?
Number of people: _____ [NOTE: DON'T ALLOW ZERO FOR A RESPONSE]
- D7. What is your age group? Are you... [READ]
1. 18 to 24
 2. 25 to 34
 3. 35 to 44
 4. 45 to 54
 5. 55 to 64
 6. 65 or over
 9. (Refused)
- D8. What is the highest grade of schooling completed by the head of your household? [DO NOT READ]
1. (Less than high school graduation certificate)
 2. (High school graduation certificate and/or some post-secondary)
 3. (Trades certificate or diploma)
 4. (College certificate or diploma)
 5. (University certificate or diploma)
 99. (Refused)
- D9. Which of the following income categories best describes your total annual household income before taxes in 2011? Stop me when I reach the right category. [READ LIST; SELECT ONE RESPONSE]
1. Less than \$15,000
 2. \$15,000 - \$24,999
 3. \$25,000 - \$34,999
 4. \$35,000 - \$49,999
 5. \$50,000 - \$69,999
 6. \$70,000 - \$79,999
 7. \$80,000 or more
 99. (Refused)
- D10. [DO NOT READ] Gender:
1. Male
 2. Female

END: that is all the questions I have for you. Thank and terminate.

APPENDIX VI – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

FR2a. In the absence of the program, what is the likelihood that you would have replaced or substituted your space heating or domestic hot water system with one that did not use electricity? (Scale 0 to 10)	FR2a = Answer x 10%
FR2b. In the absence of the program, would you have replaced or substituted your old space heating or domestic hot water system with another one that uses electricity? (Scale 0 to 10)	FR2b = (10 – Answer) x 10%
PA1 Score:	MEAN VALUE OF: (FR2a ; FR2b)
FR1. Had you already considered replacing or substituting your space heating or domestic hot water system with another heating source before you heard about the program?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just want to make sure - Before you decided to participate in the program, you had already made the decision to replace or substitute your space heating or domestic hot water system with another heating source?	IF 1. Yes: FR1 = 100% IF 2 OR 9 : FR1 = 0%
FR3. If you had not received the rebate from ENSC, would you have made the same purchase of a new space heating or domestic hot water system ? (Scale 0 to 10)	FR3 = Answer x 10%
PA2 Score:	IF FR1 = 0% : FR3 / 2 IF FR1 = 100% : FR3
FR4. Level of influence (Scale 0 to 10) Factors a, b, c, d = Program factors	FR4_P = MAX(a; b; c; d)
PA3 Score:	(10 - FR4_P) x 10%
FR2c. In the absence of the program, what is the likelihood that you would have replaced or substituted your heating system with one that did not use electricity but at a later date ? (Scale 0 to 10)	IF FR2c > 5 : ASK FR2cc Otherwise: PA4 = EMPTY
FR2cc. Approximately how many months later would you have made the replacement or the substitution? 1. Less than 6 months? 2. 6 months to less than 1 year later? 3. 1 to less than 2 years later? 4. 2 to less than 3 years later? 5. 3 to less than 4 years later? 6. 4 or more years later? 7. (Never) 9. (Don't know / Refused)	IF 1. : FR2cc = 100% IF 2. : FR2cc = 50% IF 3. : FR2cc = 25% IF 4. : FR2cc = 0% IF 5. : FR2cc = 0% IF 6. : FR2cc = 0% IF 7. : FR2cc = 0% IF 9. : FR2cc = 0%
PA4 Score:	FR2cc
Final Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)
Inconsistency Test #1	IF ABS(FR2a – FR2b) ≥ 30%: PA1 = MIN OF (FR2a ; FR2b)
Inconsistency Test #2	IF FR3 ≥ 70% AND IF (FR2a OR FR2b < 70%: PA2 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)



LOW INCOME HOMEOWNER SERVICE IMPACT EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 4, 2013



ECONOLER

ACRONYMS

ARep	Appliance Replacement
ARet	Appliance Retirement
CFL	Compact Fluorescent Lamp
DA	Delivery Agent
DCS	Department of Community Services
EA	Energy Advisor
EEH	EnerGuide for Existing Houses
ENSC	Efficiency Nova Scotia Corporation
HEA	Home Energy Assessment
LED	Light Emitting Diode
LIHS	Low Income Homeowner Service
LTE	Laboratory of Energy Technologies
NRCan	Natural Resources Canada
NTGR	Net-to-Gross Ratio
OA	Outreach Agent
OPA	Ontario Power Authority
PM	Program Manager
RDI	Residential Direct Install
RMP	Retail Markdown Program
SNSMR	Service Nova Scotia and Municipal Relations

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
EnerGuide rating	An EnerGuide rating shows a standard measure of the home's energy performance. It shows exactly how energy efficient the home is.
Demand-to-energy ratio	A ratio obtained by dividing the target peak demand savings by the target energy savings of a given program for a given year.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 impact evaluation of Low Income Homeowner Service (LIHS), which is a component of the Existing Houses program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM), as well as on three on-site visits and 20 participant simulations.

PROGRAM COMPONENT OVERVIEW

LIHS aims to facilitate the implementation of cost-effective building enclosure measures in residential low-income customer-owned households all across Nova Scotia by providing upgrades at no cost to the homeowners.

LIHS includes mainly building enclosure measures, such as draft-proofing, as well as insulation for basements, crawl spaces, exposed floors, walls and attics, if required. Ventilation fans in bathrooms, moisture reduction measures (such as covering dirt floors in basements) and programmable thermostats are installed on a case-by-case basis, if necessary. Implemented measures are funded by electricity ratepayers in electrically heated homes and by provincial funds in non-electrically heated homes. If the home has electric and non-electric heating, the funds provided by electricity ratepayers are proportional to the estimated use of electric space heating. LIHS also includes the replacement of old dehumidifiers, fridges and freezers with ENERGY STAR®-qualified models. Similarly, a new ENERGY STAR® dehumidifier is provided in cases when one is required for moisture control, but does not exist.

Through LIHS, Efficiency Nova Scotia Corporation (ENSC) collaborates with the Nova Scotia Department of Community Services (DCS) and a program outreach agent (OA) to qualify low-income participants based on specific income and home ownership criteria. Delivery agents (DAs) also operate under the program to conduct the initial energy assessment that assesses the measures to be implemented, as well the final assessment that confirms the measures implemented and provides an EnerGuide rating.

LIHS aimed to achieve net electricity savings of 1.1 GWh and demand savings of 0.5 MW for the year 2012.

KEY FINDINGS

The 2012 evaluation of LIHS demonstrated that the program has a good potential for success and that it is essential to ENSC's program portfolio, considering that it targets customers who generally do not have the financial resources to undertake deep home energy retrofits. The program totalled 811 participants for the year 2012. In the 2011 evaluation, low income participants who went through LIHS and direct install pilots were included in the low income evaluation. Low income participants in direct install initiatives in 2012 are included in the Residential Direct Install (RDI) and Multi-Unit

Residential Buildings (MURB) evaluations. As such, when comparing the low income results of the 2012 report to the 2011 report it may appear to be a decrease (5,103 participants in 2011), however; the total number of participants in LIHS has increased from 797 in 2011 to 811 in 2012.

Program Energy Savings

To calculate the net savings of LIHS in 2012, Econoler reviewed the gross savings using two features, namely the savings per EnerGuide point increase and the savings generated in relation to the implementation of a series of prescriptive measures.

Due to the nature of the products offered in LIHS and the target customers, the distortion effects of the program were assumed to be insignificant. Consequently, the net-to-gross ratio (NTGR) for this program was assumed to be 1.

Using the revised unitary savings values, the interactive effects factors and the NTGR, the evaluation revealed that LIHS generated net energy savings of 2.209 GWh and demand savings of 1.047 MW at the generator in 2012.

Table 1: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	2.292 GWh	2.202 GWh	1.00	2.202 GWh
Evaluation Results	2.277 GWh	2.209 GWh	1.00	2.209 GWh
Demand Savings				
Tracked Savings from ENSC	1.086 MW	1.044 MW	1.00	1.044 MW
Evaluation Results	1.079 MW	1.047 MW	1.00	1.047 MW

The net savings tracked by ENSC were compared with the evaluated savings for 2012. Both the energy and demand savings calculated for this evaluation are practically identical to the tracked savings. On the one hand, an adjustment was made to the gross energy savings per EnerGuide point, which was increased from 817 kWh to 914 kWh. This adjustment came from a review of 506 project simulations and a calibration on the savings from a billing analysis of 172 participants. This approach used a much bigger sample size than what was done in 2011 and is more precise. On the other hand, unitary savings for many prescriptive measures were reduced. In the end, these adjustments balanced each other and the evaluated savings ended up being very similar to the tracked savings.

RECOMMENDATIONS

Econoler finds that the program works well overall and at a satisfactory level. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various

places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- LIHS-R1. Consider the possibility of providing technical support for HOT2000:** A great majority of the EAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies, and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee or employing an external expert to provide HOT2000 expertise to the EAs when needed. This expert would also be necessary for the HOT2000 simulation review presented in the following recommendation.
- LIHS-R2. Perform a continuous HOT2000 simulation review process:** The review of 20 HOT2000 simulations proved that there was a high variability in the quality provided by the EAs. Most of the errors found were recurrent and attributable to the same EAs. While some of these issues were trivial, others substantially changed the EnerGuide rating being simulated by the software. Therefore, the Evaluator considers that a small sampling, with a focus on negative and low EnerGuide rating projects, should be reviewed by ENSC each year. This would help find and address potential errors in the on-site data collection and building simulations. Positive and negative feedback could then be given to the EAs, with a view to continuously improving their work. This HOT2000 simulation review process could also allow ENSC to identify any needs for additional training among the EAs.

1 COMPONENT DESCRIPTION

Efficiency Nova Scotia Corporation's (ENSC) Low Income Homeowner Service (LIHS) aims to facilitate the implementation of cost-effective building enclosure measures in low-income, customer-owned households across Nova Scotia. All measures are provided to the homeowner at no cost.

Potential participants can apply to ENSC or a program outreach agent (OA) directly. Alternatively, they may be referred by their Nova Scotia Department of Community Services (DCS) case worker. These parties are in charge of qualifying low-income individuals for participation. Successful applicants and recruits must meet specific income and home ownership criteria.

Three delivery agents (DAs) operate across Nova Scotia to perform an initial energy assessment in order to identify applicable measures to be implemented for each home. The DAs then complete the energy efficiency upgrades, following approval by ENSC. They also conduct a final assessment to assess the measures implemented and provide a follow-up EnerGuide rating.

LIHS includes mainly building enclosure measures, such as draft-proofing, as well as insulation for basements, crawl spaces, exposed floors, walls and attics, if required. Ventilation fans in bathrooms, moisture reduction measures (such as covering dirt floors in basements) and programmable thermostats are installed on a case-by-case basis, if necessary. Implemented measures are funded by electricity ratepayers in electrically heated homes and by provincial funds in non-electrically heated homes. If the home has electric and non-electric heating, the funds provided by electricity ratepayers are proportional to the estimated use of electric space heating. When the home has multiple fuel sources, the DA consults with the homeowner and estimates the percentage of heating supplied by each fuel source.

LIHS also includes the replacement of old dehumidifiers, fridges and freezers with ENERGY STAR®-qualified models. These measures are funded by electricity ratepayers. In homes with potential moisture issues, a new dehumidifier may be provided even if there was not one already in the home. New dehumidifiers are treated as part of the building enclosure upgrade and funded according to the proportional electric vs. non-electric use for space heating.

Homeowners who take part in LIHS are also eligible for ENSC's Residential Direct Install (RDI), in which low-cost energy-efficient products (i.e. lighting and water conservation products) are installed at no cost to the participant. Last year, these products were provided under Low Income. Homeowners can also choose to participate in RDI first and then continue with LIHS if they meet the program eligibility criteria.

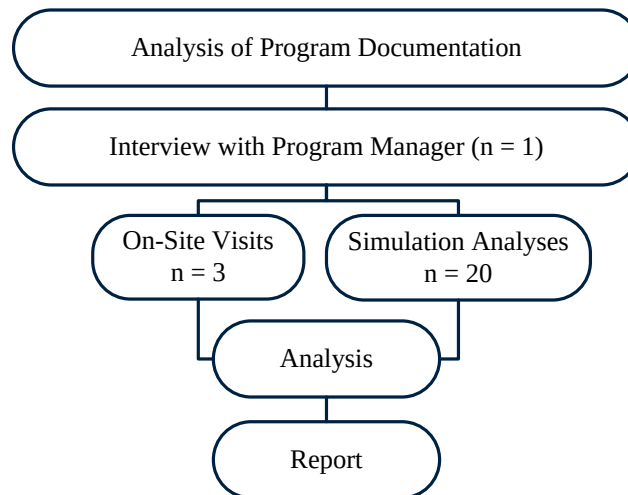
In 2012, LIHS had a net energy savings goal of 1.1 GWh and 0.5 MW for demand savings. Electric savings generated by LIHS are accounted for under the Existing Houses program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the evaluation for LIHS. At this stage, all of the available program information was reviewed.

The following sources were consulted:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheets.

2.2.2 Interview with Program Manager

Econoler staff met with the Program Manager (PM) in July 2012. The discussion allowed the Evaluator to understand all program elements, such as the program background, mechanisms and delivery.

2.2.3 On-Site Visits

In November 2012, three on-site visits were conducted at houses in which measures from LIHS had been implemented. This part of the process evaluation was carried out by Econoler's subcontractor ecoPlus Services, which appointed a certified ecoENERGY advisor to conduct the on-site evaluation of energy advisors' (EAs) assessments. The sampling was established to include at least two different DAs as well as pre- (D) and post-retrofit (E) assessments. These site visits were done to ensure that EAs were following the EnerGuide guidelines and that all pertinent information for running the house simulation with HOT2000 was collected.

Further explanations of the methodology used for the on-site visits are available in the Process Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix II.

2.2.4 HOT2000 Simulation Review

As part of this year's evaluation, Econoler also collected and reviewed a sample of 20 HOT2000 simulations. The main purpose of this verification was to validate the input data and assumptions used by the EAs, in order to ensure that they are all within a realistic range and that they concur with the actual residential building being assessed. The sample projects were selected randomly.

This in-depth assessment of HOT2000 simulations was conducted by Econoler's subcontractor ecoPlus Services. Further explanations of the methodology used for this task, as well as the key outcomes of this assessment, are available in the Process Evaluation section of this report. Finally, a copy of the HOT2000 simulation evaluation protocol is included as part of the On-Site Visit Protocols in Appendix II.

3 PROCESS EVALUATION

3.1 TRACKING SHEETS

Econoler has reviewed the content of the tracking sheets for LIHS. The tracking sheets present project information in four main tabs. Each tab refers to customers who fell under a specific “stream,” as this program underwent modifications in 2012. The four tabs were assembled into a single file to consolidate all sheets and assign every client a unique participant code that would include information about their DA. The project tracking number and the information related to electricity savings measures are listed in each tab. The client information is also included.

In general, the tracking sheets are quite complete and contain the necessary fields for program administration and evaluation purposes. They provide the PM with a way to continuously monitor the initial and final EnerGuide ratings, the number of each prescriptive measure implemented and the related energy savings.

The necessary data for calculating the estimated gross savings are included in the tracking sheet:

- > Initial and Final EnerGuide Ratings data come from the HOT2000 simulations developed by the DA.
- > Savings value per EnerGuide point of 817 kWh. This figure came from the 2011 program evaluation.
- > Main heating system type, electricity heating percentage, number of prescriptive measures and respective unitary savings values.

For projects pending the final energy assessment or for which the homeowner has not permitted a final energy assessment, the tracking sheet provides a temporary estimation of the savings based on a projection of the final EnerGuide rating (E). This projection is made during the initial assessment and assumes that all the measures recommended in the initial assessment are implemented. Since this is not representative of what happens in reality, ENSC uses a realization rate of 94 percent to estimate a temporary electric savings value for the envelope measures. This estimation is based on the verified realization rate of projects completed between January and October 2012.

To facilitate the use of the tracking sheets for the PM and for the Evaluator, Econoler recommends the following:

- > **Add complementary information:** To help keep track of the unitary savings, the actual unitary savings value for each prescriptive measure should be referred to in another table instead of entering the value directly in the formula. This will improve understanding of the savings calculations and the monitoring of the unitary savings in case of future modifications.
- > **Standardize the entries:** To avoid entering the same information in different ways and to reduce the number of data entry errors, ENSC should integrate a drop-down list of answers

when possible. For instance, the space heating sources are identified in several different ways in the tracking sheet. By entering data with the help of a drop-down menu, the treatment of data for evaluation purposes will be more efficient. The “Primary Space Heat Source,” the “Secondary Space Heat Source” and the “Primary DHW Heat Source” could easily be entered using a drop-down menu and therefore “electric” or “heat pump” will not be entered instead of “electricity,” as is sometimes found.

- > **Create fields for building energy consumption data:** Currently, the energy savings are in part calculated using the EnerGuide ratings. It would be suitable and more accurate to calculate them with the energy consumption data from HOT2000. Econoler proposes adding fields for building energy consumption per year in GJ for D and E assessments. This can later be broken down into GJ savings (non-electric fuels) and/or kWh savings (electrically heated homes), as appropriate.
- > **Track gross savings and net savings separately:** ENSC should firstly calculate the gross savings for electrically and non-electrically heated houses. Secondly, based on these savings, the net savings can be presented in another column using the net-to-gross ratio (NTGR) and the line loss factor for electrically heated houses.
- > **Determine the required fields and remove the unnecessary ones:** The PM, together with the Evaluator, should determine which fields are necessary for administration and evaluation purposes and ensure that the information is systematically entered in these fields. Conversely, the fields that are not used should be removed from the tracking sheet in order to focus on useful data. Several columns do not contain any information and therefore should be removed; examples include line 3 of the Service Address and the ENSC Total Costs for Scope 2 (Direct Install) Measures in the “REAP Tracking” tab.

3.2 ON-SITE VISITS

The on-site visits conducted as part of the evaluation of LIHS aimed to assess the procedure and the ecoEnergy protocol that the EAs have to follow during the assessments. The ecoEnergy protocol was established by NRCan to provide a framework to EAs with the ecoEnergy certification. The D and E assessments have to be performed by a certified ecoEnergy advisor who is able to answer any of the participants’ questions about energy use in the home, gather information for identifying potential energy efficiency measures, and collect energy bills and receipts. Each parameter that will afterwards be used in the HOT2000 models has to be documented appropriately, and procedures need to be clearly explained to the participants.

The on-site visits quality assessment was twofold. Firstly, the Evaluator joined three EAs during one of their on-site visits to validate that they were following the data collection protocol and communicating adequately with program participants. Then, Econoler collected the three EAs’ HOT2000 simulations,

along with all the data they collected on site, with the aim of evaluating their ability to properly generate an accurate and replicable HOT2000 simulation of the household being assessed.

During the three on-site visits, the Evaluator noticed that basic NRCan guidelines were followed well by the advisors. By collecting very detailed data about the house components and by conducting the blower door test properly, the advisors succeeded in achieving very accurate EnerGuide ratings. Furthermore, the advisors showed an extensive understanding of the HOT2000 software.

In general, the on-site visits revealed that the advisors made a great effort to complete a thorough investigation of the house energy components. However, the Evaluator noted that improvement could be made on the advisors' part to determine the exact insulation value of the house. The advisors did not always take the time to do so, either by assessing the building age and materials or by investigating in many places to find small areas where insulation can be seen directly.

Taking into account the findings from the two on-site visits and the subsequent HOT2000 simulation review, the Evaluator recommends to:

- > **Encourage better communication between DAs and sub-contractors to ensure the work is completed well:** Under LIHS, DAs are responsible for conducting the upgrades or hiring the sub-contractors that perform the upgrades. During two of the three on-site visits, it was observed that the work done by the contractors was incomplete. In one case, the contractor partially insulated the crawl space area and did not insulate the attic hatch at all, therefore reaching an R-32 insulation instead of the R-50 planned. Unfortunately, when EAs discovered such mistakes during the post-retrofit evaluation, it is usually too late to fix them. Failing to complete the recommended upgrades could not only greatly diminish their positive impact (energy savings); it could also create condensation and air quality issues. This is why a stronger communication between the advisor and the contractor should be promoted. DAs should ensure that their contractor understands the full extent of the building upgrades. Relying only on telephone conversations might not be sufficient to avoid any misunderstanding. Before the renovations begin, EAs should send the contractor basic drawings indicating exactly which areas have to be insulated and which ones do not. Furthermore, the contractor should be able to contact the EA for any additional information or questions throughout the renovation process. Noteworthy is that ENSC has set up a quality assurance program that should address more of these issues in the future.
- > **Provide homeowners with basic energy efficiency principles:** The assessment process under LIHS is somewhat different from the usual assessment process, as seen under Home Energy Assessment (HEA), for instance. Homeowners are much less involved in the LIHS assessment than they are in the HEA assessment. Under LIHS, homeowners do not pay for the renovations or choose which upgrades will be performed. The on-site visits revealed that the EAs conducting LIHS assessments spent very little time explaining the basic energy efficiency principles to homeowners as they usually do during regular HEA assessments. In spite of how

the program is structured, EAs should make sure to inform homeowners of those principles. Furthermore, EAs should provide homeowners with a brief verbal summary of the performance of the different energy components of their house and a list of potential upgrades for the future. Appropriate booklets and material could also be developed and provided to low income participants to help them understand the proposed building upgrades, as well as increase the likelihood of them adopting energy-wise habits.

Finally, additional information on the impact of an energy-efficient home on its natural ventilation could also be given to homeowners. The advisor should also ensure that homeowners are aware that the moisture level of their house could change after the upgrades and that there are proper ways to cope with such a situation.

- **Conduct a pre-evaluation interview with homeowners:** The Evaluator noticed that EAs rarely conducted a full pre-evaluation interview as required by the NRCan guidelines. Not only does this pre-evaluation interview take just a couple of minutes, but it can also prevent many issues that could happen during an energy assessment. Indeed, one of the purposes of the pre-evaluation interview is to ensure that homeowners know exactly what to do to prepare for the assessment. For instance, during one of the three on-site visits, the EA had to spend 15 minutes removing items from a closet to access the attic hatch. The homeowners should have been informed during a pre-evaluation interview to prepare their households more properly prior to the assessment.

The pre-evaluation interview also aims to make sure that homeowners will be present on the day of the assessment. Indeed, the NRCan guidelines specify that EAs should recommend that homeowners be present for the assessment or try to reschedule. A complete list of topics to cover during the pre-evaluation interview is included in the NRCan “Advisor Workshop Kit” and should be followed by the EAs.

3.3 HOT2000 SIMULATION REVIEW

The first point noticed during the HOT2000 simulation review was the high variability in professionalism and training found between DAs. Some of these organizations presented very accurate files that displayed a very good understanding of the simulation process, as defined by NRCan guidelines. On the other hand, other DAs presented files that contained a number of recurrent omissions, incomplete information and calculation mistakes. In addition, almost every file assessed was missing at least a few of the required pictures. Some of these errors were significant and led to inaccurate EnerGuide rating calculations.

In general, the Evaluator also noticed that the quality of the HEA files was better than that of the LIHS files. During the LIHS project review, Econoler found that many of the data collection forms and HOT2000 simulations were incomplete, especially in the post-retrofit evaluations. Quality assurance is

an important part of the EnerGuide rating process. It is difficult for an external auditor to assess the project file quality when so much information is missing on data collection forms.

With a view to improving the HOT2000 simulations under this program, Econoler recommends that ENSC:

- > **Perform a continuous HOT2000 simulation review process:** The review of 20 HOT2000 simulations proved that there was a high variability in the quality provided by the EAs. Most of the errors found were recurrent and attributable to the same DAs. While some of these issues were trivial, others substantially changed the EnerGuide rating being simulated by the software. Therefore, the Evaluator considers that a small sampling of all project folders should be reviewed by ENSC each year. This would help find out and address potential errors in performing the on-site data collection and then the building simulation. Positive and negative feedback could then be given to the DAs, with a view to continuously improving their work. This HOT2000 simulation review process would also allow ENSC to identify any needs for additional training among the DAs.

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation is aimed at determining the gross and net savings of the program for 2012. Both energy and demand savings were considered in this evaluation. To do so, Econoler analyzed the following parameters:

- > HOT2000 simulations;
- > prescriptive measure savings; and
- > interactive effects for lighting products and DHW measures.

The impact evaluation was essentially based on a comparative analysis of the tracking sheets and a billing calibration. The analysis of 172 simulation results and their respective electricity billing was used to calibrate the simulation results and estimate gross energy savings more realistically.

In addition, the review of the tracking sheets included an analysis of the energy savings values used for each prescriptive measure and an assessment of how these savings were calculated.

Finally, the net savings were evaluated by applying the interactive effects factors. The NTGR for LIHS is assumed to be 1.

4.2 GROSS SAVINGS

The tracking sheets provided by ENSC for 2012 contained a total of 811 participants. These participants were bundled with 1,839 participants from HEA to estimate an incremental energy savings per EnerGuide point (hereafter referred to as “savings per EnerGuide point”), which was used to calculate a portion of the gross savings. Then, Econoler reviewed and properly adjusted the prescriptive measure savings on the basis of the findings from other ENSC programs.

In summary, Econoler used the following parameters for evaluating the LIHS gross savings:

- > For the gross energy savings calculation, the parameters are the incremental energy savings value per EnerGuide point increase and the independent savings per prescriptive measure installed.
- > For the gross demand savings calculation, the parameter is the demand-to-energy ratio.

The methodology for evaluating these elements is described in the following sections.

4.2.1 Savings per EnerGuide Point

In 2012, ENSC calculated a portion of the program’s energy savings linked to building envelope using an incremental savings coefficient per EnerGuide point increase (also referred to as “savings per

EnerGuide point"). The difference between pre-assessment (D) and post-assessment (E) simulation ratings was used to calculate the EnerGuide point increase. For this calculation, ENSC used an energy savings of 817 kWh per EnerGuide point. The 817 kWh savings figure came from the 2011 Low Income evaluation report.

For the 2012 LIHS evaluation, Econoler used the same energy savings coefficient as the one calculated in the 2012 HEA evaluation. For that program evaluation, Econoler conducted several analyses to confirm the savings per EnerGuide point value. The details of these analyses are included in the HEA evaluation report. The main features of this work are summarized below.

First, Econoler selected all projects completed up to August 2012 under HEA and LIHS. Subsequently, Econoler evaluated the average value of space heating savings per EnerGuide point for those projects using the initial and final space heating energy consumption data simulated with HOT2000 in relation to the respective EnerGuide ratings. The overall average of these space heating savings values per project amounted to 1,115 kWh of savings per EnerGuide point.

Econoler noted that the HOT2000 simulations tended to overestimate residential building electricity consumption. A billing calibration was therefore conducted with 172 projects to evaluate the accuracy of the results obtained from the HOT2000 simulations. This analysis demonstrated that the HOT2000 software seems to overestimate the space heating electric consumption by approximately 18 percent. As a result, this last percentage was used to lower the evaluated average savings per EnerGuide point (1,115 kWh) previously defined. This yielded a final value of **914 kWh** of savings per EnerGuide point.

4.2.2 Prescriptive Measure Savings

In addition to the savings per EnerGuide point coefficient, ENSC calculated incremental savings for a set of prescriptive measures that are not taken into account in HOT2000 simulations. The savings values used by ENSC for this calculation are taken in most part from other 2011 evaluation reports for ENSC's residential programs.

13-Watt CFLs

ENSC uses a unitary savings value of 46.3 kWh that was calculated by Econoler in last year's evaluation. The replacement of a 60-watt incandescent lamp with a 13-watt CFL is considered the base case for this product and has a displaced wattage of 47 W.

As with all ENSC residential programs, a daily usage of 2.7 hours is used. This value is based on a metering study conducted for Hydro-Québec's residential lighting program.

These assumptions result in a unitary savings value for 13-watt CFLs of 46.3 kWh, as shown below.

$$\text{Annual Unitary Savings} = \frac{(60 \text{ W} - 13 \text{ W}) \times 2.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 46.3 \frac{\text{kWh}}{\text{yr}}$$

For 2012, Econoler reviewed new metering studies on the daily usage of residential lighting to validate the hours of operation of CFLs. This review showed that the Hydro-Québec study used by ENSC still contains, at this moment, the most reliable data for Nova Scotia. The proportion of CFLs installed inside and outside of the house, as given in a socket study conducted by ENSC in 2011, is used to adjust the overall hours of operation, which remains 2.7 hours per day:

$$\text{Overall Hours of Operation} = \left(94\% \times 2.68 \frac{\text{h}}{\text{day}}\right) + \left(6\% \times 3.6 \frac{\text{h}}{\text{day}}\right) = 2.7 \frac{\text{h}}{\text{day}}$$

The base case, which consists of replacing a 60-watt incandescent lamp with a 13-watt CFL, is adequate; therefore, the unitary savings value of 46.3 kWh is accepted.

23-Watt CFLs

The unitary savings value used by ENSC for 23-watt CFLs is based on last year's evaluation of the Efficient Products – Direct Install program. Based on the data collected through this program specifically for residential buildings, Econoler estimated that old incandescent lamps replaced by 23-watt CFLs have an average wattage of 93.5 W. This value is consistent with what is found on the market. It resulted in an average displaced wattage of 70.5 W. As for 13-watt CFLs, a daily usage of 2.7 hours was used, based on a metering study conducted for Hydro-Québec's residential lighting program.

These assumptions result in a unitary savings value for 23-watt CFLs of 69.5 kWh, as shown in the equation below.

$$\text{Annual Unitary Savings} = \frac{(93.5 \text{ W} - 23.0 \text{ W}) \times 2.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 69.5 \frac{\text{kWh}}{\text{yr}}$$

For 2012, Econoler maintained that an average of 93.5 watts is acceptable for the replaced incandescent lamps. As overall hours of operation were also confirmed at 2.7 h/day, the Evaluator kept the unitary savings value at 69.5 kWh per year.

Specialty CFLs

For the specialty CFLs, ENSC uses the unitary savings figure calculated in the 2011 Retail Markdown Program (RMP) evaluation. The analysis of specialty CFLs sold through the RMP revealed that the typical difference in wattage between the CFLs installed through the program and the old lamps replaced was equal to 50.5 watts.¹

As with the other types of CFL, a daily usage of 2.7 hours is used. As a result, a unitary savings of 49.8 kWh per year is used for specialty CFLs, as shown in the equation below.

$$\text{Annual Unitary Savings} = \frac{(64.9 \text{ W} - 14.4 \text{ W}) \times 2.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 49.8 \frac{\text{kWh}}{\text{yr}}$$

For 2012, Econoler elected to continue using the displaced wattage value obtained from Instant Savings (previously known as the RMP). For 2012, a displaced wattage of 46.9 watts was calculated for the specialty CFLs sold through Instant Savings. This value was based on the average wattage of the specialty CFLs sold (14.4 watts) and the average equivalent power of the incandescent lamps replaced (61.3 watts), which, combined with the 2.7 hours per day, results in a unitary savings value of 46.2 kWh per year.

$$\text{Annual Unitary Savings} = \frac{(61.3 \text{ W} - 14.4 \text{ W}) \times 2.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 46.2 \frac{\text{kWh}}{\text{yr}}$$

Flush-Mount CFLs and CFL Porch Lights

For these two products, ENSC uses the same unitary savings value calculated for the specialty CFLs in 2011; i.e., 49.8 kWh per year. With this in mind, Econoler decided to keep the same approach and use the updated unitary savings of 46.2 kWh per year calculated above for specialty CFLs in 2012.

Programmable Thermostats

For programmable thermostats, ENSC uses a unitary savings value of 221 kWh per year. This value comes from the 2011 EnerGuide for Existing House (EEH) impact evaluation report.

¹ In the 2011 RMP evaluation report, the average power of CFLs was 14.4 watts and the average equivalent power of incandescent lamps replaced was 64.9 watts.

It is based on the 2009 evaluation of Hydro-Québec's Residential Electronic Thermostats in New Construction program² in which energy savings generated by thermostat accuracy and by temperature setback were estimated as presented below.

Table 2: Main Outputs from Hydro-Québec's Evaluation of Electronic Thermostat Savings

Calculation Parameters	Housing Type		
	Single Detached	Duplex / Triplex / Townhouse	Apartment
Gross Energy Savings for Electronic Thermostat Accuracy			
Savings per thermostat (kWh)	121	94	61
Gross Energy Savings for Temperature Setback with Programmable Thermostats			
Savings per thermostat (kWh)	100	201	118
Total savings per thermostat (kWh)	221	295	179

To calculate the savings from electronic thermostat accuracy, the percentages of savings were based on research supervised by Hydro-Québec's laboratory of energy technologies (LTE).³ The research used results from tests conducted in LTE's environmental chambers and in single-family homes by comparing the operation of bimetallic thermostats versus electronic thermostats and the consumption of houses with bimetallic thermostats versus electronic thermostats. The annual consumption for electric space heating was estimated through a billing analysis including 25,703 clients and 206,861 billing periods.

To calculate the savings from temperature setback, the savings per housing unit were taken from a billing analysis regression which compared the consumption of houses with electronic thermostats and houses with programmable thermostats.

Since the information on the housing type was not available in last year's tracking sheet, the Evaluator chose to use the unitary savings value estimated for a single-detached house. This choice was conservative since single-detached houses represent a large portion of houses in the Nova Scotian market and programmable thermostats installed in single-detached houses generate fewer savings than those installed in duplexes, triplexes or townhouses (221 kWh per year and 295 kWh per year respectively). In light of the above, Econoler estimated the total unitary savings value associated with the installation of a programmable thermostat at 221 kWh per year.

² Econoler, Évaluation du programme thermostats électroniques – Volet nouvelle construction au marché résidentiel, Final Report presented to Hydro-Québec, February 9, 2009.

³ Hydro-Québec – Laboratoire des technologies de l'énergie (LTE), Sommaire exécutif de rapports publiés par Hydro-Québec concernant les économies d'énergie dues aux thermostats électroniques, October 2004.

This latter value is still considered appropriate for estimating the savings generated by the programmable thermostats installed through the program.

Electric Kettles

For this product, ENSC uses a unitary savings value of 49 kWh per year, based on the Navigant study, for which the calculation details were not available. This value had also been used in previous evaluations of LIHS. As with the 2011 evaluation, Econoler has not found secondary information on energy savings estimates for electric kettles. Since this product was removed from the program during 2012, Econoler considers that the unitary savings value of 49 kWh per year should be maintained for gross savings calculations in this year's evaluation.

Power Bars with Integrated Timer

ENSC promoted the installation of power bars with integrated timer through LIHS for the first part of 2012. This product helps reduce the standby power of the electronic devices plugged into it. Based on the 2011 Ontario Power Authority (OPA) Prescriptive Measures and Assumptions report,⁴ ENSC used a unitary savings value of 53 kWh per year for each energy-saving power bar installed. The OPA calculated the annual savings for this product using a weighted average of the savings generated for each group of electric devices that can be plugged into a power bar. The details of this calculation are shown in the following table.

Table 3: OPA Unitary Savings Estimate for Power Bars with Integrated Timer

Parameters	Entertainment Centres	Computer Systems	Lighting	Others
Proportion	40.3%	15.7%	19.4%	24.6%
Average Wattage	38.1 W	28 W	60 W	28 W
Old Operating Time	9 h/day	14 h/day	6 h/day	11 h/day
New Operating Time – with Timer	5 h/day	8 h/day	3 h/day	4 h/day
Operating Season	12 months	12 months	8.5 months	8.6 months
Annual Savings	53 kWh			

Since this product was removed from the program during 2012, Econoler considers that the unitary savings value of 53 kWh per year, which was validated during the 2011 evaluation, should be maintained for gross savings calculations in this year's evaluation.

⁴ Ontario Power Authority (OPA), "2011 Prescriptive Measures and Assumptions," Release Version 1, March 2011.

Dehumidifiers

LIHS promoted the replacement of old dehumidifiers with more efficient models. In some instances, ENSC also installed dehumidifiers in households where there was no dehumidifier in place before the project.

With regard to the replacement of existing dehumidifiers, ENSC uses a unitary savings value of 686 kWh per year for each installed product. This figure is based on the 2008 evaluation of the OPA Every Kilowatt Counts program⁵ and was provided in the 2011 evaluation report of Appliance Retirement (ARet).

Regarding the installation of high-efficiency dehumidifiers in houses where there was no such appliance before the project, ENSC kept a conservative approach and considered neither additional consumption nor energy savings for the new dehumidifiers installed in houses where there was no dehumidifier before the project. This approach was proposed by Econoler in the 2011 evaluation report.

For 2012, Econoler used the 2011 OPA Prescriptive Measures and Assumptions report⁶, in which the replacement of a standard dehumidifier with an ENERGY STAR[®] dehumidifier yields 500 kWh in electrical savings. This unitary savings was based on metering conducted for the OPA's Keep Cool Pilot Program.

Refrigerator Replacements

In 2012, ENSC promoted the replacement of old refrigerators with more efficient models through LIHS. For this appliance replacement measure, ENSC uses a unitary savings value of 817 kWh per year. This figure is based on the 2011 Appliance Replacement (ARep) evaluation, where the unitary savings value was obtained by subtracting the annual consumption of old refrigerators, estimated at 1,104 kWh, from the annual consumption of new ENERGY STAR[®] models, corresponding to 287 kWh on average.

For 2012, Econoler revised this unitary savings value using the average consumption of old appliances retired through ARet and the average consumption of ENERGY STAR[®] refrigerators obtained from the NRCan EnerGuide Appliance Directory⁷. Since LIHS guidelines to DAs indicate that refrigerators and freezers must be older than 1990 to be eligible, Econoler based its calculation on the 20- to 29-year-old category presented in ARet. Using the following parameters, the analysis showed that old refrigerators consumed on average 1,034 kWh per year.

⁵ The Cadmus Group, Evaluation of the Ontario Power Authority's 2008 Every Kilowatt Counts Power Savings Event, Keep Cool Pilot and Rewards for Recycling Programs, Final Report, Prepared for the Ontario Power Authority, July 9, 2009.

⁶ Ontario Power Authority (OPA), "2011 Prescriptive Measures and Assumptions," Release Version 1, March 2011.

⁷ Natural Resources Canada, 2012 EnerGuide Appliance Directory (includes ENERGY STAR[®] qualified appliances)

Table 4: Unitary Savings Values for Retired Refrigerators 20 to 29 Years Old

Refrigerator Category	Primary	Secondary
Average Consumption per Retired Unit	75.6 kWh/cu ft. × 14.2 cu ft. = 1,074 kWh/year	
Occupant Adjustment Factor	1.12	
Partial Use Factor	1.00	0.71
Unitary Savings Value per Category	1,203 kWh/year	848 kWh/year
Proportion (%) ⁸	52.5%	47.5%
Average Unitary Savings Value	1,034 kWh/year	

Compared with the average energy consumption of 369 kWh for new ENERGY STAR® refrigerators, the replacement of an old refrigerator with a new ENERGY STAR® model would result in unitary savings of 665 kWh.

Freezer Replacements

LIHS supports the replacement of existing inefficient freezers with high efficiency models. For each replaced freezer, ENSC uses a unitary savings figure of 637 kWh per year. This value is based on the 2011 ARep evaluation; the annual consumption of old freezers, estimated at 916 kWh, was subtracted from the annual consumption of new ENERGY STAR® models, corresponding to 279 kWh on average.

For 2012, Econoler revised this unitary savings value using the average consumption of old appliances retired through ARet and the average consumption of ENERGY STAR® freezers obtained from the NRCAN EnerGuide Appliance Directory⁹. This analysis showed that old freezers in the 20- to 29-year-old category consumed on average 1,113 kWh per year.

Table 5: Unitary Savings Values for Retired Freezers 20 to 29 Years Old

Freezer Category	Secondary
Average Consumption per Retired Unit	84.1 kWh/cu ft. × 13.9 cu ft. = 1,169 kWh/year
Occupant Adjustment Factor	1.12
Partial Use Factor	0.85
Average Unitary Savings Value	1,113 kWh/year

Compared with the average energy consumption of 348 kWh for new ENERGY STAR® freezers, the replacement of an old freezer with a new ENERGY STAR® model would result in unitary savings of 765 kWh.

⁸ From the ARet participant survey.

⁹ Natural Resources Canada, 2012 EnerGuide Appliance Directory (includes ENERGY STAR® qualified appliances)

Refrigerator Retirements

For this appliance retirement measure, ENSC uses a unitary savings value of 1,016 kWh per year. This result was based on an average consumption of 1,373 kWh for the unit retired, a partial use factor of 0.74 and an occupant adjustment factor of 1.12. The average consumption of old refrigerators was obtained from the metering activity conducted at the recycling facility to measure the consumption of the old refrigerators retired through ARet.

For 2012, Econoler updated the unitary savings value to 756 kWh. This unitary savings was calculated as part of the 2012 ARet evaluation for the retirement of secondary refrigerators, using the 2011 metering data, the list of models retired in 2012, an occupant adjustment factor of 1.12 and a partial use factor of 0.71.

Freezer Retirements

For each retired freezer, ENSC uses a unitary savings figure of 1,274 kWh per year. This result was based on an average consumption of 1,223 kWh for the unit retired, a partial use factor of 0.93 and an occupant adjustment factor of 1.12. As with refrigerator retirements, the average consumption of old freezers was obtained from the metering activity conducted at the ARet recycling facility.

For 2012, Econoler updated the unitary savings value to 950 kWh. This unitary savings was calculated as part of the 2012 ARet evaluation, using the 2011 metering data, the list of models retired in 2012, an occupant adjustment factor of 1.12 and a partial use factor of 0.85.

Faucet Aerators

For all faucet aerators installed through the program, ENSC uses a unitary savings value of 176.3 kWh per year. This value comes from the 2011 OPA Prescriptive Measures and Assumptions report.

The OPA reports a base flow rate of 2.2 gpm (8.33 L/min) having been reduced to 1.5 gpm (5.68 L/min) as a result of installing the faucet aerator; this represents a reduction of 31.8 percent. The daily use of hot water is estimated at 28.27 litres per day per faucet. It translates into a total amount of 8.81 liters per day in hot water consumption for a typical household with an average of three faucets (one in the kitchen and two in the bathroom). Therefore, the unitary savings value used by ENSC corresponds to an average value per faucet, assuming that all faucets in a household have the same amount of usage.

Econoler conducted a literature review to validate the assumptions used by the OPA. The studies found provided very few details on the savings calculations and assumptions used by other jurisdictions. Therefore, as in the 2011 evaluation report, Econoler considers it adequate to continue using the average unitary savings value of 176 kWh estimated by the OPA for faucet aerators.

Low-Flow Showerheads

ENSC calculated the energy savings achieved from the installation of low-flow showerheads only when the energy source for domestic water heating was electricity. For this product, ENSC uses a unitary savings value of 377 kWh, based on a flow-rate improvement of 0.75 gpm (from 2 gpm with an old showerhead to 1.25 gpm with the new low-flow product). This unitary savings value comes from the OPA report. For 2012, Econoler reviewed this unitary savings value by conducting a literature review to validate the assumptions used by the OPA. As for faucet aerators, no more recent studies with energy savings calculation details could be found for low-flow showerheads. Nevertheless, Econoler was able to validate the flow-rate assumptions used by the OPA. While most low-flow showerheads found on the market have a flow rate of 1.5 gpm (compared to 1.25 gpm used by the OPA), the baseline flow rate of 2 gpm seems conservative. Most standard showerheads sold on the market these days have a flow rate of around 2.5 gpm and, according to Environment Canada, conventional showerheads found in Canadian homes can have flow rates of up to 4 to 5 gpm.¹⁰ Therefore, Econoler concludes that the unitary savings value of 377 kWh from the OPA report is largely acceptable.

Electric Hot Water Heater Pipe Insulation

For the installation of water heater pipe insulation, ENSC uses a unitary savings value of 74 kWh per year, based on the 2009 impact evaluation report of LIHS. ENSC assumed that pipe insulation was installed on a 10-foot-long pipe with 0.75-inch in diameter, which were considered as common length and size in residential applications.

Using the detailed assumptions used in the 2011 OPA Prescriptive Measures and Assumptions report, Econoler observed that the unitary savings value of 74 kWh used by ENSC corresponds approximately to the value calculated for 6 feet of insulation.

Table 6: Unitary Savings Values by Length of Insulated Pipe

Length of Insulated Pipe	Unitary Savings Value
3 feet	38 kWh/year
6 feet	76 kWh/year
9 feet	114 kWh/year
12 feet	152 kWh/year
15 feet	190 kWh/year

¹⁰ Environment Canada, "Wise Water Use," Web, January 21, 2013, <<http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=F25C70EC-1>>.

While 3 feet seems to be a common length when purchasing pipe insulation, the length of pipe insulated for residential applications typically varies between 6 to 15 feet, according to what was found in the literature. The length of pipe that can be insulated in a house is often limited, since the largest portion of the pipes is hidden in the walls. In the savings calculation, it is assumed that the pipe insulation is installed immediately downstream of the hot water storage tank, where most of the heat loss would occur. Moreover, the general equation used to calculate the energy savings cannot be used on an infinite length of insulated pipe, since it uses the assumption that the water temperature is uniform throughout the insulated portion of the pipe.

For this year's evaluation, since no information on the length of insulation installed was collected in the tracking sheet, Econoler will use a unitary savings value of 76 kWh per year, based on the OPA report and a 6-foot insulated pipe (compared to the 74 kWh value currently used and for which we do not have all the calculation details).

Hot Water Tank Wraps

For this product, ENSC uses a unitary savings value of 270 kWh per year for each installed system. This value was used in last year's evaluation and is based on the 2011 OPA Prescriptive Measures and Assumptions report.

The Evaluator reviewed the assumptions and the engineering calculations used by the OPA. The thermal resistances used for the bare tank and the wrapped tank, as well as the tank size, are accurate. Therefore, Econoler concludes that the unitary savings value of 270 kWh per year for hot water tank wrap is adequate.

4.2.3 Demand-to-Energy Ratio

Econoler calculated the demand savings for LIHS based on a demand-to-energy ratio of 0.474 MW/GWh. This ratio was obtained from the final 2012 program targets by dividing the target peak demand savings by the target energy savings.

4.2.4 Revised Gross Savings

The annual gross savings for LIHS are presented in the table below. Energy and demand savings for the program were revised to reflect the calibrated savings per EnerGuide rating point and the savings from prescriptive measures presented in the previous section. Overall, total gross energy and demand savings amount to 2.070 GWh and 0.981 MW at the meter.

At the generator level, total gross energy and demand savings are estimated at 2.277 GWh and 1.079 MW, using a line loss factor between the meter and the generator of 1.100. This value was provided by ENSC.

Table 7: Evaluation Results – Gross Energy and Demand Savings

Product Category	Savings per EnerGuide Point*	13-Watt CFL	23-Watt CFL	Specialty CFL	Flush- Mount CFL	CFL Porch Light	Program- mable Thermostat	Electric Kettle	Power Bar with Timer	Dehumidifier Replacement
Energy Savings										
Total Number of Units	641	3,339	884	48	19	27	941	108	443	98
Unitary Savings (kWh)	914	46.3	69.5	46.2	46.2	46.2	221	49	53	500
Total Gross Energy Savings – at the Meter (GWh)	1.205	0.155	0.061	0.002	0.001	0.001	0.208	0.005	0.023	0.049
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Gross Energy Savings – at the Generator (GWh)	1.325	0.170	0.068	0.002	0.001	0.001	0.229	0.006	0.026	0.054
Demand Savings										
Demand-to-Energy Ratio	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474
Total Gross Demand Savings – at the Meter (MW)	0.571	0.073	0.029	0.001	0.000	0.001	0.099	0.003	0.011	0.023
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Gross Demand Savings – at the Generator (MW)	0.628	0.081	0.032	0.001	0.000	0.001	0.108	0.003	0.012	0.026

* In the “Savings per EnerGuide Point” column, the number of units is in fact the number of participants for whom the Evaluator calculated savings per EnerGuide point.

Product Category	Fridge Replacement	Freezer Replacement	Fridge Retirement	Freezer Retirement	Faucet Aerator	Low-Flow Showerhead	Pipe Insulation	Hot Water Tank Wrap	Total
Energy Savings									
Total Number of Units	132	157	1	1	204	139	202	167	7,551
Unitary Savings (kWh)	665	765	922	950	176	377	76	270	-
Total Gross Energy Savings – at the Meter (GWh)	0.088	0.120	0.001	0.001	0.036	0.052	0.015	0.045	2.070
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Energy Savings – at the Generator (GWh)	0.097	0.132	0.001	0.001	0.040	0.058	0.017	0.050	2.277
Demand Savings									
Demand-to-Energy Ratio	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	-
Total Gross Demand Savings – at the Meter (MW)	0.042	0.057	0.000	0.000	0.017	0.025	0.007	0.021	0.981
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Demand Savings – at the Generator (MW)	0.046	0.063	0.000	0.000	0.019	0.027	0.008	0.024	1.079

4.3 INTERACTIVE EFFECTS

In a residence, interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as space heating and cooling equipment. In the case of LIHS, replacement of lighting products with CFLs causes an increase in the heating load during winter and a decrease in the cooling load during summer. This is because CFLs release less heat than the less efficient lamp they replace.

For the CFL products installed through LIHS, the calculation of interactive effects is based on a study conducted by ADS in 1992 for Hydro-Québec.¹¹ The work done in this study was intended to modify certain parameters in simulations of an average home in Quebec to determine the impact of these changes on the interactive effects. The simulations were performed with DOE-2¹² software and only focused on homes heated entirely by electricity. Three scenarios for interactive effects were considered in carrying out the simulations: low, moderate and high. The scenario with minimum interactive effects was selected for 2011 program impact calculations because it enabled the Evaluator to account for the evolution of construction practices in the residential sector since 1992.

The following table presents the calculation details of the interactive effects. The Evaluator adjusted the interactive effects factors from the ADS study using the proportion of space heating provided by electric systems under LIHS. The tracking sheet showed the primary energy source used for space heating of each participant (electricity, oil, natural gas, wood pellets, etc.). Econoler thus calculated the average percentage of electric heating in those participant houses, which resulted in 38 percent of participant households being mainly heated with electric heating systems. For electrically heated houses, Econoler assumed the overall efficiency of electric heating systems to be 100 percent, which is a typical value used for electric baseboards. No interactive effect was considered on space heating for all other houses which were primarily heated with non-electric systems. Since the presence of space cooling was not available in the tracking sheet and considering the target customers of LIHS, Econoler considers that 0 percent of households are equipped with air conditioning.

¹¹ ADS ASSOCIÉS, “Évaluations des effets énergétiques combinés des mesures d’économies d’énergie – résidence unifamiliale,” report presented to Hydro-Québec, 1992.

¹² DOE-2 is a widely used and accepted software building energy analysis program developed under funding from the U.S. Department of Energy.

Table 8: Interactive Effects Calculation for CFL Products

Parameters	% of Residences	Interactive Effects
Electric Heating with Air Conditioning	$38\% \times 0\% = 0\%$	-54.4%
Electric Heating without Air Conditioning	$38\% \times 100\% = 38.3\%$	-58.0%
No Electric Heating with Air Conditioning	$62\% \times 0\% = 0\%$	3.6%
No Electric Heating without Air Conditioning	$62\% \times 100\% = 61.7\%$	0.0%
Weighted Interactive Effects Factor	100%	-22.2%

These interactive effects occur only when the CFLs are installed inside the house. As CFLs can also be used for outdoor lighting, the interactive effects factor for the CFL products installed through the program was adjusted to take that into account. To do so, Econoler used the same proportions as those used to calculate the hours of operation, being 94 percent of CFLs installed inside houses and the remaining 6 percent installed in outdoor sockets. This information comes from a socket study conducted for ENSC in 2011 to investigate CFL installations. Therefore, the overall interactive effects for CFLs are established at -20.9 percent:

$$(94\% \times -22.2\%) + (6\% \times 0\%) = -20.9\%$$

For pipe insulation and hot water tank wraps installed through LIHS, interactive effects of -100 percent were considered during the heating period in electrically heated houses. This estimation is based on the fact that, when there is no insulation, all the heat lost through the pipes and the hot water tank is released into the room. Assuming that the pipes and tank are located in a heated room, it means that 100 percent of the energy released from the hot water is used for the heating load. Conversely, during the cooling period, interactive effects are estimated at +100 percent in houses with air conditioning. Based on the heating and cooling degree-days for the region of Halifax,¹³ Econoler considered an eight-month period of heating and a two-month period of cooling in the interactive effects calculation.

¹³ RETScreen International, Normalized climate data for Halifax International Airport, Natural Resources Canada, 1997-2010.

The table below presents the details for such a calculation. As for lighting products, the table shows the proportion of residences in Nova Scotia that are heated electrically and those that use air conditioning units or systems, which results in a weighted interactive effects factor of -25.5 percent.

Table 9: Interactive Effects Factor for Pipe Insulation and Hot Water Tank Wraps

Parameters	% of Residences	Interactive Effects During Heating Period	Interactive Effects During Cooling Period
Electric Heating with Air Conditioning	$38\% \times 0\% = 0\%$	$-100\% \times 8/12 = -66.7\%$	$+100\% \times 2/12 = 16.7\%$
Electric Heating without Air Conditioning	$38\% \times 100\% = 38.3\%$	$-100\% \times 8/12 = -66.7\%$	$0\% \times 2/12 = 0\%$
No Electric Heating with Air Conditioning	$62\% \times 0\% = 0\%$	$0\% \times 8/12 = 0\%$	$+100\% \times 2/12 = 16.7\%$
No Electric Heating without Air Conditioning	$62\% \times 100\% = 61.7\%$	$0\% \times 8/12 = 0\%$	$0\% \times 2/12 = 0\%$
Weighted Interactive Effects Factor	100%	-25.5%	0.0%
		-25.5%	

For all other products installed, interactive effects were considered to be negligible.

4.4 NET-TO-GROSS RATIO

LIHS offers no-cost energy assessments and implementation of energy efficiency measures for low-income homeowners. Due to the nature of the measures proposed and the target customers, the distortion effects of the program are assumed to be insignificant. Consequently, the NTGR is considered to be 1 for LIHS.

4.5 NET SAVINGS

The net savings for the program were estimated using the interactive effects factors and the NTGR above. The equation below was used to calculate the net savings.

$$\text{Net savings} = \text{Gross Evaluation Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

The results obtained are presented in the following table. Overall, the total net energy and demand savings for LIHS amount to 2.008 GWh and 0.952 MW at the meter, and 2.209 GWh and 1.047 MW at the generator.

Table 10: Evaluation Results – Gross and Net Savings

Product Category	Savings per EnerGuide Point	13-Watt CFL	23-Watt CFL	Specialty CFL	Flush- Mount CFL	CFL Porch Light	Programmable Thermostat	Electric Kettle	Power Bar with Timer	Dehumidifier Replacement
Energy Savings										
Total Gross Energy Savings – at the Meter (GWh)	1.205	0.155	0.061	0.002	0.001	0.001	0.208	0.005	0.023	0.049
Interactive Effects Factor	0%	-20.9%	-20.9%	-20.9%	-20.9%	-20.9%	0%	0%	0%	0%
NTGR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total Net Energy Savings (GWh) – at the Meter	1.205	0.122	0.049	0.002	0.001	0.001	0.208	0.005	0.023	0.049
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Net Energy Savings (GWh) – at the Generator	1.325	0.135	0.053	0.002	0.001	0.001	0.229	0.006	0.026	0.054
Demand Savings										
Total Gross Demand Savings – at the Meter (MW)	0.571	0.073	0.029	0.001	0.000	0.001	0.099	0.003	0.011	0.023
Interactive Effects Factor	0%	-20.9%	-20.9%	-20.9%	-20.9%	-20.9%	0%	0%	0%	0%
NTGR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total Net Demand Savings (MW) – at the Meter	0.571	0.058	0.023	0.001	0.000	0.000	0.099	0.003	0.011	0.023
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Net Demand Savings (MW) – at the Generator	0.628	0.064	0.025	0.001	0.000	0.001	0.108	0.003	0.012	0.026

Product Category	Fridge Replacement	Freezer Replacement	Fridge Retirement	Freezer Retirement	Faucet Aerator	Low-Flow Showerhead	Pipe Insulation	Hot Water Tank Wrap	Total
Energy Savings									
Total Gross Energy Savings – at the Meter (GWh)	0.088	0.120	0.001	0.001	0.036	0.052	0.015	0.045	2.070
Interactive Effects Factor	0%	0%	0%	0%	0%	0%	-25.5%	-25.5%	-
NTGR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total Net Energy Savings (GWh) – at the Meter	0.088	0.120	0.001	0.001	0.036	0.052	0.011	0.034	2.008
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Net Energy Savings (GWh) – at the Generator	0.097	0.132	0.001	0.001	0.040	0.058	0.013	0.037	2.209
Demand Savings									
Total Gross Demand Savings – at the Meter (MW)	0.042	0.057	0.000	0.000	0.017	0.025	0.007	0.021	0.981
Interactive Effects Factor	0%	0%	0%	0%	0%	0%	-25.5%	-25.5%	-
NTGR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total Net Demand Savings (MW) – at the Meter	0.042	0.057	0.000	0.000	0.017	0.025	0.005	0.016	0.952
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Net Demand Savings (MW) – at the Generator	0.046	0.063	0.000	0.000	0.019	0.027	0.006	0.018	1.047

The net energy savings resulting from this evaluation were compared to the energy savings estimations from the 2012 tracking sheet. The following table details the final evaluated and tracked impacts for 2012.

Table 11: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	2.292 GWh	2.202 GWh	1.00	2.202 GWh
Evaluation Results	2.277 GWh	2.209 GWh	1.00	2.209 GWh
Demand Savings				
Tracked Savings from ENSC	1.086 MW	1.044 MW	1.00	1.044 MW
Evaluation Results	1.079 MW	1.047 MW	1.00	1.047 MW

The net savings tracked by ENSC were compared with the evaluated savings for 2012. Both the energy and demand savings calculated for this evaluation are practically identical to the tracked savings. On the one hand, an adjustment was made to the gross energy savings per EnerGuide point, which was increased from 817 kWh to 914 kWh. This adjustment came from a review of 506 project simulations and a calibration on the savings from a billing analysis of 172 participants. This approach used a much bigger sample size than the one used in 2011 and is more precise. On the other hand, many unitary savings for prescriptive measures were reduced. In the end, these adjustments balanced each other and the evaluated savings ended up being very similar to the tracked savings.

CONCLUSION

The 2012 evaluation of LIHS demonstrated that the program is well designed and important to ENSC's program portfolio, considering that it targets customers who generally do not have the financial resources to undertake deep home energy retrofits on their own. The program totalled 811 participants in the year 2012, a slight increase over the 797 LIHS participants in 2011.

The Evaluator found major improvements to the program since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving little time to follow up on all the process and impact recommendations before the new evaluation window, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes.

On-site visits revealed that the advisors made a great effort to complete a thorough investigation of the house energy components. However, the Evaluator noted that improvement could be made on the advisors' part to determine the exact insulation value of the house. The advisors did not always take the time to do so, either by assessing the building age and materials, or by investigating in many places to find small areas where insulation can be seen directly.

The HOT2000 simulations review showed the high variability in professionalism and training found among DAs. Some of these organizations presented very accurate files that displayed a very good understanding of the simulation process, as defined by NRCan guidelines. On the other hand, other DAs presented files that contained a number of recurrent omissions, incomplete information and calculation mistakes. In addition, almost every file assessed was missing at least a few of the required pictures. Some of these errors were significant and led to inaccurate EnerGuide rating calculations.

The evaluation revealed that LIHS generated net energy savings of 2.209 GWh and demand savings of 1.047 MW at the generator in 2012. In 2011, the Low Income report savings totaled 7.636 GWh and 1.632 MW. However, this included both LIHS and low income direct install participants (the latter are included in Residential Direct Install and Multi-Unit Residential Buildings in 2012). To calculate the net savings of LIHS in 2012, Econoler reviewed the gross savings estimated by ENSC and included interactive effects.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Consider the possibility of providing technical support for HOT2000: A great majority of the EAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies, and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee or employing an external expert to provide HOT2000 expertise to the EAs when needed. This expert would also be necessary for the HOT2000 simulation review presented in the following recommendation.
	2. Perform a continuous HOT2000 simulation review process: The review of 20 HOT2000 simulations proved that there was a high variability in the quality provided by the EAs. Most of the errors found were recurrent and attributable to the same EAs. While some of these issues were trivial, others substantially changed the EnerGuide rating being simulated by the software. Therefore, the Evaluator considers that a small sampling, with a focus on negative and low EnerGuide rating projects, should be reviewed by ENSC each year. This would help find and address potential errors in the on-site data collection and building simulations. Positive and negative feedback could then be given to the EAs, with a view to continuously improving their work. This HOT2000 simulation review process could also allow ENSC to identify any needs for additional training among the EAs.
Tracking Sheet	3. Add complementary information: To help keep track of the unitary savings, the actual unitary savings value for each prescriptive measure should be referred to in another table instead of entering the value directly in the formula. This will improve understanding of the savings calculations and the monitoring of the unitary savings in case of future modifications.

Tracking Sheet	4. Standardize the entries: To avoid entering the same information in different ways and to reduce the number of data entry errors, ENSC should integrate a drop-down list of answers when possible. For instance, the space heating sources are identified in several different ways in the tracking sheet. By entering data with the help of a drop-down menu, the treatment of data for evaluation purposes will be more efficient. The “Primary Space Heat Source,” the “Secondary Space Heat Source” and the “Primary DHW Heat Source” could easily be entered using a drop-down menu and therefore “electric” or “heat pump” will not be entered instead of “electricity,” as is sometimes found.
	5. Create fields for building energy consumption data: Currently, the energy savings are in part calculated using the EnerGuide ratings. It would be suitable and more accurate to calculate them with the energy consumption data from HOT2000. Econoler proposes adding fields for building energy consumption per year in GJ for D and E assessments. This can later be broken down into GJ savings (non-electric fuels) and/or kWh savings (electrically heated homes), as appropriate.
	6. Track gross savings and net savings separately: ENSC should firstly calculate the gross savings for electrically and non-electrically heated houses. Secondly, based on these savings, the net savings can be presented in another column using the net-to-gross ratio (NTGR) and the line loss factor for electrically heated houses.
	7. Determine the required fields and remove the unnecessary ones: The PM, together with the Evaluator, should determine which fields are necessary for administration and evaluation purposes and ensure that the information is systematically entered in these fields. Conversely, the fields that are not used should be removed from the tracking sheet in order to focus on useful data. Several columns do not contain any information and therefore should be removed; examples include line 3 of the Service Address and the ENSC Total Costs for Scope 2 (Direct Install) Measures in the “REAP Tracking” tab.

On-Site Visits	8. Encourage better communication between DAs and sub-contractors to ensure the work is completed well: Under LIHS, DAs are responsible for conducting the upgrades or hiring the sub-contractors that perform the upgrades. During two of the three on-site visits, it was observed that the work done by the contractors was incomplete. In one case, the contractor partially insulated the crawl space area and did not insulate the attic hatch at all, therefore reaching an R-32 insulation instead of the R-50 planned. Unfortunately, when EAs discovered such mistakes during the post-retrofit evaluation, it is usually too late to fix them. Failing to complete the recommended upgrades could not only greatly diminish their positive impact (energy savings); it could also create condensation and air quality issues. This is why a stronger communication between the advisor and the contractor should be promoted. DAs should ensure that their contractor understands the full extent of the building upgrades. Relying only on telephone conversations might not be sufficient to avoid any misunderstanding. Before the renovations begin, EAs should send the contractor basic drawings indicating exactly which areas have to be insulated and which ones do not. Furthermore, the contractor should be able to contact the EA for any additional information or questions throughout the renovation process. Noteworthy is that ENSC has set up a quality assurance program that should address more of these issues in the future.

On-Site Visits	9. Provide homeowners with basic energy efficiency principles: The assessment process under LIHS is somewhat different from the usual assessment process, as seen under Home Energy Assessment (HEA), for instance. Homeowners are much less involved in the LIHS assessment than they are in the HEA assessment. Under LIHS, homeowners do not pay for the renovations or choose which upgrades will be performed. The on-site visits revealed that the EAs conducting LIHS assessments spent very little time explaining the basic energy efficiency principles to homeowners as they usually do during regular HEA assessments. In spite of how the program is structured, EAs should make sure to inform homeowners of those principles. Furthermore, EAs should provide homeowners with a brief verbal summary of the performance of the different energy components of their house and a list of potential upgrades for the future. Appropriate booklets and material could also be developed and provided to low income participants to help them understand the proposed building upgrades, as well as increase the likelihood of them adopting energy-wise habits. Finally, additional information on the impact of an energy-efficient home on its natural ventilation could also be given to homeowners. The advisor should also ensure that homeowners are aware that the moisture level of their house could change after the upgrades and that there are proper ways to cope with such a situation. 10. Conduct a pre-evaluation interview with homeowners: The Evaluator noticed that EAs rarely conducted a full pre-evaluation interview as required by the NRCan guidelines. Not only does this pre-evaluation interview take just a couple of minutes, but it can also prevent many issues that could happen during an energy assessment. Indeed, one of the purposes of the pre-evaluation interview is to ensure that homeowners know exactly what to do to prepare for the assessment. For instance, during one of the three on-site visits, the EA had to spend 15 minutes removing items from a closet to access the attic hatch. The homeowners should have been informed during a pre-evaluation interview to prepare their households more properly prior to the assessment. The pre-evaluation interview also aims to make sure that homeowners will be present on the day of the assessment. Indeed, the NRCan guidelines specify that EAs should recommend that homeowners be present for the assessment or try to reschedule. A complete list of topics to cover during the pre-evaluation interview is included in the NRCan “Advisor Workshop Kit” and should be followed by the EAs.

APPENDIX II – ON-SITE VISIT PROTOCOL

The other on-site visit protocols for LIHS are attached in PDF format to this report.

ASSESSMENT OF THE HEA PROGRAM / D EVALUATION

QUALITY ASSURANCE GRID (D Assessment)

RELEVANCE AND ACCURACY OF OBSERVATIONS AND RECOMMENDATIONS MADE BY ADVISOR

The advisor made an effort to collect as much information as possible about the house components	/ 5
The advisor understood the different sections of the house and recorded each one with its specificities rather than oversimplifying	/ 5
The advisor's measurements of insulation levels and types were precise and accurate	/ 5
The advisor recorded the right number and type of windows and doors	/ 5
The advisor understands ventilation issues and the "house as a system " concept	/ 5
The advisor assumptions and recommendations about the heating system are accurate	/ 5
The advisor recommended the right type of insulation for the right purpose	/ 5
The advisor has a clear understanding of the "building envelope" concept and does not confuse parts of the house that are inside the envelope with those that are outside.	/ 5
The advisor did not forget to recommend any important improvement	/ 5
The advisor succeeded in establishing the recommendations that will have the strongest impact on the house energy consumption	/ 5
The advisor identified any abnormal moisture and air quality issues present in the house	/ 5
The advisor noted the presence or absence of exhaust fans (bathroom, kitchen, etc.) and verified if they function properly	/ 5
The advisor performed the Combustion Spillage Test as required due to the presence of a fuel burning appliance in the house	/ 5
The advisor carried with him the proper and functional equipment to successfully perform the assessment	/ 5
BLOWER DOOR TEST : the advisor succeeded in preparing the house for a proper blower door test	/ 5
BLOWER DOOR TEST : the advisor installed the blower door test equipment properly (manometer, pressure gages,)	/ 5
BLOWER DOOR TEST : the advisor identified the main air leakage areas	/ 5

ABILITY OF THE ADVISOR TO CONVEY HIS/HER OBSERVATIONS TO THE CLIENT

The advisor explained his views in simple language which the client can easily understand	/ 5
The advisor made an effort to convince the client to undertake the recommended renovations	/ 5
The advisor has the ability to listen to the client concerns and to answer his/her questions	/ 5
The advisor was polite and made the client feel comfortable	/ 5
At the beginning of the evaluation, the advisor gave a clear summary of the energy assessment process to inform the client of what to expect	/ 5
The advisor explained what the ENERGUIDE RATING is	/ 5
The advisor explained what is included in the ENERGUIDE REPORT	/ 5
During the blower door test, the advisor showed the client the main air leakage areas and gave basic tips on how to seal them	/ 5
The advisor asked the client about his intentions, his concerns	/ 5
The advisor gathered information about the building's past renovations or issues, past moisture or air quality issues, etc.	/ 5
The advisor explained the requirements and eligibility for grants to the client to ensure that the client knew what kind of grants he could expect and what information he needs to provide to receive the grants.	/ 5
The advisor made sure that the client understood the impact that air sealing reduction could have on the ventilation and moisture level and/or on combustion back spillage	/ 5
If applicable, the advisor explained the combustion spillage test result and gave advice on how to avoid combustion spillage	/ 5
The advisor explained the basics of mechanical and natural ventilation and stack effect	/ 5
The advisor contacted the client for the pre-assessment phone interview prior to going to the evaluation	/ 5
The advisor avoided recommending any particular contractor or brand.	/ 5
The advisor took into account the renovation work already planned by the owner	/ 5
The advisor gave a sense of priorities to his recommendations so that the client understood which of these will have the biggest impact.	/ 5
The advisor made an effort to convince the client of the importance of reading the report and that he is available to answer questions about the report	/ 5
The advisor indicated the effects that air leakage could have on energy bills and also on moisture issues such as intra-wall condensation	/ 5
The advisor submitted the report and etiquette to the client within 14 days	/ 5
SAFETY : the advisor made sure that all safety precautions were taken during the assessment	/ 5
The advisor respected the client's property, did not damage or dirty the house	/ 5

QUALITY AND PRECISION OF THE COMPUTER SIMULATION AND ENERGUIDE RATING

The data that was input in the HOT2000 simulation is consistent with the actual real measurements of the house	
The ENERGUIDE RATING given to the house is accurate	/ 5
The ENERGUIDE REPORT that was produced is accurate and contains the texts that are consistent with the recommendations	/ 5
BLOWER DOOR TEST : the advisor input all of the required data	/ 5
The total volume of the house was calculated accurately	/ 5
The walls and attic dimensions and insulation levels entered in the program are accurate	/ 5
The advisor took into account the different sections of the house without oversimplifying the modelization	/ 5
The energy consumption calculated is within the 3 percent acceptable	/ 5
Windows and doors were modeled correctly (right number, right elevations, etc.)	/ 5
The space heating and cooling, the hot water heating, as well as the ventilation systems type and efficiencies data is accurate	/ 5
The advisor used effective insulation values over nominal values for a more accurate modelization	/ 5
The advisor selected the proper foundation type(s) and took into account the different sections.	/ 5
The advisor made sure that the recommendations in the report are relevant and specifically apply to the building in question.	/ 5
The advisor submitted the basic required date-stamped pictures with his file, in the proper format and quality required	/ 5

FINAL RATING		

FILE NUMBER: _____

EVALUATOR: _____

ENERGY ADVISOR: _____

DATE OF ASSESSMENT: _____

SERVICE ORGANISATION: _____

GENERAL NOTES:

DESCRIPTION OF THE ASSESSMENT:

STRONG POINTS:

ASPECTS TO IMPROVE:

FINAL COMMENT:

QUALITY ASSURANCE GRID (E Assessment)

RELEVANCE AND ACCURACY OF THE INFORMATION COLLECTED BY THE ADVISOR

The advisor made a complete list of all of the relevant retrofits that were performed	/5
The advisor collected all of the relevant invoices and pictures to clearly identify what changes were made to the house efficiency	/5
The advisor made an effort to determine if the renovations done were done correctly and would not create moisture or air quality problems	/5
The advisor made an effort to verify, with his own eyes, the changes listed by the homeowner and not to rely only on client claims	/5
The advisor took all of the required pictures and ensured they were clear, of good quality and well named	/5
The advisor measurements of insulation retrofit(s) were accurate	/5
The advisor noted any changes that were made to the heating system since the first assessment	/5
Where insulation retrofits level vary throughout the house , the advisor noted the difference between these different sections and did not oversimplify the data collected	/5
The advisor identified any abnormal moisture and air quality issues present in the house	/5
Blower door test : the advisor took all the necessary steps to prepare the house for a proper blower door test	/5
Blower door test: the advisor installed all the equipment properly, including the manometer settings and the pressure gages	/5
Blower door test : the advisor conclusions about the air leakage rate are accurate	/5
Combustion spillage test : the advisor correctly performed the combustion spillage test	/5

ABILITY OF THE ADVISOR TO CONVEY HIS OBSERVATIONS TO THE CLIENT

At the beginning of the assessment, the advisor gave a clear summary of the energy assessment process so that the client knows what to expect.	/5
The advisor explained his views in simple language which the client could understand	/5
The advisor was polite and made the client feel comfortable	/5
The advisor was attentive to the client concerns and to provide answers to his/her questions	/5
The advisor explained the requirements and eligibility in regards to grant applications	/5
The advisor made sure that the client signed all of the proper forms including the NRCan Grant Application and the authorization form	/5
The advisor informed the client that he would receive a final rating and the importance of keeping it	/5
Blower door test : the client was informed of the new air leakage results	
Blower door test : the client was informed on the impact that the air sealing reduction could have on ventilation, moisture, and gas spillage issues	/5
If applicable, the advisor informed the client about the risk of combustion gas spillage and recommended the installation of a carbon monoxide detector	/5
The advisor encouraged the client to keep upgrading the efficiency of the house	/5
The advisor submitted the final etiquette to the client within 14 days	/5

QUALITY AND PRECISION OF THE COMPUTER SIMULATION AND ENERGUIDE RATING

The data that was input in the HOT2000 simulation is consistent with the actual measurements of the house	/5
The ENERGUIDE RATING given to the house is accurate	/5
The ENERGUIDE ETIQUETTE that was produced is accurate	/5
BLOWER DOOR TEST : the advisor correctly input all of the new data	/5
The combustion spillage test was readjusted with new results	/5
The advisor used effective insulation values over nominal values for a more accurate modelization	/5
When applicable, The advisor took into account the different sections of the house without oversimplifying his modelization	/5
The energy consumption calculated is within the 3 percent acceptable	/5

OTHERS

The advisor carried with him the proper functional equipment to successfully perform the assessment	/5
The advisor submitted the basic required date-stamped pictures with his file, in the proper format and quality required	/5
SAFETY : the advisor made sure that all safety precautions were followed during the assessment	/5
The advisor submitted a complete data form for the purpose of quality assurance	/5
The advisor left the house as clean as when he entered.	/5

Final Rating		



Notes on the On-Site Evaluation (D)

Quality assurance

Appendix 1

Audit file number _____
Name of the advisor _____
Service Organization _____

ENSP Program : _____
QA done by: _____
Date of Audit : _____

☐ =task performed well ☐ task not completed ☐ Not/Applicable

Introduction ☐ required equipment ☐ program presentation ☐ client concerns ☐ building history

Remarks: _____

Foundation 1 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture ☐ rim joist
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Foundation 2 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture ☐ rim joist
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Walls type 1 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Walls type 2 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Attic 1 ☐ insulation values ☐ attic ventilation ☐ vapor barrier ☐ signs of moisture ☐ mask,gloves
☐ information to client ☐ recommendations to client ☐ required pictures ☐ ducting in attic

Remarks: _____

Attic 2 ☐ insulation values ☐ attic ventilation ☐ vapor barrier ☐ signs of moisture ☐ mask,gloves
☐ information to client ☐ recommendations to client ☐ required pictures ☐ ducting in attic

Remarks: _____

Windows/doors ☐ correct count ☐ types ☐ insulation value ☐ condensation ☐ air leakage
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Notes on the On-Site Evaluation (D)

Quality assurance

Appendix 1

Audit file number _____
Name of the advisor _____
Service Organization _____

ENSProgram : _____
QA done by: _____
Date of Audit : _____

Main Heating ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Main Heating ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Air cooling ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

DHW ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Ventilation ☐ Basic inspection ☐ info on plate ☐ air quality issues ☐ efficiency ☐ exhaust fans
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Blower Door Test ☐ equipment set-up ☐ preparation for test ☐ Readings (8X) ☐ identification of air leaks
☐ information to client ☐ recommendations to client ☐ required pictures ☐ comb.spillage test

Remarks: _____

Energide Report ☐ ACH and ELA explained ☐ ENERGIDE Rating ☐ texts ☐ priorities
☐ recommendations ☐ Energide Label

Remarks: _____

Grants ☐ general info ☐ requirements and eligibility ☐ deadline ☐ amounts info

Remarks: _____

Others ☐ Data collection sheet ☐ air quality and ventilation explanations ☐ house-as-a-system

Remarks: _____

Notes on the HOT2000 Simulation

Quality assurance

Appendix 2

Audit file number _____
Name of the advisor _____
Service organisation _____

QA done by _____
Date of audit _____

Check boxes where errors were identified

General information

☐ Name and address ☐ Fuel Cost and Weather Libraries ☐ Specifications

Remarks: _____

Ceiling 1

☐ Code ☐ Area ☐ Slope ☐ Compression

Remarks: _____

Ceiling 2

☐ Code ☐ Area ☐ Slope ☐ Compression

Remarks: _____

Wall 1

☐ Code ☐ height ☐ Perimeter

Remarks: _____

Wall 2

☐ Code ☐ height ☐ Perimeter

Remarks: _____

Windows & Doors

☐ Number ☐ Orientation ☐ Code ☐ Dimension

Remarks: _____

Foundation 1

☐ Type ☐ Area ☐ Perimeter ☐ Total Height ☐ Depth BG ☐ Code
☐ code of floor above foundation ☐ rim joist code ☐ rim joist measurements

Remarks: _____

Foundation 2

☐ Type ☐ Area ☐ Perimeter ☐ Total Height ☐ Depth BG ☐ Code
☐ code of floor above foundation ☐ rim joist code ☐ rim joist measurements

Remarks: _____

Air leakage

☐ Temperatures ☐ Pressures ☐ Readings (8) ☐ Volume ☐ combustion spillage test

Remarks: _____

Notes on the HOT2000 Simulation

Audit file number
Name of the advisor
Service organisation

QA done by
Date of audit

Check boxes where errors were identified

Ventilation ☐ Type ☐ CFM Rates ☐ Model

Remarks

Main Heating ☐ Type ☐ Efficiency ☐ Fans ☐ Model

Remarks:

Secondary Heating ☐ Type ☐ Efficiency ☐ Model

Remarks:

Cooling ☐ Type ☐ Efficiency ☐ Model

Remarks:

DHW ☐ Type ☐ Efficiency ☐ Model

Remarks:

Recommendations ☐ Report texts ☐ List of Upgrades

Remarks:

Other Remarks

Final Comment

PERFORMANCE PLUS

IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 11, 2013



ECONOLER

ACRONYMS

ASHPs	Air Source Heat Pumps
CATI	Computer-Assisted Telephone Interviewing
CEATI	Center for Energy Advancement through Technology Innovation
CFL	Compact Fluorescent Lamp
COP	Coefficient of Performance
CRA	Corporate Research Associates
DA	Delivery Agent
DHW	Domestic Hot Water
DWHR	Drain Water Heat Recovery
EA	Energy Advisor
EDSM	Electricity Demand Side Management
EEH	EnerGuide for Existing Houses
ENSC	Efficiency Nova Scotia Corporation
ETS	Electric Thermal Storage
GSHPs	Ground Source Heat Pumps
HEA	Home Energy Assessment
HVAC	Heating, Ventilation and Air Conditioning
LIHS	Low Income Homeowner Service
NTGR	Net-to-Gross Ratio
NRCan	Natural Resources Canada
PM	Program Manager

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
EnerGuide rating	An EnerGuide rating shows a standard measure of the home's energy performance. It shows exactly how energy-efficient the home is.
Demand-to-energy ratio	A ratio obtained by dividing the target peak demand savings by the target energy savings of a given program for a given year.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Market effects	Percentage of savings attributable to spillover from a program beyond program participants, i.e., in terms of supply, not demand.

Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.
Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Performance Plus, also known as the New Houses program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM), three delivery agents (DAs) and three energy advisors (EAs); two on-site visits; and two telephone surveys of 70 participants and 57 builders.

PROGRAM OVERVIEW

Efficiency Nova Scotia Corporation's (ENSC) Performance Plus' main objective is to encourage homeowners and builders across Nova Scotia to exceed the required building code for energy efficiency in new homes, in order to increase the amount of energy-efficient dwellings across the province.

Performance Plus includes a first review and analysis of house plans, using a simulation tool developed by the federal government, HOT2000. The simulation results are then provided to the builder or the homeowner through a report. This report includes the recommended energy efficiency measures as well as the estimated EnerGuide rating that will be achieved through the implementation of the suggested measures. The homeowner or builder has up to 12 months to complete construction after registration in the program. A final inspection and a blower door test are completed once the home is built to assess the home's level of efficiency and to provide a final EnerGuide rating.

Changes were made to the Performance Plus in 2012, especially regarding the incentive attribution structure. Singular and distinctive incentives are no longer attributed for every implemented prescriptive measure. Instead, the approach is now based on a global incentive determined by an overall EnerGuide rating provided during the final evaluation of the house. Based on this final EnerGuide rating, the following levels of incentives are available to either the homeowner or the builder.

Table 1: Rebates Provided by ENSC per EnerGuide Rating

EnerGuide Rating	Total Rebate
83 or 84	\$3,000
85, 86 or 87	\$5,000
88 or higher	\$7,000

In 2012, the program aimed to achieve net electricity savings of 2.2 GWh and demand savings of 0.6 MW.

KEY FINDINGS

The 2012 evaluation of Performance Plus demonstrated that the program is well designed. The program totalled 1,024 participants for the year 2012, which represents an increase compared to the previous year (701 participants). In terms of net energy savings at the generator, the program achieved 4.942 GWh in 2012, compared to 2.454 GWh in 2011.

Homeowner and Builder Involvement

The vast majority of homeowners were involved early in the decision to participate in the program and in decisions related to the implementation of energy efficiency measures. The involvement of the homeowners in the early planning stages of the projects demonstrates the importance of communicating with the general public regarding the program.

In addition, the input of the builders in the decision making is very high, as the survey results showed that 74 percent of them usually made the decision to participate in the program. This demonstrates the importance of informing builders of the program.

Satisfaction

Satisfaction with the program is very high among participant homeowners. Indeed, nearly all surveyed participants (93%) expressed their satisfaction with the overall program. They were also highly satisfied with various aspects of the program, notably the final energy assessment, which received the highest score (89%), and scheduling and timing of final assessment (81%). They expressed recommendations to improve the program; these mainly had to do with more marketing and advertising as well as more information on the measures recommended.

As for the participant homebuilders, the survey indicated that the vast majority of them were satisfied with the program overall. Suggestions to improve the program included speeding up the process to receive the rebates, making the participation process simpler and increasing program advertising.

On this last matter related to program advertising, the majority of the program partners expressed a low level of satisfaction, since they feel that a large part of the marketing is left up to them. Most of the program partners agreed that people should be more informed about the assessment process, energy efficiency in general and the impact the implemented measures will have.

Program Energy Savings

To calculate the net savings of Performance Plus in 2012, Econoler reviewed the gross savings estimated by ENSC using two features, namely the savings per EnerGuide point increase estimated in the Home Energy Assessment (HEA) evaluation and the savings generated in relation to the implementation of a series of prescriptive measures.

In the 2011 program evaluation, Econoler took into account the studies conducted for validating the average baseline EnerGuide rating and adjusted the baseline used by ENSC from 80 to 78. This value was still considered acceptable for 2012 and was used as a baseline for the gross savings calculation for building envelope. In addition, Econoler estimated the gross savings per EnerGuide point through comparative analysis of the program tracking sheet data with the results of 506 project simulations and using a calibration analysis from 172 simulation results.

In its net savings calculations, Econoler took into consideration the free-ridership level measured through the participant and builder surveys, as well as the market effects obtained through the builder survey. Econoler found that the 2012 free-ridership level calculated among builders (24%) was similar to that featured in the 2011 evaluation (23%). On the other hand, the free-ridership level among homeowners slightly increased between the two evaluations, from 37 percent in 2011 to 42 percent in 2012. This change in the homeowner free-ridership affected the overall program free-ridership level. Indeed, it went from 32 percent in 2011 to 37 percent in 2012. This slight increase in free-ridership could be partially due to the change in the incentives calculation, which is now based on an EnerGuide rating.

The evaluation revealed market effects of 13 percent. This result is an increase when compared to the 2011 evaluation (5 percent) and indicates the positive impact that the program has had on the builders' market, beyond participant builders.

The next table presents the key distortion effects calculated through the program impact evaluation.

Table 2: Distortion Effects and Net-to-Gross Ratio

Distortion Effects	2012
Free-Ridership Level	37%
Market Effects	13%
Net-to-Gross Ratio	0.76

The evaluation revealed that Performance Plus generated net energy savings of 4.942 GWh and demand savings of 1.478 MW in 2012, as shown in the next table.

Table 3: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	5.775 GWh	5.689 GWh	0.73	4.153 GWh
Evaluation Results	6.558 GWh	6.503 GWh	0.76	4.942 GWh
Demand Savings				
Tracked Savings from ENSC	1.746 MW	1.723 MW	0.73	1.257 MW
Evaluation Results	1.960 MW	1.945 MW	0.76	1.478 MW

The net savings tracked by ENSC were compared with the evaluated savings for 2012. Both the energy and demand savings calculated for this evaluation are higher than the tracked savings by 19 percent and 18 percent respectively. This difference can mainly be explained by the adjustment made to the gross energy savings per EnerGuide point, which was changed from 817 kWh to 914 kWh. This adjustment came from a review of 506 project simulations and a calibration on the savings from a billing analysis of 172 participants. This approach used a much bigger sample size than that used in 2011 and is more precise. Furthermore, since the energy savings per EnerGuide point was only calculated from the heating consumption reduction, solar domestic hot water (DHW) systems were considered a prescriptive measure, whereas ENSC included this measure in the savings per EnerGuide point.

RECOMMENDATIONS

Econoler finds that the program works well overall and at a satisfactory level. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- PP-R1. Provide participants with more information on the measures recommended:** Survey results revealed that participants want more information on the measures recommended to them following the first review of house plans. Besides being mentioned as a recommendation to improve the program, the lack of information on the measures recommended was also brought up as the main reason why participants did not reach the EnerGuide rating they were aiming for. Program partners and builders also favor this approach and believe everyone could benefit from more information on the measures recommended during the participation process. Considering this, the Evaluator recommends providing participants with more information on the measures recommended and how these measures affect the EnerGuide rating. This information could be outlined in the HOT2000 report.
- PP-R2. Simplify the incentive table:** The incentive table in the program manual should be significantly simplified, since the incentives will be managed through ENSC as a single window and will be based on an EnerGuide rating only. Tables 8 and 9 of the current program manual are good examples of incentive summaries. For additional improvement, the “pay in full” note in Table 8 should be replaced by the amount required from both the homeowner and ENSC (\$300 each) when referring to the assessment cost.
- PP-R3. Provide more support to DAs in their marketing efforts to reach more homeowners and builders:** A large part of the program marketing is handled by the DAs. More joint marketing efforts between the DAs and ENSC would allow reaching more homeowners and builders across Nova Scotia. This recommendation would address one of the main

dissatisfactions identified by the program partners, which refers to the lack of support from ENSC in the marketing activities. Indeed, program partners feel the marketing is left up to them. They also believe people should be more informed about the assessment process and energy efficiency in general. The Evaluator thus recommends working in collaboration with the DAs to offer a better program delivery and inform more homeowners and builders about the program.

- PP-R4. Consider the possibility of providing technical support for HOT2000:** A great majority of the DAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee on HOT2000 or employing an external expert that could provide HOT2000 expertise to the DAs when needed.
- PP-R5. Investigate the baseline EnerGuide rating for new houses in Nova Scotia:** Four studies were performed in 2011 with a view to fine-tuning the baseline EnerGuide value to be used for energy savings calculations. After reviewing these studies as part of the 2011 evaluation, the Evaluator elected to use 78 as the EnerGuide rating baseline value for calculating program gross savings and used the same baseline assumption for 2012. Considering the rapid penetration of high efficiency technology on the market and the relatively high level of free-ridership observed under Performance Plus, the Evaluator believes that ENSC should investigate the evolution of the EnerGuide rating baseline for 2013 and update this value if needed in their savings calculation.

1 PROGRAM DESCRIPTION

Efficiency Nova Scotia Corporation's (ENSC) Performance Plus' main objective is to encourage homeowners and builders across Nova Scotia to exceed the required building code for energy efficiency in new homes, in order to increase the amount of energy-efficient dwellings across the Province. The incentives offered in Performance Plus make the initial capital cost of investing in an energy-efficient home more affordable for the participants.

Performance Plus is funded through electricity demand side management (EDSM) and the Province of Nova Scotia. The funds received from electricity ratepayers go towards measures that reduce electricity consumption, whereas funds from the Province of Nova Scotia are directed to all homes regardless of their heating type.

New home plans are evaluated by three delivery agents (DAs) approved by Natural Resources Canada (NRCan) who operate across Nova Scotia under Performance Plus. To participate in the program, the homeowner or the builder must first register the house within 30 days of obtaining the building permit. A fee of \$300 is charged at this stage for the initial evaluation of the house plans. ENSC pays an additional incentive of \$300 to cover the cost of the assessment. Prior to May 1, 2012, ENSC and the participant both paid \$250. Once the house is registered, an energy analysis tool developed by the federal government (HOT2000¹) is used to model the energy efficiency of the home based on the building code and house plans before it gets built, in order to calculate and assign an EnerGuide rating. The software uses a scale from 0–100 to score the homes; the higher the rate, the more efficient the home. For instance, a score of 100 would be given to a house that produces as much energy as it uses over the course of the year.

The simulation results are then provided to the builder or the homeowner through a report which includes the recommended energy efficiency measures as well as the estimated EnerGuide rating that will be achieved through the implementation of the suggested measures. In Nova Scotia, the building code requires new homes to include minimum energy efficiency standards equivalent to a minimum EnerGuide rating² of 80; this is achieved by following prescriptive standards or by having an EnerGuide test completed. In order to be eligible for Performance Plus and its rebates, builders and homeowners must reach an EnerGuide rating equivalent to 83 or higher. In addition, homes must register within 30 days of obtaining the building permit, and have a forced hot air or hydronic distribution system. An exception is made for homes with ductless heat pumps, where at least 2/3 of the home's heating requirements must be met by the heat pump(s). Similarly, a home achieving a rating of 88 or higher is eligible for rebates, regardless of the heat source.

¹ This software was developed by the Housing, Buildings, Communities and Simulation (HBCS) group of CanmetENERGY, a division of NRCan. For additional information: http://198.103.48.154/eng/software_tools/hot2000.html.

² As of January 2012, studies had been done to determine the minimum EnerGuide rating value that would be most representative of the building practices that were in compliance with the Nova Scotia Building Code Regulations.

The homeowner or the builder has up to 12 months after registration in the program to complete construction and have all paperwork submitted to ENSC. A final inspection and a blower door test are completed once the home is built to assess the home's level of efficiency and to provide a final EnerGuide rating. Based on the EnerGuide rating provided during the final evaluation of the house, the following ranges of incentives are available to either the homeowner or the builder.

Table 4: Rebates Provided by ENSC per EnerGuide Rating

EnerGuide Rating	Total Rebate
83 or 84	\$3,000
85, 86 or 87	\$5,000
88 or higher	\$7,000

Rebates are paid to the homeowner or occupant of the house unless the homeowner and builder decide to transfer the rebates directly to the builder, which would reduce the final costs of the construction begun by the builder.

In addition to the incentives listed above, any homes registered before January 15, 2012, were eligible for a number of incentives for prescriptive measures such as the efficiency and type of space or water heating system and the lighting equipment installed.

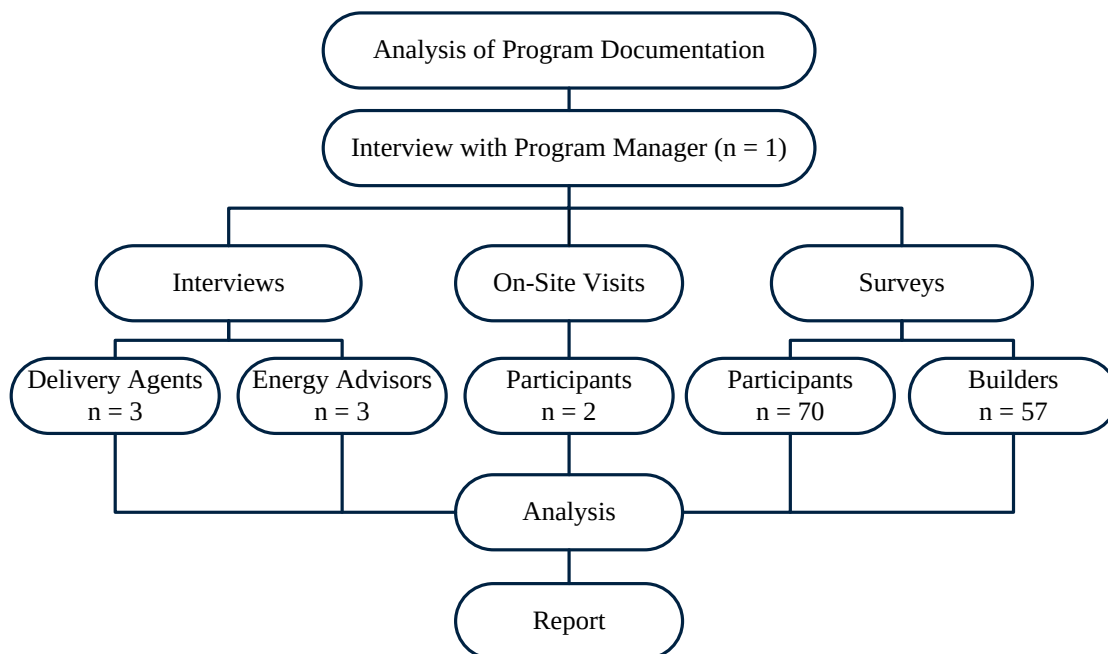
The program aims to achieve net electricity savings of 2.2 GWh and demand savings of 0.6 MW for 2012. Savings generated by Performance Plus are accounted for under the New Houses program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for Performance Plus. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was obtained primarily from the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews in July and September 2012 respectively with the Program Manager (PM). These interviews were intended, among other things, to follow up on the 2011 evaluation recommendations regarding process issues, as well as to understand the main changes that occurred in the program delivery in 2012. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 Interviews with Delivery Agents and Energy Advisors

In October 2012, three interviews with the program DAs (also called service organizations) and three interviews with energy advisors (EAs) were conducted in order to understand, among other things, their involvement in the program, their participation process, as well as their perception of and satisfaction with the program.

The protocols used for the interviews with the DAs and the EAs are presented in Appendices II and III for reference.

2.2.4 On-Site Visits

In November 2012, two on-site visits were conducted at new houses in which measures from Performance Plus had been implemented. This part of the process evaluation was carried out by Econoler's subcontractor ecoPlus Services, which appointed a certified ecoENERGY advisor to conduct the on-site evaluation of the EAs' assessments. The sampling was established to include two different DAs. These site visits were done to ensure that EAs were following the EnerGuide guidelines and that all pertinent information for running the house simulation with HOT2000 was collected. Further explanations of the methodology used for the on-site visits are available in the Process Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix IV.

2.2.5 Surveys

Two telephone surveys were conducted under the evaluation of Performance Plus: one participant survey and one builder survey. Both surveys were conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in October and November 2012 using computer-assisted telephone interviewing (CATI) technology.

Participant Survey

The participant survey was conducted with a total of 70 homeowner participants. The average length of the survey was 14 minutes.

The participant survey was meant to generate feedback on the following aspects of the program:

- > free-ridership;
- > program awareness;
- > participant motivations, concerns and barriers;
- > satisfaction with the program; and
- > recommendations for improvements.

The demographic profile of survey respondents and the survey questionnaire are shown in Appendices V and VII respectively. The table below shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2011 and 2012 participant surveys.

Table 5: Sample Size and Sampling Error

Survey	Population	Sample Size (n)	Sampling Error at 90% Confidence Level
2011 Participants	701	70	±9.3%
2012 Participants	1,024 ³	70	±9.5%

Builder Survey

The builder survey was conducted with a total of 57 builders across Nova Scotia. The average length of the builder survey was 11 minutes. Of the 57 builders, 50 were participant builders and 7 were non-participant builders. Builders were asked different series of questions depending on whether they were participants or non-participants.

Participant builders were interviewed on the following aspects of Performance Plus:

- > free-ridership;
- > spillover in the form of market effects;
- > program awareness;
- > reasons for participation;
- > satisfaction with the program; and
- > recommendations for improvements.

Feedback from participant builders is reflected in the Builder Perspectives and Impact Evaluation sections of this report. Considering a total of 50 participant builders, the corresponding sampling error at a 90 percent confidence level is ±11.6 percent.

³ The program population for the 2012 survey was 151 participants at the time the survey was being conducted.

On the other hand, questions asked of non-participants were specifically to measure spillover in the form of market effects. Results from these questions are shown solely in the Impact Evaluation section of the report.

The firmographic profile of survey respondents and the survey questionnaire are shown in Appendices VI and VIII respectively.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

In 2011, Performance Plus did not require a complete process evaluation as no significant changes had occurred since the 2010 process evaluation. Only a few process indicators were obtained from the impact evaluation survey, which also included questions linked to program awareness, program barriers and overall satisfaction. Hence, there were no 2011 process-related recommendations for the Evaluator to follow up on this year.

The program manual and website, the evaluation plan and the application forms were among the program elements examined in the 2012 process evaluation. The PM was interviewed along with program DAs, EAs, participants and builders.

The 2012 process evaluation covers the following aspects:

- > new and/or updated program documentation including program modifications since the last evaluation;
- > program tracking sheet;
- > program partners' perspectives on process issues; and
- > program participants' perspectives on process issues.

Recommendations and follow-ups regarding impact evaluation (energy or demand) will be reflected in the Impact Evaluation section of this report.

3.2 PROGRAM DOCUMENT ANALYSIS AND INTERVIEW WITH THE PROGRAM MANAGER

The following section describes the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interview with the PM.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory, in which all the information about the program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program, based on a template provided by the Evaluator.

In 2012, the Evaluator noted that the program memory has been included in the program manual along with its various Appendices. The Evaluator is also pleased to report that Performance Plus now has an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The purpose of the program manual is to capture information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The Performance Plus program manual is presented in a standardized template which applies to all ENSC programs and includes the same table of contents with 10 sections.

The following table presents the program manual content. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 6: Program Manual Content – Performance Plus

Program Manual Content	2012
Document revisions	✓
Program description (including nature or type of program)	✓
Program justification	✓
Program objectives	✓
Incentives	✓
Eligibility criteria	✓
Program partners and their roles	✓
Program barriers	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	✓
Details about the savings calculations and types of measure	✓
Annual budget	✓
Cost-effectiveness test results	✓
Market study or technical study supporting program elements or assumptions	✓
Marketing plan	✓
Evaluation plan	✓
Program theory	✓
Logic model	✓
Program process flow chart	✓
Partner or participant process flow chart	✓
Program forms	✓
 Information included in the program manual  Information partially included in the program manual  No information	

Various information can be found in the Performance Plus program manual regarding the incentives, their sources and their eligibility dates. This is due to the fact that Performance Plus is now in its third rebate structure and incentives vary depending on when the homeowner registered.

The current incentive structure is different from previous years. Incentives are no longer calculated according to each specific prescriptive measure implemented, but rather based on an EnerGuide rating that takes into consideration the interaction effects between the different measures. This is a much more effective way to offer incentives since it becomes a performance approach rather than a prescriptive approach. For additional improvements, the program manual should better explain this significant change.

Considering this, the Evaluator has a few additional minor recommendations:

- > **Simplify the incentive table:** The incentive table included in the program manual should be significantly simplified, since the incentives will be managed through ENSC as a single window and will be based on an EnerGuide rating only. Tables 8 and 9 of the current program manual are good examples of incentive summaries. For additional improvement, the “pay in full” note in Table 8 should be replaced by the amount required from both the homeowner and ENSC (\$300 each) when referring to the assessment cost.
- > **Document major changes in the Document Revision section:** In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual, such as the new incentive mechanism. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program’s logic model. Econoler is currently working with ENSC to make sure that each program’s updated logic model reflects the current program strategy, and the performance indicators established based on the program theory. The programs’ logic models will all be finalized and included in the programs’ manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the Evaluator's recommended template for an evaluation plan, which is included as an Appendix of the Performance Plus program manual.

The evaluation plan is a great asset to program documentation. The Evaluator has the following recommendation to further improve the evaluation plan:

- **Adapt the evaluation plan template to meet program needs:** Since Performance Plus is now a program where incentives are measured following an EnerGuide rating, the program base case could be simplified by keeping only the variables that are used to calculate the net savings. This would simplify the table.

3.2.4 Program Charts

The program has two process charts: one for the partners and the other for the participants. These charts are very informative for any new staff responsible for the program as well as for program partners and participants.

Econoler has the following recommendation on the program charts:

- **Provide partners and participants with simplified process charts:** The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well-designed. Moreover, the partners should be given copies of their process charts. After all, these charts are intended for the partners and the participants. Hence, they must be distributed as widely as possible to gain maximum exposure. The version date should be indicated in each chart.

3.2.5 Marketing and Outreach Activities

Due to the restructuring of the residential sector, to avoid program silos and to provide a one-window approach for participants, there is one general marketing plan for the residential sector. Indeed, ENSC is moving away from program-specific marketing towards a more all-inclusive approach, which offers a full suite of energy saving services and rebates for customers. Over the last year, a focus was put on developing a customer-centric approach.

- **Facebook:** Launched in September 2011, the Facebook page is being followed by over 28,000 people, which is a great accomplishment considering that there are fewer than 500,000 potential followers in Nova Scotia. It provides followers with energy saving tips and informs them about special offers, ways to meet with energy-efficiency representatives in person and energy-efficiency contests they can enter. It encourages followers to access all the energy-efficiency services for which they are eligible.

- > **New Website:** ENSC's new website will feature robust categorization (allowing the user to find specific content in a variety of ways), as well as a state-of-the-art predictive index. These combined features will make it easier for the user to locate specific services and for the website to suggest other appropriate services based on the user's needs and online behavioural patterns.
- > **Email Marketing:** Email addresses for e-newsletter communication are collected at various points of contact: home shows, retail in-store engagement events, program application forms and inbound calls.
- > **Customer Relationship Management:** The back end of the residential services is being retooled to fit the customer-centric approach. The systems undergoing development will allow ENSC to call up customer history and provide thoughtful advice on future energy savings, whether through personal contact, direct mail, or online communication.

In addition to the overall residential marketing strategy, other marketing activities were specifically designed in order to promote Performance Plus among homeowners and builders in Nova Scotia:

- > strong presence at home shows;
- > advertising in targeted builder and homeowner publications;
- > extensive promotion through home builder associations; and
- > online advertising.

Moreover, the Evaluator acknowledges ENSC's marketing strategy to address one of the program's main barriers, which is missing the registration deadline. This problem has been addressed by providing literature on the program at building permit offices across the province.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice, because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

For additional improvements, the Evaluator has the following recommendation on the marketing plan:

- > **Make the performance indicators more quantitative:** To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

3.3 TRACKING SHEET

Econoler reviewed the content of the tracking sheet for Performance Plus. In general, the tracking sheet is useful because it contains most of the necessary information for the PM to continuously monitor program savings. The necessary fields for program administration and evaluation purposes are present, but some improvements could make this tool a better asset for the PM and the Evaluator.

The tracking sheet is presented in several tabs with a unique file number for each participant. This file number corresponds to the EnerGuide file number and allows the PM to find participant information in each tab. The following tabs are used for evaluation purposes: “Participant Data”, “Incentives”, “Savings” and “Rebates Structures”. These tabs are separated by type of information, making it difficult to associate a project with its client information for evaluation.

The complexity of the Performance Plus monitoring lies in that it still includes older program versions such as EnerGuide for New Houses and R2000 rebates. Nevertheless, the database is well-conceived to track the project and the related rebate. Furthermore, all customer information was present in the “Participant Data” sheet, which is essential for conducting surveys.

The necessary data for calculating the estimated gross savings are included in the tracking sheet:

- > EnerGuide Rating data, which comes from the HOT2000 simulations developed by the service organization;
- > Savings value of 817 kWh per EnerGuide point, which comes from the 2011 program evaluation report;
- > Main heating system type and domestic hot water (DHW) heating type;
- > Individual measures, also known as prescriptive measures. For each measure, the quantity of equipment, the associated rebate and energy savings are presented. The energy savings values come from last year’s evaluation.

The energy savings (in kWh) and electrical demand savings (in kW) for each project are presented in different columns.

While the tracking sheet is efficient, a number of adjustments could be made in the future to improve its consistency for program evaluation. The Evaluator recommends that ENSC:

- > **Ensure that only participants appear in the “Savings” and “Incentives” tabs:** The PM should remove applicants who did not participate (i.e. whose status is incomplete, cancelled or reregistered) in Performance Plus in tabs used to calculate energy savings and incentives. This would facilitate verification by clarifying which projects are officially used by ENSC to calculate savings.
- > **Create fields for building energy consumption data:** Currently, energy savings are calculated using the EnerGuide rating. It may be suitable and more accurate to calculate them with the energy consumption data from HOT2000. Econoler recommends adding fields for building

energy consumption per year in GJ for both a baseline house built to code and the completed house.

- > **Add the percentage of electric heating:** This information can be estimated by the EA and would improve the accuracy of the calculated energy savings. It is also important that ENSC make sure that EAs know about the necessity of this information. ENSC indicated that the waiver signed by participants will be changed for 2013 so that this information will be provided by the SOs and made available in the tracking sheet.
- > **Determine the required fields and remove those that are unnecessary:** The PM, together with the Evaluator, should determine which fields are necessary for administration and evaluation purposes and ensure that the information is systematically entered in these fields. Conversely, unused fields should be removed from the tracking sheet in order to concentrate the efforts on the essential data, especially in the "Participant Data" tab.

3.4 ON-SITE VISITS

The on-site visits conducted as part of the evaluation of Performance Plus were used to assess the procedures and the ecoEnergy protocol that the EAs must follow during assessments. The ecoEnergy protocol was established by NRCAN to provide a framework for EAs with the ecoEnergy certification. The new house assessments must be conducted by a certified ecoEnergy advisor who is able to answer any of the participants' questions about energy use in the home, verify the proper implementation of energy efficiency measures and collect relevant documentation on house design (when available). Each parameter used in the HOT2000 models must be validated and documented appropriately. Furthermore, the assessment procedures should be clearly explained to participants.

The on-site visit quality assessment was twofold. Firstly, the Evaluator joined two EAs on one of their on-site visits to confirm that they were following the data collection protocol and communicating appropriately with program participants. Then, Econoler collected the two EAs' HOT2000 simulations along with all the data they collected on site with the aim of evaluating their ability to properly generate an accurate and replicable HOT2000 simulation of the household being assessed. Of particular note is that the two on-site visit assessments under Performance Plus included both the P evaluation (evaluation of the house "Per Plan") and the N evaluation (evaluation of the house "As Built").

During the on-site visits, the Evaluator noted that the advisors were following EcoEnergy protocol procedures well. By collecting very detailed data about the house components, the advisors succeeded in achieving very accurate EnerGuide ratings. Advisors also appeared to be very experienced and performed the assessments in an efficient and professional manner.

After the on-site visits, Econoler reviewed the HOT2000 simulations and EnerGuide reports developed by the two EAs. It appeared that the EAs were able to produce very precise EnerGuide ratings using the software. This was especially true when Econoler reviewed the P evaluation files. In the P evaluation, EAs must enter into HOT2000 all of the values indicated on the working plan drawings

and determine an appropriate EnerGuide Rating. For the correct rating to be determined, input data must be accurate and well detailed. The EAs evaluated were able not only to calculate building areas, perimeters and heated volumes with high accuracy, but they also took into account the various house components and features very well. They did not oversimplify house components that were found more complex, which is a common mistake in such a program. As a result, very precise and reliable EnerGuide Ratings were generated by the two EAs.

Under the P evaluation, EAs also have to produce a list of potential energy efficiency upgrades for the builders so that the latter can achieve a higher EnerGuide Rating and reduce the household energy consumption. This task was done quite successfully by the two EAs, although Econoler developed one recommendation (below) to help improve this part of the project process. Furthermore, the Evaluator considers that the N evaluations reviewed this year were well conducted in general and did not find any significant issue concerning this project step.

The on-site visits and HOT2000 simulation review did reveal, however, one possible improvement to be made by EAs: not assuming that houses are always built exactly according to the working plan drawings. The homeowners may change their plans during the construction process. For instance, they may decide to install hinged windows instead of sliders; such a modification to initial building plans would affect the expected energy consumption of the new household. Consequently, EAs should always consider the possibility that initial building plans may have been modified during construction and thereby clearly identify these changes while on site.

Taking into account the findings from the two on-site visits as well as from the subsequent HOT2000 simulation review, the Evaluator recommends to:

- > **Request all working plan information from the builder at the time of the P evaluation:** At the time of the P evaluation, the advisor must ensure that the working plan drawings contain all of the necessary information to complete the HOT2000 simulation. During one of the assessments, the drawings did not feature any information regarding window types and models, heating and ventilation system types and efficiencies, or specific values for walls, basement or attic insulation. With such information missing, the advisor used the base values of the building code and made assumptions based on other projects completed by the same builder. Though it is true that most builders use the same design and materials from one house to another, there are always exceptions, and such a practice may lead to errors when calculating the EnerGuide rating. When key information is missing on the building drawings provided by the builder, it would therefore be a better practice to obtain it from the builder before computing the new house's EnerGuide rating. For reference purposes, such important information includes details on house components' insulation, windows and doors, as well as on the heating, cooling and ventilation systems.
- > **Request all "as-built" information from the builder at the time of the N evaluation:** The N evaluation occurs once the construction is completed. Before performing this evaluation, it is

important that the advisor request a list of all of the upgrades that were performed by the builder. This list should also include any changes that were made from the initial building drawings, especially changes to the insulation values or house dimensions. In previous instances, the Evaluator saw some DAs using a waiver release form in which builders must declare the exact amount of insulation installed for each house component. This step is important because most of the insulation material is concealed at the time of the N evaluation, making it hard (and most of the time impossible) for the advisor to verify.

3.5 PARTNER PERSPECTIVES

3.5.1 Perceptions Related to Program Changes

A total of three DAs and three EAs were interviewed for the evaluation of Performance Plus. The program partners were asked, among other things, about their general satisfaction with the program and the recent changes made to the program and how these impact their work.

Generally, the vast majority of the DAs and EAs expressed a high level of satisfaction with the current form of the program and indicated that modifications made in 2012, such as the change in the total assessment cost, the change in incentives for prescriptive measures registered after January 15 and the change in eligibility criteria resulted in minor changes to the way they work.

However, the partners were also questioned about the main barriers to program delivery in order of importance. The relation between the current incentives and the cost of proposed measures, and the lack of education among the general public and among homeowners about the benefits of energy efficiency were identified as the two principal aspects of the program that could be improved. According to some EAs, the most common of the few complaints made by participants in 2012 were generally related to delays in receiving the rebate or the rebate amount given, which was considered too low.

The program partners were also asked if there were any energy efficiency upgrades that were not covered by the program that they would like to have covered. On this matter, one EA said the reinstatement of the pipe wrap and solar panel incentives would certainly be interesting to participants. Another stated it would be helpful to include in the program energy efficiency certifications that go beyond the ENERGY STAR tier in order to increase the range of products eligible for the program.

3.5.2 Relationships with Other Partners

The majority of the program partners interviewed expressed a high level of satisfaction with respect to their relationship with ENSC staff. The Evaluator noted that the DAs seem to have a better relationship with NRCAN than the EAs do. Indeed, while the majority of the DAs expressed a high level of satisfaction with respect to their relationship with NRCAN, all three EAs reported a lack of support from the federal agency after their training. They also complained about the high turnover of NRCAN staff

and the fact that NRCan often provided faulty information. Moreover, some EAs expressed their dissatisfaction with the HOT2000 software. One of them said the software was very limiting and not up-to-date in taking into account the specifications of the new equipment coming out on the market.

3.5.3 Assessment Process

Regarding the assessment process in general, all three EAs reported that the EnerGuide methodology is appropriate in the context of the program. They stated that they always make sure the protocol is well-explained to the client and that the blower-door test is strictly followed. However, not all of them always take pictures of the houses they assess since they have the blueprints for the construction. They also do not always give homeowners the *Keeping the Heat In* booklet; only if clients ask for more information do they provide it. On this matter, one EA suggested that the booklet be updated with the latest edition of Nova Scotia's building code.

3.5.4 Opinion on Marketing Strategy

The majority of the program partners expressed a very low level of satisfaction with respect to the promotional activities currently implemented, since they feel that the marketing is left up to them. Most of the program partners agreed that people should be more informed about the assessment process, energy efficiency in general and the impact the implemented measures will have.

According to several program partners, an advertising campaign through Nova Scotia radios and newspapers should be implemented to help educate builders and the general public about the importance of constructing energy-efficient homes and buildings. Some partners reiterated the importance of focusing on the initial investment versus the overall savings and getting participants to understand more about the HOT2000 model and procedure.

One EA said one piece of literature was available at building offices around the province but that it was not widely accessible. Therefore, there should be a joint effort between ENSC and building offices to ensure all new home builders get information on Performance Plus.

3.6 PARTICIPANT PERSPECTIVES

Two surveys were conducted in the evaluation of Performance Plus: one with participants (homeowners) and the other with builders. The following section presents the results from the participant survey. Results from the builder survey are given in section 3.7.

3.6.1 Program Awareness among Homeowners

Participants found out about the program in a number of different ways, with ENSC sources being the primary channel. Specifically three in ten participants found out about the program from newspapers (13%), radio advertisements (10%), home shows (9%), the ENSC website (1%), a bill insert (1%), a seminar by the delivery agent (1%), or a program delivery agent from the Nova Scotia Home Builders' Association (NSHBA) (1%). Word of mouth is also quite common, with approximately one-quarter of participants hearing about the program from friends and family (26%). Finally, the Internet in general was also a common source; just over two in ten participants finding out about the program online (23%).

Table 7: Program Awareness among Homeowners

Sources of Program Awareness*	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
TOTAL ENSC SOURCES	—	29%
Newspaper/renovation guide ad or story	4%	13%
Radio advertisement	7%	10%
Home show (unspecified)	4%	9%
ENSC website	—	1%
Bill insert	—	1%
Seminar or information session put on by delivery agent	—	1%
Program delivery agent from NSHBA	—	1%
Word of mouth (neighbour, friend, co-worker, family member, etc.)	11%	26%
Internet (unspecified)	17%	23%
From a contractor	29%	13%
From buying a house	—	3%
Builder	17%	—
Real estate agent	6%	—
NSHBA member list	1%	—
Previous experience building with EnerGuide	1%	—
Others	16%	11%
Don't know/Refused	1%	1%
*Multiple responses		

3.6.2 Homeowner Involvement in Decision Making

Nearly all participants (99%) were involved in the decision to participate in the program, and involved in decisions to implement energy efficiency measures (94%).

Table 8: Homeowner Involvement in Decision Making

Homeowner Involved in Decision to Participate in the Program	2011	2012
<i>Sample Size</i>	70	70
Yes	76%	99%
No/The builder was the only one involved	23%	1%
Don't know	1%	–
Homeowner Involved in Decision to Implement the Energy Efficiency Measures	2011	2012
<i>Sample Size</i>	70	70
Yes	74%	94%
No/The builder made the decision	16%	3%
Don't know	10%	3%

Findings indicate that homeowners were generally involved early on in this decision making, as the majority of participants were involved in the initial planning or design phase of energy efficiency decisions (77%), while a small number were involved in the decision after the plan was finalized, before the measures were implemented (14%). This homeowner involvement in the early planning stages of a project signifies the importance of communicating with the general public regarding the program, in addition to communicating with builders.

Table 9: Stage of Homeowner Involvement in Home Energy Efficiency Decision

When Homeowner Became Involved	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
Initial planning/design stage	77%	77%
After plan finalization, before measure implementation	6%	14%
Not involved/bought home after project completion	13%	6%
After measure implementation, before final review of home	4%	3%

3.6.3 Homeowner Motivations and Barriers to Participation

Encouraging participation in the program may be best done by informing the public about potential energy savings. Saving money, either through having a home that would save on energy costs, or through receiving rebates for energy efficiency measures, was the main motivation for participation. Some participants noted that their motivation was energy efficiency in general. Secondary areas of motivation are generally consistent with primary motivators.

Table 10: Reasons for Participating - Homeowners

Reasons for Participating	2011		2012	
	Most Important Motivation	Second Most Important Motivation**	Most Important Motivation	Second Most Important Motivation**
<i>Sample Size*</i>	53	52	69	68
To have a house that would save on energy costs/bills	23%	19%	41%	43%
To get rebates (general)	19%	15%	28%	26%
To get rebates for measures that had already been implemented in the house I bought	17%	10%	10%	3%
Energy efficiency (general)	6%	2%	10%	13%
Was thinking of implementing energy efficiency measures to my house anyway	6%	4%	4%	7%
To find out how energy efficient the new house would be/to have the house evaluated	6%	–	4%	6%
Interested in having a better, more energy-efficient home	11%	8%	–	1%
To help the environment	4%	4%	–	12%
To help save energy (not specified whether for cost, environment)	4%	–	–	6%
I was generally interested in energy efficiency and renewable energy	–	4%	–	–
To get expert advice on what measures to implement/how to make home more energy efficient	–	2%	–	–
Others	4%	10%	1%	6%
Refused	–	–	1%	1%
No other reasons/Don't know	2%	31%	–	13%
*Base: Respondents who personally took part in the decision to participate in the program				
**Multiple responses				

Only a few participants had any concerns prior to taking part in the program (10%).

Table 11: Concerns with Program Prior to Taking Part

Concerns with Program Prior to Taking Part	2011 (%)	2012 (%)
<i>Sample Size*</i>	53	69
Yes	6%	10%
No	94%	90%
*Base: Respondents who personally took part in the decision to participate in the program		

Of these participants, concerns were varied. Two participants felt there was a lack of information about the program, and the same number had concerns about the time frame involved. Additionally, one participant cited the amount of paperwork, not liking the measures implemented, and the cost of the measures as concerns.

Table 12: Specific Concerns with Program Prior to Taking Part

Specific Concerns*	2012 (#)
<i>Sample Size**</i>	7
Lack of information	2
Time frame to complete the house/Limited timelines	2
Would be a hassle/Too much paperwork	1
I wouldn't like what was implemented	1
The measures would cost a lot	1
Other	1
*Base: Respondents who had concerns with program prior to taking part	
**Multiple responses	

3.6.4 Program Influence on Homeowners

Given that the primary motivation for participation was to save money, it is not surprising that the program incentive was very important in participants' decisions to build or buy a house with a high level of energy efficiency (mean of 8.2 on a 10 point scale). In addition, the EnerGuide label and designation was also considered important (mean of 7.2), as were the expert advice provided by the EA (mean of 7.1) and the feedback received during the first review of the home plans (mean of 7.0). Finally, previous experience with other ENSC programs was not considered important in influencing decisions (mean of 4.1).

Table 13: Importance of Program in Influencing Homeowner Decision

Importance of Program in Influencing Homeowner Decision to Build or Buy a House with a High Level of Energy Efficiency	2011		2012	
	Sample Size*	Average	Sample Size*	Average
Average (0 = "Not at all important"; 10 = "Extremely important")				
Program incentive	57	7.7	69	8.2
The EnerGuide label and designation itself	52	6.8	68	7.2
Expert advice provided by the EA**	57	7.3	66	7.1
Feedback received from the review of home plans	53	6.5	68	7.0
Previous experience with Performance Plus, or a similar program from either Efficiency Nova Scotia or Nova Scotia Power	31	3.7	62	4.1
*Don't know/Refused excluded from calculations				
**Question wording change from 2012				

3.6.5 Impact of Measures

The program was successful at providing participants with increased home comfort, with nearly all participants in agreement that this was the case (94%).

Table 14: Impact of Measures on Comfort Level

Measures Increased Home Comfort	2011 (%)	2012 (%)
Sample Size	70	70
Yes	96%	94%
No	1%	4%
Don't know	3%	1%

3.6.6 Homeowner Satisfaction with the Program

There was a high level of satisfaction with the program overall, and with specific aspects of the program. Nearly all participants were satisfied with the program overall (93%). The majority were satisfied with the first review of the house plans (74%), the scheduling and timing of the review (75%), and the report about the house plan's current efficiency (80%). Moreover, there was high satisfaction with other aspects of the program including the final energy assessment (89%) and the scheduling and timing of the final assessment (81%). That being said, survey results seem to indicate a slight decrease in EAs' work execution satisfaction when compared to last year.

Furthermore, there may be an opportunity to improve satisfaction in terms of the information provided by the EA (63%), and the recommendations for measures (68%), as these two areas received lower ratings than the others.

Table 15: Homeowner Satisfaction with Program

Satisfaction with Program*	2011 (%)	2012 (%)
<i>Sample Size</i>	<i>70</i>	<i>70</i>
Program overall	91%	93%
<i>Sample Size**</i>	<i>54</i>	<i>53</i>
First review of house plans, overall	89%	74%
Scheduling and timing of review	85%	75%
Report received about house plan's current efficiency	84%	80%
<i>Sample Size***</i>	<i>58</i>	<i>63</i>
Final energy assessment, overall	93%	89%
Scheduling and timing of final assessment	88%	81%
Delays allowed to complete the project	n/a	76%
Overall rebates provided by program	81%	72%
Recommendations for energy efficiency measures	81%	68%
Information provided by EA	n/a	63%
*Respondents giving rating of '5' or '4' where '5' = 'Very satisfied' and '1' = "Very dissatisfied"; Don't know/no answer removed from calculations **Base: Respondents involved in initial planning and design stage ***Base: Respondents involved in initial planning and design stage or those involved after planning, but before implementation		

Among the small number of participants who were dissatisfied with the program overall, poor service from the DA was mentioned by four participants as the biggest reason for dissatisfaction, while lack of communication was mentioned by two participants.

Table 16: Reasons for Dissatisfaction with Program Overall - Homeowners

Reasons Dissatisfied with Program	2012 (#)	
	Single Most Important Reason	Other Reasons**
<i>Sample Size*</i>	5	5
Poor service from DA	4	1
Lack of communication	2	2
The review of the plans took too long	1	–
Other	–	1
None/No other reasons	–	1
*Base: Respondents who were dissatisfied with program overall		
**Multiple responses		

Participants who indicated being dissatisfied with either the first review of house plans or the final assessment were asked to provide reasons. A number of reasons were given for dissatisfaction with the review of house plans, including that mistakes were made, poor communication, not enough items being covered during the first review of the house plans and not liking the recommendations. For example, one participant stated, “They got it wrong a few times and they failed the review of my house plans four times.” Another participant noted (in reference to mistakes being made), “They missed something. I had to email him back the information and the energy advisor corrected the information.”

Table 17: Reasons for Dissatisfaction with First Review of House Plans - Homeowners

Reasons Dissatisfied with First Review of House Plans	2012 (#)	
	Single Most Important Reason	Other Reasons**
<i>Sample Size*</i>	14	14
They made mistakes	3	–
Poor communication	3	–
Not enough items covered by first review of the house plans	3	–
Didn't like the recommendations	2	1
It wasn't what I had expected	1	1
The review of the plans took too long	1	2
Others	1	2
None/No other reasons	–	8
*Base: Respondents who were dissatisfied with first review of house plans		
**Multiple responses		

Some of those participants who were dissatisfied with the final assessment did not get the EnerGuide rating they expected, while other reasons for dissatisfaction included finding the EA unpleasant and the length of time to complete the final assessment.

Table 18: Reasons for Dissatisfaction with Final Assessment - Homeowners

Reasons Dissatisfied with Final Assessment	2012 (#)	
	Single Most Important Reason	Other Reasons
<i>Sample Size*</i>	7	7
I did not get the EnerGuide rating I expected	4	2
I found the EA to be unpleasant	1	–
The final energy assessment took too long	1	–
Other	1	–
None/No other reasons	–	5
*Base: Respondents who were dissatisfied with final assessment		

The program was largely successful in helping people reach the EnerGuide rating they were aiming for. Indeed, a little over eight in ten participants reached the EnerGuide rating they hoped to achieve (81%).

Table 19: Reached EnerGuide Rating

Reached EnerGuide Rating	2012 (%)
<i>Sample Size</i>	70
Yes	81%
No	17%
Don't know	1%

That said, there may be issues with communication during the review of house plan process, given that some participants who did not achieve the EnerGuide rating they were aiming for felt this was a result of not being informed of some measures. This, paired with previous reasons for dissatisfaction, related in mistakes being made during the review of house plans and suggests that focusing on communication and providing information may further ensure that participants are achieving their desired EnerGuide rating.

Table 20: Reasons Did Not Reach EnerGuide Rating Aiming For

Reasons Did Not Reach EnerGuide Rating	2012 (#)
<i>Sample Size*</i>	12
Was not informed of the measures that would have allowed me to reach the EnerGuide rating I wanted	5
The measures I wanted were too expensive	2
Time frame/Ran out of time to implement everything	1
Others	3
Don't know	1
*Base: Respondents who did not reach EnerGuide rating they were aiming for	

With respect to the application process, the vast majority of participants felt it was very easy to participate in the program.

Table 21: Application Process

Program Application Process	2012
<i>Sample Size*</i>	64**
5 - Very easy	52%
4	30%
3	13%
2	6%
1 - Very difficult	—
*Don't know excluded from calculations	
**Sample size lower due to programming error in pre-testing stage	

The small number of participants who found participating in the program difficult offered a number of reasons. Specifically, participants identified problems with being informed of the requirements, difficulty getting the process started, and poor communication. A small number also cited problems with the assessment process or the EA or mentioned that paperwork was time-consuming.

Table 22: Causes for Program Application Difficulty

Causes for Program Application Difficulty *	2012 (#)
<i>Sample Size**</i>	<i>12</i>
Being informed of requirements/what was needed	3
Getting the process started	3
Poor communication	3
Problems with the assessment process or EA	2
Paperwork/process was time-consuming	2
Working with the contractor	1
Others	3
*Base: Respondents who found participating in program difficult	
**Multiple responses	

3.6.7 Homeowner Recommendations for Improvements

Recommendations for improving the program are perhaps not surprising, given the above-mentioned problems pertaining to communication and understanding which measures could or should be implemented. Some participants recommended more marketing or advertising (10%), more information on the measures being recommended (9%), more measures eligible for rebates (9%), or a simpler participation process (6%). These comments suggest that there is some confusion on the part of participants about aspects of the program. That said, a fairly high percentage of participants could not offer any suggestions to improve the program (41%).

Table 23: Homeowner Recommendations for Improvements

Homeowner Suggestions*	2011 (%)	2012 (%)
<i>Sample size</i>	70	70
More marketing/advertising	7%	10%
Offer more information on the measures recommended	7%	9%
Offer more measures eligible for rebates	1%	9%
Make process simpler (consolidate rebate programs)/clarify report	2%	6%
Improve the quality of work of the EA	1%	6%
Faster certification process	1%	4%
Speed up rebates	–	4%
Improve communication	–	4%
Lengthen the time frame to complete upgrades	–	3%
Increase availability of EA to answer energy efficiency-related questions	–	1%
Complete the first review of the house plans faster	–	1%
The transition from NSPI to ENSC caused confusion	1%	–
Explain why people qualify and give opportunity to correct the application	1%	–
Others	8%	6%
No recommendation	67%	41%
Refused/Don't know	4%	3%
*Multiple responses		

3.7 BUILDER PERSPECTIVES

The following section details the results from the builder survey. Even though both participant and non-participant builders were interviewed, results from the telephone interviews with participant builders only are reported in the sections below. Data obtained from interviews with non-participant builders is reflected in the Impact Evaluation section of this report.

3.7.1 Program Awareness among Builders

ENSC advertising was important in communicating with builders about the program. Indeed, while participant builders found out about the program in a number of ways, ENSC was the primary way. One-half found out about the program from ENSC sources such as the program delivery agent from NSHBA (24%), the program delivery agent from Sustainable Housing & Education Consultants (SHEC) (14%), a seminar or information session by a delivery agent (8%), the ENSC website (6%), the newspaper (4%), radio (2%), home show (2%), or the AmeriSpec Inspection Services delivery agent (2%). Two in ten participant builders also mentioned the NSHBA member list as a source of awareness for the program.

Table 24: Program Awareness among Builders

Source of Program Awareness*	2012 (%)
<i>Sample Size</i>	50
TOTAL ENSC SOURCES	54%
Program delivery agent from NSHBA	24%
Program delivery agent from SHEC	14%
Seminar or information session put on by delivery agent	8%
ENSC website	6%
Newspaper/renovation guide ad or story	4%
Radio ad	2%
Home show	2%
Program delivery agent from AmeriSpec Inspection Services	2%
NSHBA member list	22%
Contractor	10%
Through previous involvement with ENSC	8%
Word of mouth – neighbour, friend, co-worker, family member, etc.	8%
Home buyer	6%
A utility other than ENSC	2%
Permit office	2%
Internet	2%
Others	8%
Don't know	4%
*Multiple responses	

3.7.2 Builder's Decision to Register under the Program

Making builders aware of the program is important, given that they are usually the ones making the decision to participate in the program. While participants reported that they were generally involved in the decision to participate (see Section 3.6.2), these results suggest that it was the builders who most often made the decision to register under the program.

Table 25: Builder's Decision to Register under the Program

Builder's Decision to Register under the Program	2012 (%)
<i>Sample Size</i>	50
I, the builder, usually make the decision	74%
Future homeowner usually makes the decision	16%
Both builder and future homeowner make the decision	10%

Builders typically implemented a wide range of measures as part of their participation in the program. Most popular was high-efficiency insulation (84%), followed by high-efficiency windows (74%), energy-efficient lighting equipment (72%) and mini-split heat pumps (64%).

Table 26: Measures Typically Implemented

Measures Typically Implemented	2012 (%)
<i>Sample Size</i>	50
High-efficiency insulation	84%
High-efficiency windows	74%
Energy-efficient lighting equipment	72%
Mini-split heat pumps	64%
Programmable electronic thermostat	52%
Ducted heat pumps	52%
Electric water heater pipe wrap	36%
Electric water heater tank wrap	32%
Drain water heat recovery equipment	24%
Natural gas or propane furnace	14%
Solar panels	12%
Central wood or pellet heating system	10%
Natural gas or propane boiler	8%
Geothermal systems/heat pumps	6%
Oil boiler and furnace	4%
Natural gas or propane fireplace	4%
Others	28%

3.7.3 Builder Motivations to Participation

Builders primarily participated in the program to get rebates for measures they were already planning on implementing (38%). A smaller number were interested in building a better, more energy-efficient home (21%), or wanted to have a house that would save energy costs for the homeowners (14%).

Table 27: Reasons for Participating - Builder

Reasons for Participating*	2012 (%)	
	Most Important Motivation	Second Most Important Motivation
<i>Sample Size**</i>	42	42
To get rebates for measures that we were already planning	38%	19%
We were interested in building a better, more energy-efficient home	21%	14%
To make a house that would save buyers/homeowners on energy costs/bills	14%	10%
To market house/make house more attractive for potential buyers	7%	7%
General interest in energy efficiency and renewable energy	5%	2%
To meet new building code requirements	2%	—
To differentiate ourselves from other builders	2%	—
Get expert advice on measures to implement/how to make home energy-efficient	2%	—
To help buyer/homeowner save energy (cost, environment, etc., not specified)	—	5%
To find out how energy-efficient the new house would be/to have the house evaluated	—	5%
Already using many of the components/practices of Performance Plus Program	—	5%
To help the environment	—	2%
Others	7%	5%
None/other reasons	—	40%
Refused	—	2%
*Base: Builders who were involved in decision to participate in program		
**Multiple responses		

3.7.4 Program Influence on Builders

The program incentive was very important in influencing participant builders' decisions to build houses with a high level of efficiency, with an average score of 9.1 on a 10 point-scale where '10' is extremely important.

Table 28: Importance of Incentive in Influencing Builder Decision

Importance of Incentive in Influencing Builder Decision to Build Houses with a High Level of Energy Efficiency*	2012
<i>Sample Size</i>	30
Average (0 = "Not at all important"; 10 = "Extremely important")	
Program incentive	9.1
*Base: Respondents who would not have built the same number of houses without the program	

3.7.5 Program Impact

The program is highly regarded given that the large majority of participant builders believe the program provided considerable value to customers (96%) and to their company (88%).

Table 29: Program Impact

Program Impact	2012 (%)
<i>Sample Size</i>	50
Value of program to customers	96%
Value of program to company	88%
*Respondents rating a '5' or '4' a on scale where 5 = "Considerable value" and 1 = "No value"	

3.7.6 Builder Satisfaction with the Program

There was a high level of satisfaction on the part of builders. Nearly all participant builders were satisfied with the program overall (92%). Participant builders were also asked about their satisfaction with regard to the process of receiving the rebate. This refers to the rebate being paid to the homeowner of the completed house, unless the homeowner and builder agree in writing to transfer the rebate amount to the builder. The majority of participant builders were satisfied with the rebate process (77%).

Table 30: Satisfaction with Program - Builder

Satisfaction with Program	Sample Size*	2012**
Program overall	50	92%
Process to receive rebate	47	77%
**Respondents giving a ratings of "Very satisfied" or "Satisfied"		
*Don't know/Refused excluded from calculations		

In terms of the reasons for dissatisfaction, the small number of builders who were dissatisfied cited not having enough details or information on the program, lack of incentive or rebate for the builders, or poor service. Others mentioned the length of time to receive the rebate was too long or that the review of the plans took too long.

Table 31: Reasons for Dissatisfaction - Builder

Reasons for Dissatisfaction*	2012 (#)
Sample Size**	4
Not enough detail/information on program/process	1
No incentive/rebate for builders	1
Poor service from service organization	1
Took too long to receive rebate	1
The review of the plans took too long	1
None/No reasons	2
Don't know	1
*Base: Respondents who were dissatisfied with program	
**Multiple responses	

3.7.7 Builder Recommendations for Improvements

Suggestions to improve the program included speeding up the process to receive the rebates, offering more measures to be rebated, simplifying the process, increasing program marketing and advertising, and providing more information on the measures recommended. It is to be noted that a fairly high percentage of builders could not offer any suggestions to improve the program (42%).

Table 32: Builder Recommendations for Improvements

Builder Suggestions*	2012 (%)
<i>Sample Size</i>	<i>50</i>
Speed up rebates	16%
Offer more measures eligible for rebate	14%
Make process simpler/consolidate rebate programs/clarify report	10%
More marketing/advertising	6%
Offer more information on the measures recommended	6%
Improve communication	4%
Explain why people qualify and give opportunity to correct application	2%
Improve the quality of work of the EA	2%
Complete the first review of house plans faster	2%
Others	12%
No recommendations	42%
*Multiple responses	

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation is aimed at determining the gross and net savings of the program for 2012. Both energy and demand savings were considered in this evaluation. To do so, Econoler analyzed the following parameters:

- > outcomes from HOT2000 simulations performed under Home Energy Assessment (HEA);
- > prescriptive measure savings;
- > interactive effects for lighting products and DHW measures;
- > free-ridership; and
- > spillover in the form of market effects.

For savings related to the building envelope, the 2012 impact evaluation follows the approach used in 2011, whereas the energy and demand savings were calculated using the energy savings value per EnerGuide point increase estimated in the HEA evaluation report. In addition, projects registered before January 15, 2012, were also eligible for incentives on specific prescriptive measures. For these projects, an analysis of energy savings for each prescriptive measure and an assessment of how the savings were calculated were also completed.

The participant and builder surveys provided information to calculate the net-to-gross ratio for this program, including free-ridership and spillover in the form of market effects. The NTGR established was used to calculate program net savings.

4.2 GROSS SAVINGS

As mentioned previously, the 2012 evaluation of Performance Plus gross savings is essentially based on the HEA gross savings analysis. Within this latter program analysis, Econoler estimated the gross savings due to EnerGuide rating improvement through comparative analysis of the program tracking sheet data with the results of 506 project simulations coupled with a calibration analysis from 172 simulation results. Then, Econoler reviewed and properly adjusted the prescriptive measure savings on the basis of the findings from other ENSC programs. All the details of this analysis can be found in the HEA evaluation report.

In summary, Econoler used four key parameters for evaluating Performance Plus gross savings:

- > For the gross energy savings calculation, the parameters are the incremental energy savings value per EnerGuide point increase and the independent savings per prescriptive measure installed.
- > For the gross demand savings calculation, the parameters are the demand-to-energy ratio and the unitary demand savings per electric thermal storage (ETS) system installed.

The methodology for evaluating these elements is described in the following sections.

4.2.1 Savings per EnerGuide Point

The next sections present the three key features used for calculating energy savings under Performance Plus, namely the EnerGuide baseline, the savings per EnerGuide point value and the prescriptive measure savings figures.

New House EnerGuide Baseline

For Performance Plus, ENSC calculates energy savings generated by new high-efficiency houses by comparing them to standard new houses being built in Nova Scotia. In 2009, the EnerGuide rating of new houses that complied with the minimum standards⁴ was 73; this value was increased to 80 as part of the 2010 program evaluation. This was done to be compatible with the change in Nova Scotia building code minimum requirements, which came into force in early January 2010.⁵

Considering that the baseline EnerGuide rating of 80 is fairly high for new houses, ENSC suspected that the residential buildings built to code in 2011 should have a lower EnerGuide rating than this figure. Accordingly, four studies were performed in 2011 with a view to fine-tuning the baseline EnerGuide value to be used for energy savings calculations. After reviewing these studies as part of the 2011 evaluation, the Evaluator elected to use 78 as the EnerGuide rating baseline value for calculating program gross savings. This value is still considered acceptable for 2012 and was therefore used as a baseline for the gross savings calculation for building envelope. However, the Evaluator believes that ENSC should investigate the evolution of the EnerGuide rating baseline for 2013 and update this value if needed.

Savings per EnerGuide Point

ENSC calculates all building envelope and most of heating, ventilation and air conditioning (HVAC) system energy savings of Performance Plus using an incremental savings coefficient per EnerGuide point increase (also referred to as “savings per EnerGuide point”). In ENSC’s methodology, each EnerGuide point over the baseline rating of 78 accounted for 817 kWh of annual savings for 2012 gross impact calculations. The 817 kWh savings figure comes from the 2011 Performance Plus program evaluation report. In addition, the savings per EnerGuide point were calculated only when the main heat source of the house was electricity, regardless of the share of electricity in delivering heating throughout the year. By contrast, ENSC did not claim electricity savings when the main heat source was not electricity (oil, natural gas, etc.), even though the backup heating system was electric.

⁴ NMR, Impact and Process Evaluation, 2009 EnerGuide for New Houses Program. February 25, 2010.

⁵ Since January 1, 2010, the residential energy code of Nova Scotia features more stringent minimum energy efficiency requirements. This improvement of residential construction standards affected the minimum energy efficiency of new houses in Nova Scotia. For additional information: <http://www.gov.ns.ca/lwd/buildingcode/docs/NSBuildingCodeAct.pdf>.

For the 2012 Performance Plus evaluation, Econoler used the same energy savings coefficient as the one calculated in the 2012 HEA evaluation. For this program evaluation, Econoler conducted several analyses for confirming the savings per EnerGuide point value. The details of these analyses are included in the HEA evaluation report. The main features of this work are summarized below.

First, Econoler selected all projects completed up to August 2012 under HEA and Low Income Homeowner Service (LIHS). Subsequently, Econoler evaluated the average value of space heating savings per EnerGuide point for those projects using the initial and final space heating energy consumption data simulated with HOT2000 in relation to the respective EnerGuide ratings. The overall average of these space heating savings values per project amounted to 1,115 kWh per EnerGuide point.

Econoler noted that the HOT2000 simulations tended to overestimate residential building electricity consumption. A billing calibration was therefore conducted with 172 simulation results to evaluate the accuracy of the results obtained from the HOT2000 simulations. This analysis demonstrated that the HOT2000 software seems to overestimate the space heating electric consumption by approximately 18 percent. As a result, this last percentage was used to lower the evaluated average savings per EnerGuide point (1,115 kWh) previously defined. This yielded a final value of **914 kWh** of savings per EnerGuide point, which was used to calculate the building envelope and HVAC energy savings for all 2012 projects.

4.2.2 Prescriptive Measure Savings

In addition to the savings per EnerGuide point coefficient, ENSC calculated incremental savings for a set of prescriptive measures that are not taken into account in HOT2000 simulations. The savings values used by ENSC for this calculation are taken in most part from the 2011 Performance Plus evaluation report.

When evaluating the Performance Plus program, Econoler confirmed that there were four prescriptive measures that did not have their energy savings computed in HOT2000 building consumption simulations:

- > Drain Water Heat Recovery (DWHR);
- > Electric DHW heater pipe insulation;
- > Programmable thermostats; and
- > 13-watt CFLs.

In the above list, additional savings were taken into consideration for the first two prescriptive measures as long as the domestic water heating system was electric. For the programmable thermostat measure, energy savings were calculated only when the primary space heating energy was electricity. With regard to the energy-efficient lighting products, energy savings were calculated for all program participants.

In addition, since the Evaluator changed the methodology for calculating the EnerGuide point savings by focusing only on space heating savings for 2012, DHW measures are not reflected anymore in the savings per EnerGuide point. Hence, Econoler decided to add solar DHW system as a new prescriptive measure for this year's evaluation, bringing the number of prescriptive measures to six.

Drain Water Heat Recovery

For this product, ENSC uses a unitary savings value of 805 kWh per year for each installed system. This value is calculated using the online calculator from the Center for Energy Advancement through Technology Innovation (CEATI)⁶. In more detail, ENSC estimates that the average household uses 2 showers per day at 8 minutes per shower. The estimated shower flow is 9.5 litres per minute, which is based on the maximum rated flow for showerheads in the building code. For the water temperature calculations, ENSC uses Halifax groundwater temperature and a shower temperature of 41°C.

Econoler considers that the unitary savings value of 805 kWh is considered appropriate for estimating the savings generated by the installation of a DWHR system.

Electric DHW Heater Pipe Insulation

Performance Plus proposed the installation of DHW heater pipe insulation where the DHW is electrically heated. For this product, ENSC uses a unitary savings value of 74 kWh. This value was used for the 2010 and 2011 evaluations of EnerGuide for Existing Houses (EEH), based on an insulated pipe 10 feet long and 0.75 inches in diameter, which were considered common length and size in residential applications.

Using the detailed assumptions in the 2011 OPA Prescriptive Measures and Assumptions report, Econoler observed that the unitary savings value of 74 kWh used by ENSC corresponds approximately to the value calculated for 6 feet of insulation.

Table 33: Unitary Savings Values by Length of Insulated Pipe

Length of Insulated Pipe	Unitary Savings Value
3 feet	38 kWh/year
6 feet	76 kWh/year
9 feet	114 kWh/year
12 feet	152 kWh/year
15 feet	190 kWh/year

⁶ Center for Energy Advancement through Technology Innovation (CEATI), "Drain Water Heat Recovery Energy Savings Calculator," Web, February 6, 2013, <<http://www.ceati.com/calculator/>>

While 3 feet seems to be a common length when purchasing pipe insulation, the length of pipe insulated for residential applications typically varies between 6 to 15 feet, according to what was found in the literature. The length of pipe that can be insulated in a house is often limited, since most of the piping is hidden in the walls. In the savings calculation, it is assumed that the pipe insulation is installed immediately downstream of the DHW storage tank, where most of the heat loss would occur. Moreover, the general equation used to calculate the energy savings cannot be used on an infinite length of insulated pipe, since it uses the assumptions that the water temperature is uniform throughout the insulated portion of the pipe.

For this year's evaluation, since no information on the length of insulation installed was collected in the tracking sheet, Econoler will use a unitary savings value of 76 kWh per year, based on the OPA report and a 6-foot insulated pipe (compared to the 74-kWh value currently used and for which we do not have all the calculation details).

Programmable Thermostats

For programmable thermostats, ENSC uses a unitary savings value of 221 kWh per year. This value is based on the 2009 evaluation of Hydro-Québec's Residential Electronic Thermostats in New Construction program⁷ where energy savings generated by the thermostat accuracy and by the temperature setback were estimated as presented below.

Table 34: Main Outputs from Hydro-Québec's Evaluation of Electronic Thermostat Savings

Calculation Parameters	Housing Type		
	Single Detached	Duplex / Triplex / Townhouse	Apartment
Gross Energy Savings for Electronic Thermostat Accuracy			
Savings per thermostat [kWh]	121	94	61
Gross Energy Savings for Temperature Set Back with Programmable Thermostats			
Savings per thermostat [kWh]	100	201	118

For the savings calculation due to the electronic thermostat accuracy, the percentages of savings were based on research supervised by Hydro-Québec's laboratory of energy technologies (LTE)⁸. The research was based on results from tests conducted in LTE's environmental chambers and in single-family homes by comparing the operation of bimetallic thermostats versus electronic thermostats and the consumption of houses with bimetallic thermostats versus those with electronic thermostats. The

⁷ Econoler, Évaluation du programme thermostats électroniques – Volet nouvelle construction au marché résidentiel, Final Report presented to Hydro-Québec, February 9, 2009.

⁸ Hydro-Québec – Laboratoire des technologies de l'énergie (LTE), Sommaire exécutif de rapports publiés par Hydro-Québec concernant les économies d'énergie dues aux thermostats électroniques, October 2004.

annual consumption for electric space heating was estimated through a billing analysis including 25,703 clients and 206,861 billing periods.

For the savings calculation due to the temperature setback, the savings per house were based on a billing analysis regression which compared the consumption of houses with electronic thermostats and houses with programmable thermostats.

Since the information on the housing type was not available in the tracking sheet, the Evaluator chose to use the unitary savings value estimated for single-detached houses. This choice was conservative since single-detached houses represent a large portion of houses in the Nova Scotia market, as well as in the program, and programmable thermostats installed in single-detached houses generate fewer savings than those installed in duplex, triplex or townhouses (221 kWh per year and 295 kWh per year respectively). In light of the above, Econoler estimated the total unitary savings value associated with the installation of a programmable thermostat at 221 kWh per year.

This latter value is still considered appropriate for estimating the savings generated by the programmable thermostats installed through the program.

13-Watt CFLs

For this product, ENSC uses a unitary savings value of 46.3 kWh, which was calculated by Econoler in last year's evaluation. The displaced wattage is based on the replacement of a 60-watt incandescent lamp with a 13-watt CFL. As with all ENSC residential programs, a daily usage of 2.7 hours is used, this based on a metering study conducted for Hydro-Québec's residential lighting program. These assumptions result in a unitary savings value of 46.3 kWh, as shown below.

$$\text{Annual Unitary Savings} = \frac{(60 \text{ W} - 13 \text{ W}) \times 2.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 46.3 \frac{\text{kWh}}{\text{yr}}$$

For ENSC's residential program associated with prescriptive measures such as Instant Savings and Residential Direct Install, Econoler reviewed new metering studies on the daily usage of residential lighting to validate the hours of operation of CFLs. It was shown that the Hydro-Québec study used by ENSC still contains, at this moment, the most reliable data for Nova Scotia. The proportion of CFLs installed inside and outside of the house, as presented in a socket study conducted by ENSC in 2011, is used to adjust the overall hours of operation, which remains 2.7 hours per day:

$$\text{Overall Hours of Operation} = \left(94\% \times 2.68 \frac{\text{h}}{\text{day}} \right) + \left(6\% \times 3.6 \frac{\text{h}}{\text{day}} \right) = 2.7 \frac{\text{h}}{\text{day}}$$

For the displaced wattage value of 47 watts, Econoler considers this value, which comes from replacing a 60-watt incandescent lamp with a 13-watt CFL, adequate and therefore the unitary savings value of 46.3 kWh per year calculated by ENSC is considered adequate.

Solar DHW Systems Connected to Electric Water Heater Tank

ENSC does not use a unitary savings for this product since it is covered by the HOT2000 simulations and included in the EnerGuide point savings. As explained before, the new approach used by the Evaluator to calculate EnerGuide point savings excludes savings from DHW measures; consequently, a unitary savings value needs to be used for this year's evaluation.

Econoler calculated an average unitary savings for this measure by analysing the Solar tracking sheet. Indeed, since this measure was transferred in Solar for all participants who applied after January, it is possible to analyse what type of products were installed by participants who applied through HEA or Performance Plus. From this analysis, the Evaluator calculated an average unitary savings value of 2,234 kWh. This unitary savings value will be used to calculate the gross savings of this prescriptive measure for 2012.

4.2.3 Demand Savings Calculation

The demand savings of Performance Plus are calculated using two different considerations. Firstly, Econoler calculated the demand savings using a demand-to-energy ratio of 0.273 MW/GWh. This ratio was obtained from the final 2012 program targets by dividing the target peak demand savings (in MW) by the target energy savings (in GWh). The use of this ratio for demand saving calculations was confirmed by ENSC.

Secondly, Econoler added to this calculated demand savings value the estimated amount of demand savings achieved through the installation of ETS units. ETS systems reduce electricity demand by storing heat during off-peak demand hours of the day and releasing it during on-peak hours. In Performance Plus, three ETS measures are approved for implementation in residential buildings, namely ETS forced air furnaces, ETS central hydronic systems and ETS room units.

In 2011, Econoler revised the average demand savings used for each system and provided ENSC with the following annual demand savings for the installation of each type of ETS unit:

- > ETS forced-air furnaces: 10 kW per project;
- > ETS central hydronic systems: 10 kW per project; and
- > ETS room units: 4 kW per unit, up to 10 kW per project.

These savings values were considered acceptable for 2012 and were used by Econoler in its gross savings calculations.

4.2.4 Revised Gross Savings

Energy and demand savings for the program were revised to reflect the new calibrated savings per EnerGuide rating point and the savings from prescriptive measures presented in previous sections. For the calculation of savings at the generator level, Econoler used a line loss factor of 1.100, which

takes into account transmission and distribution losses. This value was provided by Nova Scotia Power for the residential sector.

Taking everything into account, the 2012 overall gross energy savings for Performance Plus are respectively estimated at 5.962 GWh at the meter and at 6.558 GWh at the generator. Furthermore, the 2012 total gross peak demand savings for this program are respectively estimated at 1.782 MW at the meter and at 1.960 MW at the generator. The total savings obtained for Performance Plus are presented in the next table.

Table 35: Evaluation Results – Gross Energy and Demand Savings

Product Category	Savings per EnerGuide Point*	DWHR	Pipe Insulation	Program-mable Thermostats	13-Watt CFLs	Solar DHW	ETS Forced Air Furnaces	ETS Central Hydronic Systems	ETS Room Units	Total
Energy Savings										
Number of Units	937	77	42	255	6,280	61	1	10	11	7,674
Unitary Savings (kWh)	914	805	76	221	46	2,234	-	-	-	-
Total Gross Energy Savings – at Meter (GWh)	5.414	0.062	0.003	0.056	0.291	0.136	-	-	-	5.962
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Energy Savings – at Generator (GWh)	5.955	0.07	0.004	0.062	0.320	0.150	-	-	-	6.558
Demand Savings										
Unitary Savings (kW)	-	-	-	-	-	-	10	10	4	-
Demand-to-Energy Ratio (MW/GWh)	0.273	0.273	0.273	0.273	0.273	0.273	-	-	-	-
Total Gross Demand Savings – at Meter (MW)	1.478	0.017	0.001	0.015	0.079	0.037	0.010	0.100	0.044	1.782
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Demand Savings – at Generator (MW)	1.626	0.019	0.001	0.017	0.087	0.041	0.011	0.110	0.048	1.960

* In the "Savings per EnerGuide Point" column, the number of units is in fact the number of participants for whom an energy assessment was conducted and for whom the Evaluator calculated savings per EnerGuide point. The unitary savings value shown in this column is the savings per EnerGuide point figure calculated through the HEA impact evaluation.

4.3 INTERACTIVE EFFECTS

In a residence, interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as heating and cooling. In the case of Performance Plus, installing energy-efficient lighting products such as CFLs instead of standard incandescent bulbs causes an increase in the heating load during winter and a decrease in the cooling load during summer. Indeed, CFLs release less heat than the less efficient lamps they replace.

For CFLs installed in 2012, the evaluation of the interactive effects is based on a study conducted by ADS in 1992 for Hydro-Québec.⁹ The work done in this study was intended to modify certain parameters in simulations of an average home in Quebec to determine the impact of these changes on the interactive effects. The simulations were performed with DOE-2¹⁰ software and only focused on homes heated solely by electricity. The simulations were carried out according to three scenarios for interactive effects: low, moderate and high. The scenario with minimum interactive effects was selected for 2012 program impact calculations because it enabled the Evaluator to account for changes in construction practices in the residential sector since 1992.

The table below presents the calculation details of the interactive effects factor for CFLs using the data from the ADS study and the proportion of space heating provided by electric systems among Performance Plus program participants. The program tracking sheet showed the primary energy source used for space heating of each program participant (electricity, oil, natural gas, wood pellets, etc.). Econoler thus calculated the average percentage of electric heating in these participant houses and found that 91 percent of program participant households were mainly heated with electric heating systems. Then, Econoler categorized the houses mainly heated with electricity on the basis of whether they had air source heat pumps (ASHPs) or ground source heat pumps (GSHPs) installed (78% of total) or only electric baseboards (13% of total). For those who had an ASHP or a GSHP as their main heating system, Econoler used an average coefficient of performance (COP) of 4 to adjust the potential interactive effects on the electricity consumption of heating systems. To take into account interactive effects on space cooling, Econoler adjusted the interactive effects in relation to the proportion of houses that had air conditioning units or systems installed. This percentage was taken from Statistics Canada,¹¹ which states that 18 percent of households have air conditioning in their residence.

⁹ ADS ASSOCIÉS, "Évaluations des effets énergétiques combinés des mesures d'économies d'énergie – résidence unifamiliale," report presented to Hydro-Québec, 1992.

¹⁰ DOE-2 is a widely used and accepted building energy analysis software program developed with funding from the U.S. Department of Energy.

¹¹ Statistics Canada (CANSIM), Households having air conditioning, Nova Scotia, 2009.

Table 36: Interactive Effects Calculation for CFLs

Parameters	% of Residences	Interactive Effects
Electric Baseboard Heating with Air Conditioning	13% x 18% = 2.3%	-54.4%
Electric ASHP or GSHP Heating with Air Conditioning	78% x 18% = 14.0%	-10.9%
Electric Baseboard Heating Without Air Conditioning	13% x 82% = 10.7%	-58.0%
Electric ASHP or GSHP Heating Without Air Conditioning	78% x 82% = 64.0%	-14.5%
No Electric Heating with Air Conditioning	9% x 18% = 1.6%	3.6%
No Electric Heating Without Air Conditioning	9% x 82% = 7.4%	0%
Weighted Interactive Effects	100%	-18.2%

These interactive effects occur only when the CFLs are installed inside the house. As 13-watt CFLs can also be used for outdoor lighting, the interactive effects factor for these products was adjusted to take that into account. To do so, Econoler used the same proportions as those used to calculate the hours of operation, being 94 percent of CFLs installed inside houses and the remaining 6 percent installed in outdoor sockets. This information comes from a socket study conducted for ENSC in 2011 to investigate CFL installations. Therefore, the overall interactive effects for CFLs are established at -17.1 percent:

$$(94\% \times -18.2\%) + (6\% \times 0\%) = -17.1\%$$

For pipe insulation installed through Performance Plus, interactive effects of -100 percent were considered during the heating period in electrically heated houses. This estimation is based on the fact that, when there is no insulation, all the heat lost through the pipes and the hot water tank is released into the room. Assuming that the pipes and tank are located in a heated room, this means that 100 percent of the energy released from the DHW is used for the heating load. Conversely, during the cooling period, interactive effects are estimated at +100 percent in houses that use air conditioning. Based on the heating and cooling degree-days for the region of Halifax,¹² Econoler considered an eight-month period of heating and a two-month period of cooling in the interactive effects calculation.

¹² RETScreen International, Normalized climate data for Halifax International Airport, Natural Resources Canada, 1997-2010.

The table below presents the details for the calculation of interactive effects for water pipe insulation. As for lighting products, the table shows the proportion of residences in Nova Scotia that are heated electrically and those that use air conditioning units or systems. This calculation resulted in a weighted interactive effects factor of -19.0 percent.

Table 37: Interactive Effects Factor for Pipe Insulation and Hot Water Tank Wraps

Parameters	% of Residences	Interactive Effects during Heating Period	Interactive Effects during Cooling Period
Electric Baseboard Heating with Air Conditioning	$13\% \times 18\% = 2.3\%$	$-100\% \times 8/12 = -67\%$	$+100\% \times 2/12 = +17\%$
Electric ASHP or GSHP Heating with Air Conditioning	$78\% \times 18\% = 14.0\%$	$-25\% \times 8/12 = -17\%$	$+100\% \times 2/12 = +17\%$
Electric Baseboard Heating Without Air Conditioning	$13\% \times 82\% = 10.7\%$	$-100\% \times 8/12 = -67\%$	$0\% \times 2/12 = 0\%$
Electric ASHP or GSHP Heating Without Air Conditioning	$78\% \times 82\% = 64.0\%$	$-25\% \times 8/12 = -17\%$	$0\% \times 2/12 = 0\%$
No Electric Heating with Air Conditioning	$9\% \times 18\% = 1.6\%$	$0\% \times 8/12 = 0\%$	$+100\% \times 2/12 = +17\%$
No Electric Heating Without Air Conditioning	$9\% \times 82\% = 7.4\%$	$0\% \times 8/12 = 0\%$	$0\% \times 2/12 = 0\%$
Weighted Interactive Effects Factor	100%	-22.0%	3.0%
		-19.0%	

For all other prescriptive measures installed through Performance Plus in 2012, interactive effects were considered negligible.

4.4 NET-TO-GROSS RATIO

The NTGR evaluation of the program is based on a self-report approach which relies on a series of questions designed to measure the influence of the program on the participants' decision whether to implement program-eligible energy efficiency measures. These questions were included in the participant survey.

This section presents the methodology used to transform responses to NTGR survey questions into an NTGR. For the program, the NTGR includes the assessment of two distortion effects: free-ridership and spillover in the form of market effects. Once each effect is quantified, the NTGR is calculated based on the equation below.

$$\text{Net-to-gross ratio} = (1 - \% \text{ free-ridership} + \% \text{ spillover})$$

4.4.1 Free-Ridership

Free-ridership occurs when participants declare that they would have implemented the energy efficiency measures in the absence of the program. The free-ridership level was measured for this program through a participant survey conducted with homeowners as well as through interviews with participating builders. The questionnaire included six questions that intended to assess:

- > whether homeowners had any plans to build or buy a house reaching an EnerGuide rating of 83 or higher before participating in the program;
- > the probability that homeowners would have built or bought a house with the same level of energy efficiency if they had not participated in the program;
- > the probability that homeowners would have built or bought a house with an EnerGuide rating under 83, instead of a house with a higher level of energy efficiency, if they had not participated in the program;
- > the probability that homeowners would have built or bought a house with the same level of energy efficiency but at a later date if they had not participated in the program;
- > the probability that homeowners would have paid the full cost of the additional energy efficiency measures required to reach the EnerGuide rating of 83 or higher; and
- > the influence of the program on homeowners' decision whether to build or buy a house with an EnerGuide rating of 83 or higher.

The participating builder interview guide included questions that intended to assess:

- > the probability that builders would have built the same number of houses with an EnerGuide rating of 83 or higher if they had not participated in the program;
- > the probability that builders would have installed the same measures with the exact same level of efficiency if they had not participated in the program; and
- > the influence of the program on builders' decision whether to build houses reaching an EnerGuide rating of 83 or higher.

Each group of questions was transposed into a level of program attribution used to calculate the general free-ridership level for each homeowner or builder. The decision of either the builder or the homeowner to participate in the program was also taken into consideration in the algorithm by looking in the tracking sheet to determine who applied for the program. Most of the time, the builders were the ones who had made the final decision to register in the program. The algorithm behind this calculation is presented in Appendix VIII.

Using this approach, survey results revealed that the free-ridership level calculated among builders in 2012 (24%) was similar than that featured in the 2011 evaluation (23%). Conversely, the free-ridership level among homeowners slightly increased between the two evaluations, from 37 percent in 2011 to 42 percent in 2012. This change in the homeowner free-ridership affected the overall program free-ridership level. Indeed, the overall free-ridership level went from 32 percent in 2011 to 37 percent in 2012.

This slight increase could be partially due to the change in the incentives calculation, which is now based on an EnerGuide rating. Another explanation for this increase in free-ridership can be found in the survey results where the main reason identified by builders (38%) for participating in the program was to get rebates for measures that they were already planning, which means that they still would have implemented the energy efficiency measures even in the absence of the program.

4.4.2 Spillover (Market Effects)

The marketing of Performance Plus is primarily conducted through builders who receive promotion and awareness documents on various energy efficiency measures. Consequently, market effects, which constitute a form of spillover, can occur when a builder decides to implement energy efficiency measures in new construction projects without participating in the program.

In 2012, following Econoler's recommendation from last year's evaluation to increase the number of interviews with participating and non-participating builders in future evaluations, a survey was conducted with 57 builders in order to measure potential market effects. Questions were asked to understand how program promotion affected builders' design decisions and to determine if, because of the program's influence, they had built houses that would probably reach an EnerGuide rating of 83 or higher without participating in the program.

Using this approach, survey results revealed market effects of 13 percent. This result is an increase when compared to the 2011 evaluation (5%). The use of a survey with 57 builders instead of interviews with a smaller sample allowed to evaluate more precisely the impact of the program and to better capture market effects. The result obtained for 2012 indicates the positive impact the program had on the builders' market, beyond participating builders. Indeed, this level of market effects shows that Performance Plus had an influence not only on participating builders in 2012, but also on builders who only heard of it or participated in the past.

4.4.3 NTGR Calculation

Using the free-ridership and spillover levels established, the NTGR value for the program is estimated at 0.76:

$$NTGR = (1 - 37\% + 13\%) = 0.76$$

This value is applied to the gross savings.

4.5 NET SAVINGS

The net savings for the program were estimated using the interactive effects factors and the NTGR above. The equation below was used to calculate the net savings.

$$\text{Net savings} = \text{Gross Evaluation Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

This equation was used for both demand and energy savings. The results obtained are presented in the following table.

Overall, the total net energy and demand savings amount to 4.493 GWh and 1.344 MW at the meter, and 4.942 GWh and 1.478 MW at the generator.

Table 38: Evaluation Results – Net Energy and Demand Savings

Product Category	Savings per EnerGuide Point*	DWHR	Pipe Insulation	Program- mable Thermo- stats	13-Watt CFLs	Solar DHW	ETS Forced Air Furnaces	ETS Central Hydronic Systems	ETS Room Units	Total
Energy Savings										
Total Gross Energy Savings – at Meter (GWh)	5.414	0.062	0.003	0.056	0.291	0.136	-	-	-	5.826
Interactive Effects Factor	0%	0%	-19.0%	0%	-17.1%	0%	-	-	-	-
NTGR	0.76	0.76	0.76	0.76	0.76	0.76	-	-	-	-
Total Net Energy Savings (GWh) – at Meter	4.114	0.047	0.002	0.043	0.183	0.104	-	-	-	4.493
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	-	-	-	-
Total Net Energy Savings (GWh) – at Generator	4.526	0.052	0.002	0.047	0.202	0.114	-	-	-	4.942
Demand Savings										
Total Gross Demand Savings – at Meter (MW)	1.478	0.017	0.001	0.015	0.079	0.037	0.010	0.100	0.044	1.782
Interactive Effects Factor	0%	0%	-19.0%	0%	-17.1%	0%	0%	0%	0%	-
NTGR	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	-
Total Net Demand Savings (MW) – at Meter	1.123	0.013	0.001	0.012	0.050	0.028	0.008	0.076	0.033	1.344
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Net Demand Savings (MW) – at Generator	1.236	0.014	0.001	0.013	0.055	0.031	0.008	0.084	0.037	1.478

The Evaluator compared the net energy savings values calculated in the previous table with the Performance Plus tracked net savings for 2012. The next table details the final evaluated and tracked impacts for 2012.

Table 39: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	5.775 GWh	5.689 GWh	0.73	4.153 GWh
Evaluation Results	6.558 GWh	6.503 GWh	0.76	4.942 GWh
Demand Savings				
Tracked Savings from ENSC	1.746 MW	1.723 MW	0.73	1.257 MW
Evaluation Results	1.960 MW	1.945 MW	0.76	1.478 MW

The net savings tracked by ENSC were compared with the evaluated savings for 2012. Both the energy and demand savings calculated for this evaluation are higher than the tracked savings, by 19 percent and 18 percent respectively. This difference can mainly be explained by the adjustment made to the gross energy savings per EnerGuide point, which was changed from 817 kWh to 914 kWh. This adjustment came from a review of 506 project simulations and a calibration of the savings from a billing analysis of 172 participants. This approach used a much bigger sample size than that used in 2011 and is more precise. Furthermore, since the energy savings per EnerGuide point were only calculated from the heating consumption reduction, solar DHW systems were considered a prescriptive measure whereas ENSC included this measure in the savings per EnerGuide point.

CONCLUSION

The 2012 evaluation of Performance Plus demonstrated that the program underwent a series of changes that altered its design and implementation. Indeed, Performance Plus went from attributing distinctive incentives for every implemented prescriptive measure to attributing a global incentive determined by an overall EnerGuide rating provided during the final evaluation of the house.

Furthermore, the Evaluator found major improvements to the program since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving little time to follow up on all the process and impact recommendations before the new evaluation window, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management such as the various process charts, the evaluation plan and a standardized program manual. Moreover, additional efforts were made in the areas of program promotion and communication.

ENSC's actions in increasing program promotion and communication contributed significantly to program awareness in 2012, as this was the main way participants learned about the program. Moreover, word of mouth was an important source of program awareness.

Survey results revealed that satisfaction with the program and its various aspects is quite high among homeowners and builders. Both groups expressed recommendations to improve the program that mainly had to do with more information on the measures recommended and more advertising.

Program partners expressed concern regarding the program marketing and advertising. They feel that a large part of the marketing is left up to them. Most of the program partners agreed that people should be more informed about the assessment process, energy efficiency in general and the impact the implemented measures will have.

On-site visits were conducted to assess the procedures and the ecoEnergy protocol that the EAs must follow during assessments. After these visits, Econoler reviewed the HOT2000 simulations and EnerGuide reports developed by the two EAs. The Evaluator considers these tasks were done successfully by the EAs, who were able to produce very precise EnerGuide ratings using the software.

The program totalled 1,024 participants for the year 2012, which is an increase compared to 2011 (701 participants). The evaluation revealed that Performance Plus generated net energy savings of 4.942 GWh and demand savings of 1.478 MW at the generator in 2012, compared to 2.454 GWh and 0.861 MW in 2011. To calculate the net savings of Performance Plus in 2012, Econoler reviewed the gross savings estimated by ENSC using two features, namely the savings per EnerGuide point increase estimated in the HEA evaluation and the savings generated in relation to the implementation of a series of prescriptive measures. In addition, free-ridership and spillover, through market effects, were measured during this evaluation by the means of participant and builder surveys.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Provide participants with more information on the measures recommended: Survey results revealed that participants want more information on the measures recommended to them following the review of house plans. Besides being mentioned as a recommendation to improve the program, the lack of information on the measures recommended was also brought up as the main reason why participants did not reach the EnerGuide rating they were aiming for. Program partners and builders also favor this approach and believe everyone could benefit from more information on the measures recommended during the participation process. Considering this, the Evaluator recommends providing participants with more information on the measures recommended and how these measures affect the EnerGuide rating. This information could be outlined in the HOT2000 report.
	2. Simplify the incentive table*: The incentive table in the program manual should be significantly simplified, since the incentives will be managed through ENSC as a single window and will be based on an EnerGuide rating only. Tables 8 and 9 of the current program manual are good examples of incentive summaries. For additional improvement, the “pay in full” note in Table 8 should be replaced by the amount required from both the homeowner and ENSC (\$300 each) when referring to the assessment cost. See section 3.2.1 Program Manual for more details.
	3. Provide more support to DAs in their marketing efforts to reach more homeowners and builders: A large part of the program marketing is handled by the DAs. More joint marketing efforts between the DAs and ENSC would allow reaching more homeowners and builders across Nova Scotia. This recommendation would address one of the main dissatisfactions identified by the program partners, which refers to the lack of support from ENSC in the marketing activities. Indeed, program partners feel the marketing is left up to them. They also believe people should be more informed about the assessment process and energy efficiency in general. The Evaluator thus recommends working in collaboration with the DAs to offer a better program delivery and inform more homeowners and builders about the program.

Executive Summary	4. Consider the possibility of providing technical support for HOT2000: A great majority of the DAs reported a lack of collaboration and support from NRCan after their training, especially when they needed additional information about HOT2000. Moreover, EAs talked about issues regarding the current management of the HOT2000 software by NRCan. They reported the HOT2000 software still contained several deficiencies and that NRCan should grant more human resources to finally fix this issue. Considering this, Econoler recommends that ENSC analyze the possibility of either training an employee on HOT2000 or employing an external expert that could provide HOT2000 expertise to the DAs when needed. 5. Investigate the baseline EnerGuide rating for new houses in Nova Scotia: Four studies were performed in 2011 with a view to fine-tuning the baseline EnerGuide value to be used for energy savings calculations. After reviewing these studies as part of the 2011 evaluation, the Evaluator elected to use 78 as the EnerGuide rating baseline value for calculating program gross savings and used the same baseline assumption for 2012. Considering the rapid penetration of high efficiency technology on the market and the relatively high level of free-ridership observed under Performance Plus, the Evaluator believes that ENSC should investigate the evolution of the EnerGuide rating baseline for 2013 and update this value if needed in their savings calculation.
Program Manual	6. Document major changes in the Document Revision section: In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual, such as the new incentive mechanism. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.
Evaluation Plan	7. Adapt the evaluation plan template to meet program needs: Since Performance Plus is now a program where incentives are measured following an EnerGuide rating, the program base case could be simplified by keeping only the variables that are used to calculate the net savings. This would simplify the table.
Program Charts	8. Provide partners and participants with simplified process charts: The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well-designed. Moreover, the partners should be given copies of their process charts. After all, these charts are intended for the partners and the participants. Hence, they must be distributed as widely as possible to gain maximum exposure. The version date should be indicated in each chart.

Marketing and Outreach Activities	9. Make the performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.
Tracking Sheet	10. Ensure that only participants appear in the “Savings” and “Incentives” tabs: The PM should remove applicants who did not participate (i.e. whose status is incomplete, cancelled or reregistered) in Performance Plus in tabs used to calculate energy savings and incentives. This would facilitate verification by clarifying which projects are officially used by ENSC to calculate savings.
	11. Create fields for building energy consumption data: Currently, energy savings are calculated using the EnerGuide rating. It may be suitable and more accurate to calculate them with the energy consumption data from HOT2000. Econoler recommends adding fields for building energy consumption per year in GJ for both a baseline house built to code and the completed house.
	12. Add the percentage of electric heating: This information can be estimated by the EA and would improve the accuracy of the calculated energy savings. It is also important that ENSC make sure that EAs know about the necessity of this information. ENSC indicated that the waiver signed by participants will be changed for 2013 so that this information will be provided by the SOs and made available in the tracking sheet.
Tracking Sheet	13. Determine the required fields and remove those that are unnecessary: The PM, together with the Evaluator, should determine which fields are necessary for administration and evaluation purposes and ensure that the information is systematically entered in these fields. Conversely, unused fields should be removed from the tracking sheet in order to concentrate the efforts on the essential data, especially in the “Participant Data” tab.

On-Site Visits	14. Request all working plan information from the builder at the time of the P evaluation: At the time of the P evaluation, the advisor must ensure that the working plan drawings contain all of the necessary information to complete the HOT2000 simulation. During one of the assessments, the drawings did not feature any information regarding window types and models, heating and ventilation system types and efficiencies, or specific values for walls, basement or attic insulation. With such information missing, the advisor used the base values of the building code and made assumptions based on other projects completed by the same builder. Though it is true that most builders use the same design and materials from one house to another, there are always exceptions, and such a practice may lead to errors when calculating the EnerGuide rating. When key information is missing on the building drawings provided by the builder, it would therefore be a better practice to obtain it from the builder before computing the new house's EnerGuide rating. For reference purposes, such important information includes details on house components' insulation, windows and doors, as well as on the heating, cooling and ventilation systems. 15. Request all “as-built” information from the builder at the time of the N evaluation: The N evaluation occurs once the construction is completed. Before performing this evaluation, it is important that the advisor request a list of all of the upgrades that were performed by the builder. This list should also include any changes that were made from the initial building drawings, especially changes to the insulation values or house dimensions. In previous instances, the Evaluator saw some DAs using a waiver release form in which builders must declare the exact amount of insulation installed for each house component. This step is important because most of the insulation material is concealed at the time of the N evaluation, making it hard (and most of the time impossible) for the advisor to verify.

APPENDIX II – INTERVIEW GUIDE WITH DELIVERY AGENTS

PROGRAM NAME: PERFORMANCE PLUS

How to complete this form

This is a Word document that integrates some form features. To enter your answers, simply position your cursor on the shaded sections and begin typing. Since this is a form, you cannot write anywhere else in the document. For the boxes, just click on the one next to your answer. Click again to uncheck it.

Please complete this form within the next 48 hours, [save the file](#) and send it back to us at mlecuyer@econoler.com.

Thank you!

Part I: General Questions

Please indicate your company name.

Q1a. How would you describe your role(s) as an ENSC energy efficiency program partner?

Q1b. How long have you held that role/those roles (specify months or years)?

Q2a. How would you qualify your participation process in this program?

- ☐ Simple
☐ Complex

Q2b. If you checked “Complex,” please indicate which parts of your involvement or participation process have been the most complex.

Q3. On a scale from 1 to 10, where 1 is very poor and 10 is excellent, please rate your satisfaction in regard to the:

Aspects of the program	Score 1 = very poor 10 = excellent	Reason If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Program marketing and outreach activities		
Relationship with ENSC staff		
Relationship with other partners		
Other Service Organizations		
Natural Resources Canada		

Part II: Questions Specific to the Performance Plus Program

Q4a. Regarding program on-course modifications, (change in total cost of the assessment, change in incentives for prescriptive measures registered after January 15, 2012, change in eligibility criteria, etc.) do you feel they:

- ☐ Are easily adapted into the way you work
- ☐ Require minor changes in the way you work
- ☐ Require major changes in the way you work
- ☐ Not applicable/No program on-course modifications

Q4b. If you answered “Require major changes in the way you work,” would you say those major changes have caused problems in the way the program is managed or delivered?

- ☐ Yes
- ☐ No

Q4c. If you answered “Yes,” what have those problems been?

Q6. In your opinion, what are the main barriers to the delivery of the program, in order of importance?

Q7a. Approximately how many complaints have you received from participants thus far in 2012?

Number of complaints:

Q7b. What was the complaint/were the complaints about?

Q8. What suggestions do you have to improve program performance?

Q9. More precisely, what suggestions do you have concerning program marketing and outreach activities?

Thank you very much for your time and co-operation.

Your answers will be treated in strict confidence—no names will ever be mentioned in the evaluation report. Our hope is that these results will contribute to improving program performance. You may be contacted by phone if we need to clarify your answers.

Date	
Your name	
Area code and phone number	
Email	

APPENDIX III – INTERVIEW GUIDE WITH ENERGY ADVISORS

ENERGY ADVISOR INTERVIEW GUIDE EFFICIENCY NOVA SCOTIA PERFORMANCE PLUS PROGRAM

October 1, 2012

INTRODUCTION

Hello, my name is _____, from Econoler. I am calling on behalf of Efficiency Nova Scotia Corporation for the Performance Plus Program.

IDENTIFICATION AND SCREENING OF RESPONDENT

I1. According to our records, you acted as a partner in the Performance Plus program from Efficiency Nova Scotia in 2012. Econoler has been mandated by Efficiency Nova Scotia to conduct an evaluation of this program. We have a few questions about your involvement in the program.

Confidentiality

Please note that your responses will be kept strictly confidential and that we will not share the information you provide with any other party in a way that could identify your individual or corporate responses.

Recording of the Interview

Please note that the interview will be recorded for transcription purposes only. The recording will remain strictly confidential.

SECTION IN – INVOLVEMENT

The first questions will be about your involvement in the Performance Plus program.

IN1. How would you describe your role(s) in the Performance Plus program?

IN1a. How long have you held that role (specify months or years)?

IN2. How would you qualify your participation process in this program?

☐ Simple

☐ Complex

IN2a. If “Complex”, can you mention which parts of your involvement or participation process have been the most complex?

IN3. On a scale from 1 to 10 (where 1 is very poor and 10 is excellent), how would you rate your satisfaction in regard to the...?

Aspects of the program	Score 1=very poor 10=excellent	Reason If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Program marketing and outreach activities		
Relationship with ENSC staff		
Relationship with other program partners		
Your training as an energy auditor directly or indirectly from NRCan		
Performance or accuracy of the HOT 2000 software		

SECTION A – ASSESSMENT PROCESS

I will now ask you questions about the assessment process.

A1. Do you believe the EnerGuide methodology or approach is appropriate in the context of the program, or does it need to be altered to better suit the assessments you conduct as part of the Performance Plus program?

- Was the protocol explained to the client? ☐ Yes ☐ No
- Does photographs were taken? ☐ Yes ☐ No
- Was the blower door test protocol followed? ☐ Yes ☐ No

A2. Are there any steps of the assessment process that are typically unnecessary or irrelevant, or that could be dropped?

A3. Conversely, are there any steps missing from the assessment process or any information that is not gathered before, during or after the assessment process, but that would be useful?

A4. Have you noticed some elements of the assessment process or protocol that are not well-understood by participants? If so, which ones?

- Does any additional information material, such as the booklet “Keep the Heat in”, has been distributed to the clients? ☐ Yes ☐ No

A5a. Do you think participants should be more informed...

- About the assessment process? ☐ Yes ☐ No
- About energy efficiency in general? ☐ Yes ☐ No
- About the impact the implemented measures will have? ☐ Yes ☐ No

A5b. [IF ANSWERED YES] How do you think participants should be more informed?

SECTION PM – PROGRAM AND MEASURES

The next questions will concern the measures promoted by the Performance Plus program.

PM1a. Regarding program on-course modifications, (change in total cost of the assessment, change in incentives for prescriptive measures registered after January 15, 2012, change in eligibility criteria, etc.) do you feel they:

- ☐ Were easily adapted into the way you work?
- ☐ Required minor changes in the way you work?
- ☐ Required major changes in the way you work?
- ☐ Does not apply

PM1b. Are there any energy efficiency upgrades that are not covered by the program that you would like to have covered through the program? If so, which ones?

PM2. Are there any program measures that are recommended but rarely implemented by participants? If so, which ones?

PM2a. What are the barriers to implementing those measures?

PM2b. What could be done to make sure participants implement all the measures that are recommended through the assessment report?

SECTION R – RECOMMENDATIONS

The last questions will allow us to help ENSC improve the Performance Plus program.

R1. In your opinion, what are the main barriers to the delivery of that program by order of importance?

R2. Approximately how many complaints from participants have you received so far in 2012?

Number of complaints:

R2a. What was/were the complaint(s) about?

R3. What suggestions do you have to improve the program?

R4. More precisely, what suggestions do you have concerning program marketing and outreach activities?

END: Those are all the questions I have for you today. Do you have anything to add regarding the program or this interview?

I thank you very much for your collaboration and the time you took to answer our questions.

APPENDIX IV – ON-SITE VISIT PROTOCOL

The other on-site visit protocol for Performance Plus is attached in PDF format to this report.

FILE NUMBER: _____ EVALUATOR: _____
ENERGY ADVISOR: _____ DATE OF ASSESSMENT: _____
SERVICE ORGANISATION: _____

QUALITY ASSURANCE GRID

QUALITY OF THE P EVALUATION PROCESS (SIMULATION AS PER PLAN)

The advisor received the blueprints from the homebuilder and the data recorded in his simulation matches the information contained on the blueprints	/ 5
The advisor made a reasonable effort to collect the missing information that did not appear on the blueprints (typically windows type, heating systems, etc.)	/ 5
The advisor understood the different sections of the house as they are drawn on the blueprints and made an effort not to oversimplify the house details in his simulation	/ 5
The advisor has a clear understanding of the "building envelope" concept and does not confuses parts of the house that are inside the envelope with those that are outside.	/ 5
The advisor chose using effective insulation values over nominal values for a more accurate modelization	/ 5
The walls and attic dimensions and the insulation levels are accurate	
Windows and doors were modeled correctly (right number, right elevations, etc.)	/ 5
The advisor identified the foundation types correctly	/ 5
The total volume of the house was calculated accurately	/ 5
Air leakage : the advisor has set a theoretical air-tightness value that was relevant	/ 5
The space heating and cooling, the hot water heating, as well as the ventilation systems type and efficiencies data were recorded correctly	/ 5
The resulting ENERGUIDE RATING attributed to the house is accurate	/ 5
The advisor has provided the builder with upgrade recommendations that would achieve, wherever possible, an upgraded rating of 80 or more.	/ 5
The recommendations made to the builder are relevant and feasible, yet at the same time will have a strong impact on the rating	/ 5
The advisor avoided recommending any particular contractor or brand.	/ 5
The advisor gave a sense of priorities to his recommendations so that the client understood which of these will have the biggest impact.	/ 5

QUALITY AND PRECISION OF THE “N” EVALUATION PROCESS

The advisor made a reasonable effort to verify what details were built exactly as on the blueprints and house that were built directly.	/ 5
Where differences between blueprints and actual building occurred, these differences were recorded and taken into account in the N simulation	/ 5
The advisor carried with him the proper and functional equipment to successfully perform the assessment	/ 5
The advisor's verification of insulation levels and types were precise and accurate	/ 5
The advisor verified the number and type of windows and doors	/ 5
The advisor performed a basic investigation of the heating and ventilation systems and recorded the relevant info	/ 5
BLOWER DOOR TEST : the advisor succeeded in preparing the house for a proper blower door test	/ 5
BLOWER DOOR TEST : the advisor installed the blower door test equipment properly (manometer, pressure gages,)	/ 5
BLOWER DOOR TEST : the advisor identified the main air leakage areas	/ 5
The advisor performed the Combustion Spillage Test as required due to the presence of a fuel burning appliance in the house	/ 5
The advisor submitted the basic required date-stamped pictures with his file, in the proper format and quality required	/ 5
The advisor identified any abnormal moisture and air quality issues present in the house	/ 5
The advisor noted the presence or absence of exhaust fans (bathroom, kitchen, etc.) and verified if they function properly	/ 5
SAFETY : the advisor made sure that all safety precautions were taken during the assessment	/ 5
The advisor respected the client's property, did not damage or dirty the house	/ 5
The advisor submitted the report and etiquette to the client within a reasonable time	/ 5

FINAL RATING		

GENERAL NOTES:

DESCRIPTION OF THE ASSESSMENT:

STRONG POINTS:

ASPECTS TO IMPROVE:

FINAL COMMENT:

APPENDIX V – DEMOGRAPHICS

The profile of the program participants interviewed for the survey is presented in the following tables.

The majority of participants resided in single-family detached homes (81%), while a small number lived in mobile homes or trailers (9%), townhouses (4%), or semi-detached homes (4%).

Table 40: Type of Residence

Type of Residence	Owners	
	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
Detached single-family home	87%	81%
Mobile home or house trailer	6%	9%
Townhouse or duplex	--	4%
Semi-detached house	1%	4%
Others	3%	--
Don't know	3%	1%

The majority of participants were in households with 3 or more bedrooms.

Table 41: Number of Bedrooms

Number of Bedrooms in Home	Owners	
	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
1	1%	1%
2	7%	17%
3	63%	54%
4	17%	21%
5+	11%	4%
Don't know	--	1%

Almost one-half of the participants were in a household with two full-time residents (47%).

Table 42: Number of Residents

Number of Full-Time Residents	Owners	
	2011 (%)	2012 (%)
<i>Sample size</i>	70	70
1	9%	11%
2	43%	47%
3	23%	16%
4	23%	20%
5	1%	3%
6+	1%	3%
Don't know/Refused	--	--

All the program participants resided in their home all year round.

Table 43: Type of Home

Type of Home	Owners	
	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
All year	99%	100%
Seasonal/vacation home	1%	--
Don't know/Refused	--	--

One-third of the participants were under the age of 35 (34%). Three in ten were 55 years of age or older (31%).

Table 44: Age

Age	Owners	
	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
18-24	3%	1%
25-34	33%	34%
35-44	24%	14%
45-54	19%	19%
55-64	16%	24%
65+	4%	7%
Refused	1%	--

One-half of the participants had a university degree (51%), while almost one-quarter had a college diploma (24%).

Table 45: Education

Education	Owners	
	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
Less than high school graduation certificate	3%	4%
High-school grad and/or some post-secondary	16%	11%
Trades certificate or diploma	4%	6%
College certificate or diploma	17%	24%
University certificate or diploma	49%	51%
Others	7%	1%
Refused	4%	1%

One-half of the program participants had a household income of \$80,000 or more (53%).

Table 46: Income

Household Income	Owners	
	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
Less than \$15,000	--	1%
\$15,000-\$24,999	--	--
\$25,000-\$34,999	--	4%
\$35,000-\$49,999	10%	9%
\$50,000-\$69,999	11%	13%
\$70,000-\$79,999	11%	6%
\$80,000 or more	53%	53%
Refused	13%	13%
Don't know	1%	1%

Finally, the majority of respondents were male (76%), while just one-quarter were female (24%).

Table 47: Gender

Gender	Owners	
	2011 (%)	2012 (%)
<i>Sample Size</i>	70	70
Male	69%	76%
Female	31%	24%

APPENDIX VI – FIRMOGRAPHICS

The profile of the program builders interviewed for the survey is presented in the following tables.
 One-half of the participating builders had between one and nine employees.

Table 48: Full-Time Equivalent Workers

Full-Time Employees	2012		
	Overall (%)	Participating Builders (%)	Non-Participating Builders (#)
<i>Sample Size</i>	57	50	7
Fewer than 5	25%	24%	2
5 to 9	28%	26%	3
10 to 19	26%	26%	2
20 to 49	16%	18%	--
50 to 99	4%	4%	--
100 to 249	2%	2%	--
250 or more	--	--	--

APPENDIX VII – PARTICIPANT SURVEY QUESTIONNAIRE

Participant Questionnaire

Performance Plus Program

October 16, 2012

Hello may I please speak with [INSERT NAME]?

- 1 Yes [GO TO INTRODUCTION]
- 2 No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

INTRODUCTION

Hello, my name is _____ and I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you or your household recently participated in Efficiency Nova Scotia Corporation’s Performance Plus program for new houses. We would appreciate your collaboration in answering questions related to your participation in this program. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve the program. The survey will take about fifteen minutes. Is this a good time for you?

The Performance Plus program may also be known as “EnerGuide for New Houses”. Throughout the questionnaire, I will refer to it as the “Performance Plus program”.

Verification and Recall (V Series)

- V1. We understand you participated in the Performance Plus program for the house you built or are building at [ADDRESS FROM FILE]. Is that correct?
1. Yes [CONTINUE]
 2. No [PROMPT: “Are you sure? This program provides rebates for installing energy efficient upgrades in newly constructed houses and residential buildings. Plans for the house are reviewed and recommendations are given for upgrades to install in the new homes. The home buyer can receive rebates to cover some of the cost of eligible measures. ” RECODE AS “YES” IF THE PROMPT WORKS; IF RESPONDENT STILL SAYS NO: “Is there someone else who would know about having participated in the Performance Plus program?”]
 1. Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
 98. Don’t know [PROMPT: “This program provides rebates for installing energy efficient measures in newly constructed houses and residential buildings. Plans for the house are reviewed and recommendations are given for upgrades to install in the new homes. The home buyer can receive rebates to cover some of the cost of eligible upgrades after they are installed.” RECODE AS “YES” IF THE PROMPT WORKS; IF

RESPONDENT STILL SAYS DON'T KNOW: "Is there someone else who would know about having participated in the Performance Plus program?"

1. Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
2. No [THANK & TERMINATE]
99. Refused [THANK AND TERMINATE]

[IF REFUSED, ASK "Can we schedule a more convenient time for you to conduct this survey?"]

[SCHEDULED, IF NECESSARY, FOR: _____]

V2. Are you in the business of building and/or selling homes?

1. Yes [THANK & TERMINATE]
2. No [CONTINUE]
98. (Don't know) [THANK & TERMINATE]
99. (Refused) [THANK & TERMINATE]

V3. Did you personally take part in the decision to participate in the Performance Plus program?
[DO NOT READ. ACCEPT ONE]

1. (Yes)
2. (No/The Builder made the decision)
98. (Don't know)
99. (Refused)

V4. Did you take part in the decisions regarding the energy efficiency measures to install through the Performance Plus program? [DO NOT READ. ACCEPT ONE]

1. (Yes)
2. (No/The Builder made the decision)
98. (Don't know)
99. (Refused)

V5. Which of the following statements would you say best describes when you became involved in the decisions about the energy efficiency of your home? Would you say... [READ STATEMENTS IN ORDER – CODE ONE ONLY]

1. You were involved from the initial planning and design stage. This is when your home existed only on paper.
2. You were involved after the plans for your home were finalized but before the energy efficiency measures were installed.
3. You were involved after the energy efficiency measures were installed but before the Final Review of your completed home, or
4. You were not involved in any of these decisions or bought the home after it was completed.
98. (Don't know)
99. (Refused)

Program Notoriety and Reasons for Participating – Homeowners (P Series)

- P1. How did you learn about the Performance Plus program? [DO NOT READ. ACCEPT MULTIPLE]
1. (Efficiency Nova Scotia bill insert)
 2. (Efficiency Nova Scotia's Website)
 3. (Through program delivery agent from Nova Scotia Home Builders Association (NSHBA))
 4. (Through program delivery agent from Sustainable Housing & Education Consultants (SHEC))
 5. (Through delivery agent from Amerispec Inspection Services)
 6. (Nova Scotia Home Builders Association's member list)
 7. (The Internet)
 8. (Radio Ad)
 9. (Newspaper/Renovation Guide Ad or Story)
 10. (Home show)
 11. (Signs on stakes)
 12. (Seminar or information session put on by delivery agent)
 13. (From a contractor)
 14. (Word of mouth -- neighbor, friend, co-worker, family member, etc.)
 15. (Builder/construction trade publication)
 16. (Real estate agent)
 17. (Permit office)
 96. (Other) [SPECIFY _____]
 98. (Don't know)
 99. (Refused)

[IF V3=1, CONTINUE OTHERWISE SKIP TO S1]

- P2. Now I'm going to ask you to think back to when you decided to participate in the Performance Plus program. What was the SINGLE most important reason you were interested in participating in the program? [ACCEPT ONE RESPONSE; DO NOT READ; PROBE FOR SPECIFIC REASONS]
1. (To have a house that would save on energy costs/bills)
 2. (I was thinking about/planning to get energy efficient measures in my house anyway)
 3. (To find out how energy efficient the new house would be/to get house evaluated)
 4. (To get expert advice about what measures to install/how to make home more energy efficient)
 5. (To help save energy—not further specified whether for cost, environment)
 6. (To help the environment)
 7. (To get rebates for measures that were already in the house I bought)
 8. (I was interested in getting a better, more energy efficient home)

- 9. (I am generally interested in energy efficiency and renewable energy)
- 10. (To get rebates (general))
- 11. (Energy efficiency (general))
- 12. (To get expert advice on what measures to implement/how to make home more energy efficient)
- 96. (Other) [SPECIFY _____])
- 98. (Don't know)
- 99. (Refused)

P3. Were there any other reasons? [SAME LIST AS P2 ABOVE. DO NOT READ. ACCEPT MULTIPLE; PROBE FOR SPECIFIC REASONS]

97 No other reasons

P4. Before participating, did you have any concerns about taking part in the program?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[IF P4 = 1]

P5. What were those concerns? [DO NOT READ. ACCEPT ALL RESPONSES]

- 1. (That my "bottom line" would suffer/I wouldn't recover the cost of installing energy efficient measures in house I'm building)
- 2. (The measures would cost a lot)
- 3. (I wouldn't like what they recommended)
- 4. (I wouldn't like what was installed)
- 5. (Would be a hassle/Too much paperwork)
- 96. (Other)(Specify: _____)
- 97. (Don't know)
- 98. (Refused)

Satisfaction with Program (S Series)

S1. Thinking of your OVERALL experience with the Performance Plus program up to this point, including any services received or energy efficient upgrades installed, how satisfied are you overall with the program? Would you say you are very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied?

1. Very satisfied
2. Satisfied
3. Neither satisfied nor dissatisfied
4. Dissatisfied
5. Very Dissatisfied
98. (Don't know)
99. (Refused)

[IF S1 = 3 OR 4 OR 5]

S2. You indicated that you were not satisfied with the program overall. What was the SINGLE most important reason you were not satisfied with the program overall? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT ONE RESPONSE]

1. (The review of the plans took too long)
2. (Took too long to receive rebate)
3. (Took too long to install the measures)
4. (Too much paperwork)
5. (Rebates were too small)
6. (Not enough items covered by program)
7. (Did not like the recommendations)
8. (Did not like what was installed)
9. (Poor service from service organization)
96. (Other) [SPECIFY _____]
98. (Don't know)
99. (Refused)

[IF S1 = 3 OR 4 OR 5]

S3. Were there any other reasons you were dissatisfied? [SAME LIST AS S2 ABOVE. DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]

- 97 No other reasons

[IF V5=3, 4, 98 OR 99, SKIP TO S9]

S4. Now I'm going to ask you about your experience with specific aspects of the Performance Plus Program. Using a scale from 1 to 5, where 1 means "very dissatisfied" and 5 means "very satisfied", please tell me how satisfied you are with your experience with each aspect of the program. [DO NOT RANDOMIZE. DO NOT ACCEPT A RANGE]

[IF V5=1, ASK ALL A THRU I]

[IF V5=2, ASK ONLY D THRU I]

a. The First Review of the house plans, overall (This was the review of the house plans, evaluating the house's energy efficiency with recommended measures.)	1	2	3	4	5	98/99
b. Scheduling and timing of the review	1	2	3	4	5	98/99
c. The report you received about the house plan's current energy efficiency	1	2	3	4	5	98/99
d. Recommendations for energy efficient measures	1	2	3	4	5	98/99
e. The Final Energy Audit Overall (This was the final audit of the house's energy efficiency to determine the rating and confirm the energy efficient upgrades that were installed.)	1	2	3	4	5	98/99
f. Scheduling and timing of the final audit	1	2	3	4	5	98/99
g. The rebates provided by the program overall	1	2	3	4	5	98/99
h. Delays allowed to complete the project	1	2	3	4	5	98/99
i. Information provided by Energy Advisor	1	2	3	4	5	98/99

[IF S4a = 1 OR 2 OR 3; OTHERWISE SKIP TO S7]

S5. You indicated that you were not satisfied with the first review of the house plans. What was the SINGLE most important reason you were dissatisfied? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT ONE RESPONSE]

1. (The review of the plans took too long)
2. (It wasn't what I had expected)
3. (Too much paperwork)
4. (Not enough items covered by first review of the house plans)
5. (Didn't like the recommendations)
96. (Other) [SPECIFY _____]
98. (Don't know)

S6. Were there any other reasons you were dissatisfied with the energy efficiency review of the house plans? [SAME LIST AS S5 ABOVE. DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]

97 No other reasons

[IF S4e=1 OR 2 OR 3; OTHERWISE SKIP TO S9]

- S7. You indicated you were not satisfied with the final energy audit. What was the SINGLE most important reason you were dissatisfied? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT ONE RESPONSE.]
1. (The final energy audit took too long)
 2. (I did not get the EnerGuide rating I had expected)
 3. (It was difficult to schedule the final energy audit)
 4. (I found the energy evaluator to be unpleasant)
 96. (Other) [SPECIFY _____]
 98. (Don't know)
 99. (Refused)
- S8. Were there any other reasons you were dissatisfied with the final energy audit? [SAME LIST AS S7 ABOVE. DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]
[IF ANSWERED 2 AT S7, GO TO S9a]
- S9. Did you reach the Energuide rating you were aiming for?
1. Yes [GO TO S10]
 2. No [GO TO S9a]
 98. (Don't know) [GO TO S10]
 99. (Refused) [GO TO S10]
- S9a. Why did you not reach the EnerGuide rating you were aiming for? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]
1. (The measures I wanted were too expensive)
 2. (The measures I wanted were not recommended for my house)
 3. (I was not informed on the measures that would have allowed me to reach the EnerGuide rating I wanted)
 4. (I changed my mind along the way)
 5. (No particular reason)
 96. Other [SPECIFY: _____]
 98. (Don't know)
 99. (Refused)
- S10. Using a scale from 1 to 5, where '1' is very difficult and '5' is very easy, how would you rate the process to participate in the program? [1-5 scale, 98 = Don't know/Don't recall, 99 = Refused]

S11. [IF S10 = 1, 2 or 3] What was difficult about participating in the program? [MULTIPLE RESPONSE – RECORD VERBATIM] Probe: Anything else?

- 1. (Record answer)
- 98. (Don't know)
- 99. (Refused)

[ASK FR SECTION IF V3=1 OR V4=1]

Free-Ridership (FR Series)

FR1. When building a house in Nova Scotia to code, one would expect an EnerGuide rating of 80. Did you decide to build or buy a house with a high level of energy efficiency, reaching an EnerGuide rating of 83 or higher, before participating in the Performance Plus program?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[IF FR1=YES]

FR1a. I just want to make sure I understand - **Before** you decided to participate in the Performance Plus program, you had already made the decision to build or buy a house with a high level of energy efficiency, reaching an EnerGuide rating of 83 or higher?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Performance Plus program.

If you had not participated in the Performance Plus program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Taken the Action,” and a 10 indicating that you “Definitely **Would Have** Taken the Action.” [AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: “AND NEXT, In the absence of the Program, would you have . . . : DO NOT ACCEPT A RANGE – ASK FR2 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FR2a. . . . built or bought a house with the exact same level of efficiency, reaching the same EnerGuide rating of 83 or higher?

___ Response ___98 Don't Know ___99 Refused

FR2b. . . . built or bought a standard house, with an EnerGuide rating under 83, instead of a house with a high level of energy efficiency that has an EnerGuide rating of 83 or higher?

___ Response ___98 Don't Know ___99 Refused

FR2c. . . . built or bought a house with the exact same level of efficiency, reaching the same EnerGuide rating of 83 or higher, *but at a later date*?

___ Response ___98 Don't Know ___99 Refused

IF FR2c > 5, THEN ASK:

FR2cc. DO NOT ASK FR2cc IF DON'T KNOW OR REFUSED IN Q.FR2c You indicated in your response to a previous question that if the Performance Plus program had not been available there was an X in 10 likelihood that you would have built or bought a house with the exact same level of efficiency, reaching the same EnerGuide rating, *but at a later date*. Approximately how many months later would you have built or bought this house? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. ___ months later
2. (Never)
3. (At the same time)
97. (Don't Know)
98. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2cc ANSWER IN MONTHS, READ]:

Would it have been within...

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

[ASK FR3_1 IF, IN SAMPLE, TOTAL INCENTIVE>0]

FR3_1. Efficiency Nova Scotia paid you \$[Total incentive] for the EnerGuide Rating of [EnerGuide Rating] that you achieved in your new house. If you had not received the rebate from Efficiency Nova Scotia, would you have paid for the full cost of the additional measures required to reach this EnerGuide Rating? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely Would Not Have Paid” and a 10 indicating that you “Definitely Would Have Paid.” [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

___ Response

- 97. (Did not receive that rebate)
- 98. (Don’t Know)
- 99. (Refused)

[ASK FR3_2 IF, IN SAMPLE, TOTAL INCENTIVE=EMPTY]

FR3_2. Efficiency Nova Scotia gave you a rebate for the EnerGuide Rating of [EnerGuide Rating] that you achieved in your new house. If you had not received the rebate from Efficiency Nova Scotia, would you have paid for the full cost of the additional measures required to reach this EnerGuide Rating? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely Would Not Have Paid” and a 10 indicating that you “Definitely Would Have Paid.” [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

___ Response

- 97. (Did not receive that rebate)
- 98. (Don’t Know)
- 99. (Refused)

FR4. Next, I'm going to ask you to rate the importance of the Performance Plus program as well as other factors that might have influenced your decision to build or buy a house with a high level of energy efficiency and achieved an EnerGuide rating of 83 or higher. Using a scale from 0 to 10, where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of each of the following in your decision to achieve an EnerGuide rating of 83 or higher for your new house.

Factor (READ AND RANDOMIZE)	Responses
a. The program incentive	___ Response ___98 Don't Know ___99 Refused
b. Expert advice provided by the auditor	___ Response ___98 Don't Know ___99 Refused
c. Feedback received from the review of home plans	___ Response ___98 Don't Know ___99 Refused
d. The EnerGuide Label and designation itself	___ Response ___98 Don't Know ___99 Refused
e. Previous experience with the Performance Plus program, or a similar program either from Efficiency Nova Scotia or Nova Scotia Power	___ Response ___98 Don't Know ___99 Refused

Impact of Measures on Comfort Level (IM Series)

IM1. Do you think the energy efficiency measures installed through the program have resulted in a more comfortable home for you and other occupants to live in?

1. Yes
2. No
98. (Don't know)
99. (Refused)

Recommendations for Program Improvements (R Series)

- R1. Do you have any recommendations for improving the Performance Plus program? PROBE: Anything else?
1. (Offer more measures eligible for rebates) [GO TO R3]
 2. (Offer more information on the measures recommended)
 3. (Complete the first review of house plans faster)
 4. (Complete the final audit of the house sooner)
 5. (More marketing/advertising)
 6. (Make process simpler (consolidate rebate programs)/clarify report)
 7. (Improve the quality of work of the auditor)
 8. (Explain why people qualify and give opportunity to correct the application)
 9. (Faster certification process)
 10. (Increase availability of auditor to answer energy efficiency-related questions)
 11. (No recommendation)
 96. (Other [SPECIFY _____])
 97. (Don't know)
 98. (Refused)
- R2. Are there any energy efficiency upgrades that were not covered by the program that you would like to have covered through the program?
1. Yes
 2. No
 98. (Don't know)
 99. (Refused)
- R3. [IF R2 = 1 OR R1=1] Which energy efficiency upgrades would you like to have had covered by the program? [PROBE FOR SPECIFIC UPGRADES; ACCEPT MULTIPLE] PROBE: Anything else?

Demographic Characteristics (D Series)

[ASK ALL HOME BUYERS]

These final questions are asked for statistical purposes only. The information collected is strictly confidential.

- D1. What type of residence do you live in? [READ RESPONSES 1-5; SELECT ONE RESPONSE]
1. Detached single-family home
 2. Semi-detached house
 3. Mobile home or house trailer
 4. Townhouse or duplex which share adjacent walls
 5. Row house (Single story apartment building)
 96. Other [SPECIFY: _____]
 98. (Don't know)
 99. (Refused)
- D2. How many bedrooms are in your home? [98=DK; Enter zero for a studio apartment with no bedrooms]
- D5. Is your home occupied year round, or is it a seasonal home?
1. Year round residence
 2. Seasonal / vacation home
 96. (Other Specify _____)
 98. (Don't know)
 99. (Refused)
- D6. Including yourself, how many people live in this residence on a full-time basis?
Number of people: _____
- [NOTE: DON'T ALLOW ZERO FOR A RESPONSE]
- D7. What is your age group? Are you...[READ]
1. 18 to 24
 2. 25 to 34
 3. 35 to 44
 4. 45 to 54
 5. 55 to 64
 6. 65 or over
 99. (Refused)

- D8. What is the highest grade of schooling completed by the head of your household? [DO NOT READ]
1. (Less than high school graduation diploma)
 2. (High school graduation diploma and/or some post secondary)
 3. (Trades certificate or diploma)
 4. (College certificate or diploma)
 5. (University degree, certificate or diploma)
 98. (Don't know)
 99. (Refused)
- D9. Which of the following income categories best describes your total annual household income before taxes in 2011? Stop me when I reach the right category. [READ LIST; SELECT ONE RESPONSE]
1. Less than \$15,000
 2. \$15,000 - \$24,999
 3. \$25,000 - \$34,999
 4. \$35,000 - \$49,999
 5. \$50,000 - \$69,999
 6. \$70,000 - \$79,999
 7. \$80,000 or more
 98. (Don't know)
 99. (Refused)
- D10. [DO NOT READ] Gender:
1. Male
 2. Female

END: That is all the questions I have for you. Thank you for taking the time to respond to this survey.

APPENDIX VIII – BUILDER SURVEY QUESTIONNAIRE

Builder Survey

Performance Plus Program

October 25, 2012

INSTRUCTION

PARTICIPANT BUILDERS= SAMPLE COLUMN “PARTICIPANT”=1 OR VR4=1 (YES)

NON PARTICIPANT BUILDERS= [SAMPLE COLUMN “PARTICIPANT”=0 OR VR3=0 OR VR4 = 2 (NO)] AND [VR2≠0]

Hello may I please speak with [INSERT NAME]?

- 1 Yes [GO TO INTRODUCTION]
- 2 No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

INTRODUCTION – PARTICIPANT BUILDERS

Hello, my name is _____ and I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you or your company has recently participated in Efficiency Nova Scotia Corporation’s Performance Plus program for new houses. We would appreciate your collaboration in answering questions related to your participation in this program and the residential new construction market in general. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve the program. The survey will take about fifteen minutes. Is this a good time for you?

The Performance Plus program may also be known as “EnerGuide for New Houses” Throughout the questionnaire, I will refer to it as the “Performance Plus program”. [GO TO VRP1]

INTRODUCTION – NON PARTICIPANT BUILDERS

Hello, my name is _____ and I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. We would appreciate your collaboration in answering questions about the residential new construction market in Nova Scotia and the Performance Plus program offered by Efficiency Nova Scotia. This program incents builders to go above and beyond the building code to build more efficient homes. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve their program. The survey will take about fifteen minutes. Would you be the right person to answer this survey?

1. Yes [GO TO VR1]

2. No [PROMPT: "Are you sure? This program provides rebates for installing energy efficient upgrades in newly constructed houses. Plans for the house are reviewed and recommendations are given for upgrades to install in the new homes. The home buyer can receive rebates to cover some of the cost of eligible measures. " RECODE AS "YES" IF THE PROMPT WORKS; IF RESPONDENT STILL SAYS NO: "Is there someone else who would know about the Performance Plus program?"]
1. Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
98. Don't know [PROMPT: "This program provides rebates for installing energy efficient measures in newly constructed houses. Plans for the house are reviewed and recommendations are given for upgrades to install in the new homes. The home buyer can receive rebates to cover some of the cost of eligible upgrades after they are installed." RECODE AS "YES" IF THE PROMPT WORKS; IF RESPONDENT STILL SAYS DON'T KNOW: "Is there someone else who would know about the Performance Plus program?"]
1. Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
2. No [THANK & TERMINATE]
99. Refused [THANK AND TERMINATE]

[ASK NON PARTICIPANT BUILDERS]

Verification and Recall (VR Series)

- VR1. Are you in the business of building and/or selling homes?
3. Yes [CONTINUE]
 4. No [THANK & TERMINATE]
 98. (Don't know) [THANK & TERMINATE]
 99. (Refused) [THANK & TERMINATE]
- VR2. Approximately how many new houses, including single units, semi-detached units and row houses, has your firm built so far in 2012 in Nova Scotia? If you built semi-detached units in 2012 in Nova Scotia, please count as two units.
[PROBE FOR A SPECIFIC ANSWER.DO NOT ACCEPT A RANGE] [IF NUMBER IS 0 OR DK OR REFUSED THANK AND TERMINATE]
1. [ENTER NUMBER]
 98. (Don't know)
 99. (Refused)
- VR3. Among the new houses that you have built so far in 2012 in Nova Scotia, how many have been built under the Performance Plus program? [PROBE FOR A SPECIFIC ANSWER.DO NOT ACCEPT A RANGE]
1. [ENTER NUMBER]
 98. (Don't know)
 99. (Refused)

[ANSWER TO VR3 CANNOT BE HIGHER THAN ANSWER TO VR2]

[IF ANSWER IS 0, GO TO SECTION M]

[IF ANSWER IS HIGHER THAN 0, GO TO VR4]

VR4. So you or someone else from your firm participated in the Performance Plus program for houses you built or are currently building? Is that correct?

1. Yes [GO TO SECTION VR5]

2. No [GO TO SECTION M]

98. Don't know [PROMPT: "Did you or someone else from your firm participated in the Performance Plus program for houses you built in 2012 or are currently building?" RECODE AS "YES" IF THE PROMPT WORKS; RECODE AS NO, IF THE RESPONDENT SAYS NO; IF RESPONDENT STILL SAYS DON'T KNOW, THANK AND TERMINATE.]

99. Refused [THANK AND TERMINATE]

VR5. Usually, who makes the decision to participate in the Performance Plus program, is it you or the future owner? [DO NOT READ. ACCEPT ONE]

3. (Me, the builder usually makes the decision) [GO TO SECTION V]

4. (The future homeowner usually makes the decision) [GO TO SECTION V]

3. (Both builder and future homeowner make decision) [GO TO SECTION V]

98. (Don't know) [GO TO SECTION V]

99. (Refused) [GO TO SECTION V]

[ASK PARTICIPANT BUILDERS]

Verification and Recall (VRP Series)

VRP1. Are you in the business of building and/or selling homes?

5. Yes [CONTINUE]

6. No [THANK & TERMINATE]

98. (Don't know) [THANK & TERMINATE]

99. (Refused) [THANK & TERMINATE]

VRP2. We understand you or someone else from your firm participated in the Performance Plus program for houses you built or are currently building? Is that correct?

1. Yes [CONTINUE]

2. No [PROMPT: "Are you sure? This program provides rebates for installing energy efficient upgrades in newly constructed houses. Plans for the house are reviewed and recommendations are given for upgrades to install in the new homes. The home buyer can receive rebates to cover some of the cost of eligible measures. " RECODE AS "YES" IF THE PROMPT WORKS; IF RESPONDENT STILL SAYS NO: "Is there

someone else who would know about having participated in the Performance Plus program?”]

1. Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
98. Don't know [PROMPT: “This program provides rebates for installing energy efficient measures in newly constructed houses. Plans for the house are reviewed and recommendations are given for upgrades to install in the new homes. The home buyer can receive rebates to cover some of the cost of eligible upgrades after they are installed.” RECODE AS “YES” IF THE PROMPT WORKS; IF RESPONDENT STILL SAYS DON'T KNOW: “Is there someone else who would know about having participated in the Performance Plus program?”]
1. Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
2. No [THANK & TERMINATE]
99. Refused [THANK AND TERMINATE]

[IF REFUSED, ASK “Can we schedule a more convenient time for you to conduct this survey?”]

[SCHEDULED, IF NECESSARY, FOR: _____]

VRP3. Approximately how many new houses, including single units, semi-detached units and row houses, has your firm completed so far in 2012 in Nova Scotia? If you built semi-detached units in 2012 in Nova Scotia, please count as two units.

[PROBE FOR A SPECIFIC ANSWER.DO NOT ACCEPT A RANGE] [IF ANSWER IS 0 OR DK OR REFUSED, THANK AND TERMINATE]

1. [ENTER NUMBER]
98. (Don't know)
99. (Refused)

VRP4. Among the new houses that you have built so far in 2012 in Nova Scotia, how many have been built under the Performance Plus program? [PROBE FOR A SPECIFIC ANSWER.DO NOT ACCEPT A RANGE] [IF ANSWER IS 0, THANK AND TERMINATE]

1. [ENTER NUMBER]
98. (Don't know)
99. (Refused)

VRP5. Usually, who makes the decision to participate in the Performance Plus program, is it you or the future owner? [DO NOT READ. ACCEPT ONE]

1. (Me, the builder usually makes the decision)
2. (The future homeowner usually makes the decision)
3. (Both builder and future homeowner make decision)
98. (Don't know)
99. (Refused)

Please note that during this interview, we will consider your overall experience with the Performance Plus program in 2012 and not just one specific new house you have built through the program.

[ASK PARTICIPANT BUILDERS]

Verification of Measures Implemented (V Series)

- V1. Do you typically implement any of the following measures as part of your participation in the Performance Plus Program? [FOR EACH MEASURE READ AND ROTATE, EXCEPT ASK N LAST, CODE: YES=1, NO=2, DK=98, REFUSED=99.]
- a. Programmable electronic thermostat
 - b. Energy-efficient lighting equipment
 - c. High efficiency windows
 - d. High efficiency insulation
 - e. Mini-split heat pumps
 - f. Ducted heat pumps
 - g. Natural gas or propane boiler
 - h. Oil boiler and furnace
 - i. Natural gas or propane furnace
 - j. Central wood or pellet heating system
 - k. Drain water heat recovery equipment
 - l. Electric water heater tank wrap
 - m. Electric water heater pipe wrap
 - n. Any others? Specify: _____

[ASK PARTICIPANT BUILDERS]

Free-Ridership (FR Series)

Now, I would like to examine the influence of the Performance Plus program on your decision to build houses with a high level of efficiency.

- FR1. Without the Performance Plus program and its rebate, would you have built the same number of houses with the exact same level of efficiency, reaching an EnerGuide rating of 83 or higher in Nova Scotia in 2012?
- 1. Yes
 - 2. No
 - 98. (Don't know)
 - 99. (Refused)

[IF FR1=1]

FR1a. I just want to make sure I understand - If the Performance Plus program had **NOT** been in place and had not offer incentives to build houses reaching an EnerGuide rating of 83 or higher, you would you have still built the same number of houses with the exact same level of efficiency?

- 1. Yes [GO TO SECTION MP]
- 2. No
- 98. (Don't know)
- 99. (Refused)

[IF VRP4 or VR3=NUMERIC ANSWER]

FR2a. From the [ANSWER TO VRP4 OR VR3] houses that you have built under the program in 2012 in Nova Scotia, how many houses with an EnerGuide rating of 83 would you have built if the Performance Plus program had **NOT** been in place?

- 1. [ENTER NUMBER] [CAN'T BE HIGHER THAN VRP4 OR VR3]
- 98. (Don't know)
- 99. (Refused)

[IF VRP4 OR VR3=98 OR 99]

FR2b. If the Performance Plus program had **NOT** been in place, would you have built the same number of houses with an EnerGuide rating of 83 that you have built so far in 2012 in Nova Scotia? [READ]

- 1. Definitely less
- 2. Probably less
- 3. Probably the same number
- 4. Definitely the same number
- 98. (Don't know)
- 99. (Refused)

FR3. Using a scale from 0 to 10, where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of the Performance Plus program and the incentive it offers in your decision to build houses reaching an EnerGuide rating of 83 or higher.

- 1. [0 to 10] Probe for an exact number
- 98. (Don't know)
- 99. (Refused)

[ASK NON PARTICIPANT BUILDERS]

Market Effects – Non Participants (M Series)

We will now talk about the houses you have built in 2012 without participating in the Performance Plus program.

- M1. Before today, had you ever heard of the Performance Plus program from Efficiency Nova Scotia? [CHOOSE ONLY ONE ANSWER]
1. Yes [GO TO M2]
 2. No [GO TO SECTION F]
 98. (Don't know) [GO TO SECTION F]
 99. (Refused) [GO TO SECTION F]
- M2. Has your firm ever participated in the Performance Plus program? [CHOOSE ONLY ONE ANSWER]
1. Yes
 2. No
 98. (Don't know)
 99. (Refused)
- M3. Among the [VR2] houses you told me you or your firm have built in 2012 in Nova Scotia, how many would have reached an EnerGuide rating of 83? [ENTER NUMBER] [IF DON'T KNOW OR REFUSED, GO TO SECTION F]
- M4. Did you implement any of the following measures promoted by the Performance Plus program in those houses but not as part of the program? [FOR EACH MEASURE READ, CODE: YES=1, NO=2, DK=98, REFUSED=99.]
- a. Energy-efficient space heating system
 - b. Electronic thermostat
 - c. Energy-efficient water heating system
 - d. Energy-efficient lighting equipment
 - e. High efficiency windows
 - f. High efficiency insulation
 - g. Any other measures: SPECIFY:_____
- M5. [DO NOT ASK IF NONE IN M4 MENTIONED] What is the likelihood that you would have implemented those measures if you had never heard of or participated in the Performance Plus program or heard of the EnerGuide rating? Please answer on a scale from 0 to 10, where 0 means "very unlikely" and 10 "very likely." [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]
- ____ Response
98. (Don't Know)
 99. (Refused)

M6. Why did you not take part in the Performance Plus program for houses built in 2012 in Nova Scotia? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]

1. (I was following the homeowner's wish not to participate in the program)
2. (Did not believe the measures or rebates applied to those houses)
3. (Participated in another program instead)
4. (I did not have a positive past experience with the program)
96. (Other, please specify: _____)
98. (Don't know)
99. (Refused)

[ASK PARTICIPANT BUILDERS]

[[IF VRP3-VRP4=0] OR [VR2-VR3=0], SKIP TO SECTION P]

Market Effects – Participants (MP Series)

We will now talk about the houses you have built in 2012, but without participating in the Performance Plus program.

MP1. **[DO NOT ASK IF DK/REFUSED IN VRP4 OR VR3]** You told me that you or your firm have built approximately [VRP3 OR VR2] houses, including single units, semi-detached units and row houses, so far in 2012 in Nova Scotia. Among these houses, you told me that roughly [VRP4 OR VR3] have been built under the Performance Plus program. It means that you or your firm have built [VRP3-VRP4 OR VR2-VR3] houses so far in 2012 in Nova Scotia without participating in the Performance Plus program. Is that correct? [CHOOSE ONLY ONE ANSWER]

1. Yes
2. No [READ INSTRUCTION BELOW]
98. (Don't know)
99. (Refused)

INSTRUCTION

READ: "Can you please tell me which answer(s) need(s) to be corrected between the number of new houses you or your firm have built so far in 2012 in Nova Scotia and the number of houses built in 2012 in Nova Scotia under the Performance Plus program? [CHANGE ANSWER TO VRP3 AND/OR VRP4 BASED ON ANSWER FROM RESPONDENT]"

1. [CHANGE VRP3]
2. [CHANGE VRP4]
3. [CHANGE VRP3 AND VRP4]

[ASK IF VRP4 OR VR3=DK OR REFUSED]

- MP1a. You told me that you or your firm have built approximately [VRP3 OR VR2] houses, including single units, semi-detached units and row houses, so far in 2012 in Nova Scotia. Among these houses, what percentage has been built under the Performance Plus program? [IF DON'T KNOW OR REFUSED, GO TO SECTION P]
1. ENTER % BUILT UNDER PROGRAM
 98. (DON'T KNOW)
 99. (REFUSED)
- [DO NOT ASK IF VRP4 OR VR3=DK OR REFUSED]
- MP2. Among the [VRP3-VRP4 OR VR2-VR3] houses you told me you or your firm have built so far in 2012 without participating in the Performance Plus program, if the house had been given an EnerGuide rating, how many would have reached an EnerGuide rating of 83? [ENTER NUMBER] [IF DON'T KNOW OR REFUSED, GO TO SECTION P]
- MP3. Did you implement any of the following measures promoted by the Performance Plus program in those houses but not as part of the program? [FOR EACH MEASURE READ, CODE: YES=1, NO=2, DK=98, REFUSED=99.]
- a. Energy-efficient space heating system
 - b. Electronic thermostat
 - c. Energy-efficient water heating system
 - d. Energy-efficient lighting equipment
 - e. High efficiency windows
 - f. High efficiency insulation
 - g. Any other measures: SPECIFY:_____
- MP5. [DO NOT ASK IF NONE IN MP3 MENTIONED] What is the likelihood that you would have implemented those measures if you had never participated in the Performance Plus program? Please answer on a scale from 0 to 10, where 0 means "very unlikely" and 10 "very likely." [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]
- ___ Response
98. (Don't Know)
 99. (Refused)
- MP6. Why did you not take part in the Performance Plus program for those houses? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]
1. (I was following the homeowner's wish not to participate in the program)
 2. (Did not believe the measures or rebates applied to those houses)
 3. (Participated in another program instead)
 4. (I did not have a positive past experience with the program)
 96. (Other, please specify:_____)
 98. (Don't know)
 99. (Refused)

[ASK PARTICIPANT BUILDERS]

Program Notoriety and Reasons for Participating (P Series)

- P1. How did you learn about the Performance Plus program? [DO NOT READ. ACCEPT MULTIPLE]
18. (Efficiency Nova Scotia bill insert)
 19. (Efficiency Nova Scotia's Website)
 20. (Through program delivery agent from Nova Scotia Home Builders Association (NSHBA))
 21. (Through program delivery agent from Sustainable Housing & Education Consultants (SHEC))
 22. (Through delivery agent from Amerispec Inspection Services)
 23. (Nova Scotia Home Builders Association's member list)
 24. (The Internet)
 25. (Radio Ad)
 26. (Newspaper/Renovation Guide Ad or Story)
 27. (Home show)
 28. (Signs on stakes)
 29. (Seminar or information session put on by delivery agent)
 30. (From a contractor)
 31. (Word of mouth -- neighbor, friend, co-worker, family member, etc.)
 32. (Builder/construction trade publication)
 33. (Real estate agent)
 34. (Permit office)
 97. (Other) [SPECIFY _____]
 98. (Don't know)
 99. (Refused)

[IF VRP5=1 or 3 OR VR5=1 or 3, CONTINUE OTHERWISE SKIP TO S1]

- P2. Now I'm going to ask you to think back to when you decided to participate in the Performance Plus program. What was the SINGLE most important reason you were interested in participating in the program? [ACCEPT ONE RESPONSE; DO NOT READ; PROBE FOR SPECIFIC REASONS]
1. (To make a house that would save buyers / homeowners on energy costs/bills)
 2. (We were already using many of the components or practices of the Performance Plus program)
 3. (To find out energy efficient the new house would be/to get house evaluated)
 4. (To get expert advice about what measures to install/how to make home more energy efficient)

5. (To help buyer / homeowners save energy—not further specified whether for cost, environment)
6. (To help the environment)
7. (To get rebates for measures that we were already planning)
8. (To market house/make house more attractive for potential buyers)
9. (To differentiate ourselves from other builders)
10. (We were interested in building a better, more energy efficient home)
11. (We are generally interested in energy efficiency and renewable energy)
12. (We had previously worked with other energy efficiency programs)
13. (To meet new building code requirements)
14. (Other) [SPECIFY _____]
98. (Don't know)
99. (Refused)

P3. Were there any other reasons? [SAME LIST AS P2 ABOVE.DO NOT READ. ACCEPT MULTIPLE; PROBE FOR SPECIFIC REASONS.]

97 No other reasons

[ASK PARTICIPANT BUILDERS]

Satisfaction with Program (S Series)

S1. Thinking of your OVERALL experience with the Performance Plus program up to this point, including any services received or energy efficient upgrades installed, how satisfied are you overall with the program? Would you say you are very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied?

6. Very satisfied
7. Satisfied
8. Neither satisfied nor dissatisfied
9. Dissatisfied
10. Very Dissatisfied
98. (Don't know)
99. (Refused)

[IF S1 = 3 OR 4 OR 5]

S2. You indicated that you were not satisfied with the program overall. What was the SINGLE most important reason you were not satisfied with the program overall? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT ONE RESPONSE]

10. (The review of the plans took too long)
11. (Took too long to receive rebate)
12. (Took too long to install the measures)

- 13. (Too much paperwork)
- 14. (Rebates were too small)
- 15. (Not enough items covered by program)
- 16. (Did not like the recommendations)
- 17. (Did not like what was installed)
- 18. (Poor service from service organization)
- 97. (Other) [SPECIFY _____]
- 98. (Don't know)
- 99. (Refused)

[IF S1 = 3 OR 4 OR 5]

- S3. Were there any other reasons you were dissatisfied? [SAME LIST AS S2 ABOVE.DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]
- 97 No other reasons
- S4. The program offers the possibility for the builder to receive the incentive directly from ENSC or through the participant. How satisfied are you with the process to receive the incentive? Would you say you are very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied?
- 1. Very satisfied
 - 2. Satisfied
 - 3. Neither satisfied nor dissatisfied
 - 4. Dissatisfied
 - 5. Very Dissatisfied
 - 98. (Don't know)
 - 99. (Refused)

[ASK PARTICIPANT BUILDERS]

Value of the Program to Builders and Customers (VA Series)

- VA1. Overall how would you rate the value of the Performance Plus program to your company? On a scale from one to five, where one is No VALUE and five is considerable VALUE, how would you rate the overall value of the program? [98 = DK, 99 = REFUSED]
 [ENTER VALUE] ____ [RECORD ONE NUMBER NOT A RANGE]
- VA2. Overall how would you rate the value of the Performance Plus program to the customers who buy and live in the houses you build? On a scale from one to five, where one is No VALUE and five is considerable VALUE, how would you rate the overall value of the program to your homebuyers? [98 = DK, 99 = REFUSED]
 [ENTER VALUE] ____ [RECORD ONE NUMBER NOT A RANGE]

[ASK PARTICIPANT BUILDERS]

Recommendations for Program Improvements (R Series)

- R1. Do you have any recommendations for improving the Performance Plus program? Probe: Anything else? Accept multiple responses.
- 12. (Offer more measures eligible for rebates) [GO TO R3]
 - 13. (Offer more information on the measures recommended)
 - 14. (Complete the first review of house plans faster)
 - 15. (Complete the final audit of the house sooner)
 - 16. (More marketing/advertising)
 - 17. (Make process simpler (consolidate rebate programs)/clarify report)
 - 18. (Improve the quality of work of the auditor)
 - 19. (Explain why people qualify and give opportunity to correct the application)
 - 20. (Faster certification process)
 - 21. (Increase availability of auditor to answer energy efficiency-related questions)
 - 22. {Another way of receiving the incentive}
 - 23. (No recommendation)
 - 99. (Other [SPECIFY _____])
 - 98. (Don't know)
 - 99. (Refused)
- R2. Are there any energy efficiency upgrades that were not covered by the program that you would like to have had covered through the program?
- 1. (Yes)
 - 2. (No)
 - 98. (Don't know)
 - 99. (Refused)
- R3. [IF R2= 1 OR R1=1] Which energy efficiency upgrades would you like to have covered by the program? [PROBE FOR SPECIFIC UPGRADES; ACCEPT MULTIPLE] PROBE: Anything else?

[ASK ALL]

Firmographics (F Series)

The final question is asked for statistical purposes only.

- F1. Approximately how many full-time equivalent workers are employed by your company/organization within Nova Scotia?
1. Fewer than 5
 2. 5 to 9
 3. 10 to 19
 4. 20 to 49
 5. 50 to 99
 6. 100 to 249
 7. 250 or More
 98. (Don't know)
 99. (Refused)

END: That is all the questions I have for you. Thank you for taking the time to respond to this survey.

APPENDIX VIII – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

Participants

FR2a. If you had not participated in the program, what is the likelihood that you would have built or bought a house with the exact same level of efficiency, reaching the same EnerGuide? (Scale 0 to 10)	FR2a = Answer x 10%
FR2b. If you had not participated in the program, what is the likelihood that you would have built or bought a standard house instead of a house reaching an EnerGuide rating of 83 or higher? (Scale 0 to 10)	FR2b = (10 – Answer) x 10%
PA1 Score:	MEAN VALUE OF: (FR2a ; FR2b)
FR1. Did you decide to build or buy a house with a high level of energy efficiency, reaching an EnerGuide rating of 83 or higher, before participating in the program?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just want to make sure I understand - Before you decided to participate in the program, you had already made the decision to build or buy a house reaching an EnerGuide rating of 83 or higher?	IF 1. Yes: FR1 = 100% IF 2 OR 9 : FR1 = 0%
FR3. If you had not received the rebate from ENSC, would you have paid for the full cost of the additional measures required to reach this EnerGuide Rating?(Scale 0 to 10)	FR3 = Answer x 10%
PA2 Score:	IF FR1 = 0% : FR3 / 2 IF FR1 = 100% : FR3
FR4. Level of influence (Scale 0 to 10) Factors a, b, c, e = Program factors Factors d= Non Program factors	FR4_P = SUM(a; b; c; e) FR4_NP = FR4d
PA3 Score:	100% - [FR4_P/(FR4_P+FR4_NP)]
Final Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3)
Inconsistency Test #1	IF ABS(FR2a – FR2b) ≥ 30%: PA1 = MIN OF (FR2a ; FR2b)
Inconsistency Test #2	IF FR3 ≥ 70% AND IF (FR2a OR FR2b < 70%: PA2 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3)

Builders

FR1. Without the program and its rebate, would you have built the same number of houses with the exact same level of efficiency?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just want to make sure I understand – If the program had not been in place and had not offer incentives to build houses reaching an EnerGuide rating of 83 or higher, you would you have still built the same number of houses with the exact same level of efficiency?	IF 1. Yes: FR1 = 100% AND GO TO FR3 IF 2 OR 9 : FR1 = 0%
FR2a. From the [#] houses that you have built under the program in 2012 in Nova Scotia, how many houses with an EnerGuide rating of 83 would you have built if the program had not been in place?	FR2 = FR2a / [#] of houses
[IF NO # AT FR2a] FR2b. If the program had not been in place, would you have built the same number of houses with an EnerGuide rating of 83 that you have built so far in 2012 in Nova Scotia? 1. Definitely less 2. Probably less 3. Probably the same number 4. Definitely the same number 9. (Don't know / Refused)	IF 1. : FR2 = 0% IF 2. : FR2 = 25% IF 3. : FR2 = 50% IF 4. : FR2 = 100% IF 9. : FR2 = 0%
PA1 Score:	IF FR1 = 0% : FR2 / 2 OTHERWISE : FR1
FR3. Rate the importance of the program and the incentive it offers in your decision to build houses reaching an EnerGuide rating of 83 or higher?(Scale 0 to 10)	FR3 = (10 – Answer) x 10%
PA2 Score:	FR3
Final Free-Ridership	MEAN VALUE OF: (PA1 ; PA2)
Inconsistency Test #1	IF (FR2 – FR3) ≥ 30%: PA1 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2)



Notes on the On-Site Evaluation (D)

Quality assurance

Appendix 1

Audit file number _____
Name of the advisor _____
Service Organization _____

ENSP Program : _____
QA done by: _____
Date of Audit : _____

☐ =task performed well ☐ task not completed ☐ Not/Applicable

Introduction ☐ required equipment ☐ program presentation ☐ client concerns ☐ building history

Remarks: _____

Foundation 1 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture ☐ rim joist
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Foundation 2 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture ☐ rim joist
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Walls type 1 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Walls type 2 ☐ insulation values ☐ insulation types ☐ wall height ☐ signs of moisture
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Attic 1 ☐ insulation values ☐ attic ventilation ☐ vapor barrier ☐ signs of moisture ☐ mask,gloves
☐ information to client ☐ recommendations to client ☐ required pictures ☐ ducting in attic

Remarks: _____

Attic 2 ☐ insulation values ☐ attic ventilation ☐ vapor barrier ☐ signs of moisture ☐ mask,gloves
☐ information to client ☐ recommendations to client ☐ required pictures ☐ ducting in attic

Remarks: _____

Windows/doors ☐ correct count ☐ types ☐ insulation value ☐ condensation ☐ air leakage
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Notes on the On-Site Evaluation (D)

Quality assurance

Appendix 1

Audit file number _____
Name of the advisor _____
Service Organization _____

ENSProgram : _____
QA done by: _____
Date of Audit : _____

Main Heating ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Main Heating ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Air cooling ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

DHW ☐ Basic inspection ☐ info on plate ☐ safety issues ☐ efficiency estimation
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Ventilation ☐ Basic inspection ☐ info on plate ☐ air quality issues ☐ efficiency ☐ exhaust fans
☐ information to client ☐ recommendations to client ☐ required pictures

Remarks: _____

Blower Door Test ☐ equipment set-up ☐ preparation for test ☐ Readings (8X) ☐ identification of air leaks
☐ information to client ☐ recommendations to client ☐ required pictures ☐ comb.spillage test

Remarks: _____

Energide Report ☐ ACH and ELA explained ☐ ENERGUIDE Rating ☐ texts ☐ priorities
☐ recommendations ☐ Energide Label

Remarks: _____

Grants ☐ general info ☐ requirements and eligibility ☐ deadline ☐ amounts info

Remarks: _____

Others ☐ Data collection sheet ☐ air quality and ventilation explanations ☐ house-as-a-system

Remarks: _____

Notes on the HOT2000 Simulation

Quality assurance

Appendix 2

Audit file number _____
Name of the advisor _____
Service organisation _____

QA done by _____
Date of audit _____

Check boxes where errors were identified

General information

☐ Name and address ☐ Fuel Cost and Weather Libraries ☐ Specifications

Remarks: _____

Ceiling 1

☐ Code ☐ Area ☐ Slope ☐ Compression

Remarks: _____

Ceiling 2

☐ Code ☐ Area ☐ Slope ☐ Compression

Remarks: _____

Wall 1

☐ Code ☐ height ☐ Perimeter

Remarks: _____

Wall 2

☐ Code ☐ height ☐ Perimeter

Remarks: _____

Windows & Doors

☐ Number ☐ Orientation ☐ Code ☐ Dimension

Remarks: _____

Foundation 1

☐ Type ☐ Area ☐ Perimeter ☐ Total Height ☐ Depth BG ☐ Code
☐ code of floor above foundation ☐ rim joist code ☐ rim joist measurements

Remarks: _____

Foundation 2

☐ Type ☐ Area ☐ Perimeter ☐ Total Height ☐ Depth BG ☐ Code
☐ code of floor above foundation ☐ rim joist code ☐ rim joist measurements

Remarks: _____

Air leakage

☐ Temperatures ☐ Pressures ☐ Readings (8) ☐ Volume ☐ combustion spillage test

Remarks: _____

Notes on the HOT2000 Simulation

Audit file number _____
Name of the advisor _____
Service organisation _____

QA done by _____
Date of audit _____

Check boxes where errors were identified

Ventilation ☐ Type ☐ CFM Rates ☐ Model

Remarks _____

Main Heating ☐ Type ☐ Efficiency ☐ Fans ☐ Model

Remarks: _____

Secondary Heating ☐ Type ☐ Efficiency ☐ Model

Remarks: _____

Cooling ☐ Type ☐ Efficiency ☐ Model

Remarks: _____

DHW ☐ Type ☐ Efficiency ☐ Model

Remarks: _____

Recommendations ☐ Report texts ☐ List of Upgrades

Remarks: _____

Other Remarks _____

Final Comment _____

RESIDENTIAL DIRECT INSTALL IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 6, 2013



ECONOLER

ACRONYMS

CATI	Computer-Assisted Telephone Interviewing
CFL	Compact Fluorescent Lamp
CRA	Corporate Research Associates
DA	Delivery Agent
ENSC	Efficiency Nova Scotia Corporation
HEA	Home Energy Assessment
LED	Light Emitting Diode
LI	Low Income
LTE	Hydro-Québec's Laboratory of Energy Technologies
NTGR	Net-to-Gross Ratio
OPA	Ontario Power Authority
PM	Program Manager
RDI	Residential Direct Install

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Demand-to-energy ratio	A ratio obtained by dividing the target peak demand savings by the target energy savings of a given program for a given year.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.

Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Spillover (internal)	Percentage of savings attributable to participants who continue to implement the energy efficiency measures introduced by a program after participating in it once, without participating in the program a second time.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Residential Direct Install (RDI), which is a component of the Existing Houses program. The 2012 evaluation was based on interviews with the Program Manager (PM) and two delivery agents (DAs), 100 on-site visits as well as a telephone survey with a total of 181 non-low-income participants.

PROGRAM COMPONENT OVERVIEW

Efficiency Nova Scotia Corporation (ENSC) launched the Residential Direct Install (RDI) component in July 2012, based on the pilot program in place at the beginning of 2012. RDI offers free low-cost energy efficiency upgrades to Nova Scotia homeowners and renters. It was created following the success of several direct-install pilot projects offered to the customers involved in the Home Energy Assessment (HEA), Low Income (LI) and other direct install programs in the fall of 2011.

RDI provides participants with direct installation of new standard energy-efficient lighting and domestic water-heating products free of charge. In addition, participants may purchase specialty compact fluorescent lamps (CFLs) and/or light-emitting diode (LED) lamps at reduced costs.

The products installed through RDI are the following:

- > CFLs;
- > LED lamps;
- > LED nightlights;
- > faucet aerators;
- > low-flow showerheads;
- > pipe insulation; and
- > storage tank wraps for electrically heated hot water systems.

RDI targets low-income residents in particular, but also targets participants of other ENSC residential programs. RDI program promotion is conducted in conjunction with ENSC programs, namely Low Income, Appliance Retirement, Home Energy Assessment, Fuel Substitution and Solar.

RDI aimed to achieve net electricity savings of 18.9 GWh and demand savings of 4.3 MW for 2012.

KEY FINDINGS

The 2012 evaluation of RDI demonstrated that the program is well designed and revealed a significant level of participation, particularly considering that it is a new program. The program totalled 28,397 participants for the year 2012 and generated 37.043 GWh in terms of energy savings.

Awareness

In order for the number of participants to keep increasing and to ensure program continuity in the years to come, program awareness constitutes an important aspect of the program strategy. This year's evaluation revealed that the main ways non-low-income participants became aware of RDI were ENSC advertising, ENSC staff and the DAs, word of mouth as well as past participation in other ENSC programs. These facts highlight the positive results of the marketing strategy, which notably relies on word of mouth and promotional efforts from DAs.

However, some participants still believe that improvements are possible with respect to marketing efforts. Indeed, when asked for recommendations to improve the program, non-low-income participants first mentioned better advertising. According to the two interviewed DAs, the program marketing was one of the major barriers to program delivery. They felt that the program is more difficult to market, given that it is restricted to certain regions or demographics and that it is only available in certain areas at certain times. They therefore both recommended ramping up outreach and marketing activities.

Satisfaction

Satisfaction with the program was very high. Indeed, nearly all participants were satisfied with the program overall and its various aspects. As for the DAs, they indicated being satisfied with the overall program and especially with their relationship with ENSC staff and the other DA, even though ramping up to full capacity took longer than they expected because of the complexity of assimilating all aspects of the new program within a short time frame.

Program Influence and Impact

While free installation of energy-efficient products is the main factor influencing the decision to install such products, it should be noted that information or advice provided by the program advisor during the installation also had an influence. One half of the households that received information about energy-efficient products during the installer's visit indicated that this information inspired and caused changes in their behavior in terms of energy use at home. Thus, the program should continue to include an educational perspective by providing participants with information and advice on the energy-efficient products installed. This would also address the suggestion made by some participants to offer more information on the products installed and improve communication.

Program Energy Savings

To calculate the net savings of RDI in 2012, Econoler reviewed the gross savings estimated by ENSC and conducted 100 on-site visits to establish the installation rates for each category of products installed through the program.

Moreover, Econoler took into consideration the free-ridership and spillover measured for non-low-income participants as part of the survey. Through this approach, a free-ridership level of 19 percent was captured, while a spillover of 3 percent was identified for this group of participants. For the low-income customers, the distortion effects of the program are assumed to be insignificant, and therefore, the NTGR was established at 1. Using the proportion of low-income and non-low-income participants, the overall NTGR associated with the program is 0.91. This value was applied to the gross savings calculation.

Table 1: Distortion Effects and Overall Net-to-Gross Ratio Calculation

Group of Participants	Non-Low-Income	Low-Income
Free-Ridership Level	19%	-
Spillover Level	3%	-
NTGR	0.84	1.00
Proportion ¹	58%	42%
Overall NTGR	0.91	

The evaluation revealed that RDI generated net energy savings of 37.043 GWh and demand savings of 8.446 MW at the generator in 2012.

Table 2: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	46.127 GWh	46.127 GWh	39.477 GWh	0.90	35.590 GWh
Evaluation Results	47.660 GWh	46.427 GWh	40.706 GWh	0.91	37.043 GWh
Demand Savings					
Tracked Savings from ENSC	10.517 MW	10.517 MW	9.001 MW	0.90	8.115 MW
Evaluation Results	10.867 MW	10.585 MW	9.281 MW	0.91	8.446 MW

The net energy values calculated were compared to the tracked savings for 2012. The values calculated for the program are slightly higher than those calculated from the tracking sheet. This can be explained by the difference in some of the parameters used by ENSC and the Evaluator to estimate gross and net savings:

¹ Weighted average of the Low-Income Factor registered in the tracking sheet with the revised gross savings.

- > Econoler revised some of the unitary savings values used by ENSC in the tracking sheet. These adjustments resulted in a small increase of the initial gross savings.
- > Installation rates were added for all products installed through the program, except for programmable thermostats and electric kettles. Though these installation rates were very high, they had an impact on the installed gross savings, since ENSC used installation rates of 100 percent in the tracking sheet.
- > The NTGR measured during this evaluation is slightly higher than the one used by ENSC. In fact, ENSC estimated a NTGR of 0.83 for non-low-income participants, in comparison to the value of 0.84 measured by Econoler. This higher NTGR is mainly explained by the internal spillover effects of 3 percent that were calculated during this evaluation.

RECOMMENDATIONS

Econoler finds that the program works well overall and at a satisfactory level. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- RDI-R1. Fine-tune the program marketing approach:** The evaluation results indicated that RDI promotional efforts did yield positive results. Nevertheless, according to the DAs, the program marketing was one of the major barriers to program delivery. They felt that the program is more difficult to market, given that it is restricted to certain regions or demographics and that it is only available in certain areas at certain times. As part of the evaluation, DAs as well as some participants suggested improving marketing efforts and communication. Thus, ENSC should continue to conduct consultation with the DAs on this matter and fine-tune the program marketing approach.
- RDI-R2. Continue informing participants about energy-efficient products:** The survey results showed that information or advice provided by the program advisor during the installation had an influence on the decision to install energy-efficient products. They also indicated that three quarters of the households remembered receiving information about energy-efficient products during the installer's visit and that this information encouraged many of them to change their behavior in terms of energy use at home. Thus, the Evaluator recommends continuing to include an educational perspective to the program by providing participants with information and advice on the energy-efficient products installed. This would also address the suggestion made by some participants to offer more information on the products installed and improve communication.
- RDI-R3. Improve the content of the tracking sheet:** Considering that the program component was launched this year and has never been evaluated before, the tracking sheet was

complete and sufficient for the first year of the program. In the future, Econoler recommends the following to facilitate program evaluation:

- > Add a unique identification number for each participant;
- > Identify the products installed in each residential unit;
- > Collect information on air conditioning;
- > Make sure that all the fields (e.g. rate code, heat type) are systematically filled out;
- > Set limitations for entries and develop a validation process.

RDI-R4. Ensure that there is a real need for nightlights in the household before offering LED nightlights to participants: LED nightlights showed the lowest installation rate. Established at 95 percent, this was not considered as problematic, but the Evaluator noticed one main issue during the on-site visits that could be addressed in the future in order to avoid LED nightlight removal. In some cases, the participants declared that they had removed or given away their nightlights because they did not need them. All of these cases occurred when more than one LED nightlight was installed. In fact, for more than three quarters of the homes visited during this evaluation, two LED nightlights or more were installed. Thus, the Evaluator recommends that before offering a LED nightlight the installer ensure there is a real need for nightlights in the household and that the LED nightlights would replace old incandescent nightlights that are used on a regular basis.

RDI-R5. Follow the penetration of regular CFLs in the next years: The survey results revealed that CFLs are the product that tends to increase the global free-ridership level of the program. Indeed, many participants declared that they would have installed CFLs without the program, which tends to indicate the acceptance of CFLs by Nova Scotian households. Moreover, the on-site visits demonstrated that most participants already had CFLs installed in their house before their participation. A socket study conducted in 2011 also indicated that households in Nova Scotia have an average of 36 sockets, of which an average of 16 contained CFLs. Overall, this is good news for ENSC as a promoter of energy-efficient products. However, given the penetration of regular CFLs in the market, Econoler recommends that ENSC follow this evolution in the next years to eventually stop offering the installation of free regular CFLs to non-low-income participants.

1 COMPONENT DESCRIPTION

In July 2012, Efficiency Nova Scotia Corporation (ENSC) launched Residential Direct Install (RDI). RDI offers free low-cost energy efficiency upgrades to homeowners and renters. It was created following the success of several direct-install pilot projects offered to customers involved in Home Energy Assessment (HEA), Low Income (LI), and other programs in the fall of 2011. Until June 2012, RDI had been carried out using the previous delivery model established for the various direct-install pilot projects, which featured a variety of upgrades and delivery options. The lessons learned and the insights gained from these pilot projects led to the creation of a standardized province-wide program.

Since July 2012, the RDI province-wide program component has been operating under a new delivery model. For service delivery, ENSC has contracted two delivery agents (DAs) to cover the entire province. Clean Nova Scotia is in charge of the eastern, central and southwestern regions, while Trinity Inspection Services is in charge of the northern region. The program provides participants with direct installation of new standard energy-efficient lighting and domestic water-heating products free of charge. In addition, participants may purchase specialty compact fluorescent lamps (CFLs) and/or light-emitting diode (LED) lamps at reduced costs.

The products installed through RDI are the following:

- > CFLs;
- > LED lamps;
- > LED nightlights;
- > faucet aerators;
- > low-flow showerheads;
- > pipe insulation; and
- > storage tank wraps for electrically-heated hot water systems.

Initially, pilot projects offered electric kettles and programmable thermostats for installation, but they were eliminated from the list of free direct-install products under the new RDI delivery model.

Program funding is provided by two different sources, depending on the type of energy saved. Upgrades that reduce electricity consumption are paid for by ENSC with funds from electricity rate-payers. Upgrades that reduce the use of other fuels are paid for by ENSC with funds from the Province of Nova Scotia.

RDI targets low-income residents in particular, but also targets participants of other ENSC residential programs. RDI program promotion is conducted in conjunction with ENSC programs, namely LI, Appliance Retirement, HEA, Fuel Substitution and Solar.

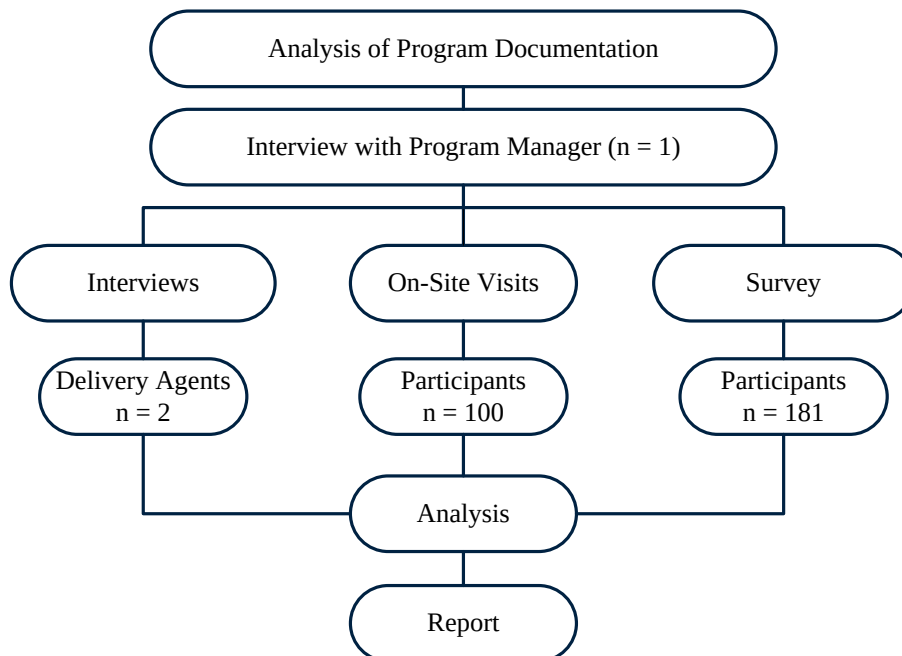
RDI aimed to achieve net electricity savings of 18.9 GWh and demand savings of 4.3 MW for 2012. Savings generated by RDI are accounted for under the Existing Houses program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for RDI. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was obtained primarily from the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews with the Program Manager (PM), in July 2012 and August 2012 respectively. The main objective of these interviews was to gain a basic understanding of the program mechanisms and delivery. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 Interviews with Delivery Agents

In October 2012, two interviews were conducted with the program DAs in order to understand, among other things, their involvement in the program, their participation process, as well as their perception of and satisfaction with the program.

The protocol used for the interviews with the DAs is presented in Appendix II for reference.

2.2.4 On-Site Visits

From October 10 through December 14, 2012, a total of 100 on-site visits were conducted in households where energy-efficient products had been installed by the DAs. These visits were conducted by Econoler's subcontractor, Equilibrium Engineering. Their purpose was to validate whether the products were properly installed according to the information contained in the tracking sheet. Whenever any discrepancies arose, causes were to be identified and documented for the removal of products after their installation. In addition, technical information such as lamp wattages was collected during the on-site visits and participant interviews to validate the unitary savings assumptions used for each category of product.

Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix III.

2.2.5 Participant Survey

A telephone survey with a total of 181 program participants was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in October 2012 using computer-assisted telephone interviewing (CATI) technology. The average length of the survey was 12.5 minutes.

The participant survey was meant to generate feedback on the following aspects of RDI:

- > spillover and free-ridership;
- > program awareness;
- > participant motivations, concerns and barriers;
- > satisfaction with the program; and
- > recommendations for improvements.

The demographic profile of the survey respondents and the survey questionnaire are shown in Appendices IV and V respectively. The survey was conducted only among participants of the new full program, i.e. those who have participated since July 2012. Moreover, only non-low-income participants were interviewed as part of the survey. This should be kept in mind while analyzing survey results. The table below shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2012 telephone survey.

Table 3: Sample Size and Sampling Error

Survey	Population	Sample Size (n)	Sampling Error at 90% Confidence Interval
2012 Participants	13,271 ²	181	± 6.1%

² The population consisted of all the participants who have participated since July 2012, after duplicates removal based on the phone number.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

RDI is a new component to the Existing Houses program launched in 2012. As RDI is being evaluated for the first time, the process evaluation focuses on assessing the effectiveness of the program design and delivery, as well as on enhancing program performance. The process evaluation included a thorough analysis of the program documentation. Moreover, the PM was interviewed along with program partners and participants.

The 2012 process evaluation covers the following aspects:

- > program documentation;
- > program tracking sheet;
- > program partners' perspectives on process issues; and
- > program participants' perspectives on process issues.

3.2 PROGRAM DOCUMENT ANALYSIS AND INTERVIEW WITH THE PROGRAM MANAGER

The following section describes the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interview with the PM.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory, in which all the information about a program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program, based on a template provided by the Evaluator.

The Evaluator noted that RDI has a program memory in the form of a program manual and its various Appendices. The Evaluator is also pleased to report that RDI has an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff, as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The program manual is intended to capture information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The RDI program manual is presented in a standardized template which applies to all ENSC programs and includes the same table of contents with 10 sections. Important information is included in the program manual, as well as its attached files and Appendices. The savings assumptions section is

comprehensive and very well presented. Not only is this information of great value to evaluating the program, but it also makes it easier to revise assumptions in light of new market intelligence. Moreover, the base case for the evaluation plan provides comprehensive information about the assumptions and calculations to arrive at the deemed net savings.

The following table presents the program manual content. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 4: Program Manual Content

Program Manual Content - RDI	2012
Document revisions	✓
Program description (including nature or type of program)	✓
Program justification	✓
Program objectives	✓
Incentives	✓
Eligibility criteria	✓
Program partners and their roles	✓
Program barriers	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	✓
Details about the savings calculations and types of measure	✓
Annual budget	✓
Cost-effectiveness test results	✓
Market study or technical study supporting program elements or assumptions	⚠
Marketing plan	✓
Evaluation plan	✓
Program theory	✓
Logic model	✓
Program process flow chart	⊘
Partner or participant process flow chart	✓
Program forms	Not Applicable
✓ Information included in the program manual ⚠ Information partially included in the program manual ⊘ No Information	

Although the program manual is useful and well-designed, the Evaluator has a minor recommendation for its improvement.

- > **Document major changes in the Document Revision section:** In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual. For example, this section should briefly describe the new standardized approach for the program (which is no longer a pilot project), and the use of the term “Efficient Product Installation Service” on the ENSC website (considering that “direct install” is a term unfamiliar to consumers). In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program’s logic model. Econoler is currently working with ENSC to make sure that each program’s updated logic model reflects the current program strategy, and the performance indicators established based on the program theory. The programs’ logic models will all be finalized and included in the programs’ manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the Evaluator’s recommended template for an evaluation plan, which is included as an Appendix of the RDI program manual. The PM provided positive feedback on this important tool that complements the program manual and makes it possible to evaluate the program. The evaluation plan is a great asset to program documentation. In particular, the base case in the evaluation plan is very rich in information.

3.2.4 Program Charts

The program has two process charts: one for the partners and the other for the participants. These charts are very informative for any new staff responsible for the program as well as for program partners and participants.

Econoler has the following recommendation on the program charts:

- > **Provide partners and participants with simplified process charts:** The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well designed. Moreover, the partners should be given copies of their process chart. After all, since these charts are intended for the partners and the participants, they must describe the participation process in a simple way and be distributed

as widely as possible to gain maximum exposure. The version date should be indicated in each chart.

3.2.5 Marketing and Outreach Activities

Due to the restructuring of the residential sector, to avoid program silos and to provide a one-window approach for participants, an integrated marketing plan has been drawn up and is being implemented for this sector. Indeed, ENSC is moving away from program-specific marketing towards a more all-inclusive approach, which offers a full suite of energy-saving services and rebates for customers. Over the last year, a focus was put on developing a customer-centric approach:

- > **Facebook:** Launched in September 2011, the Facebook page is being followed by over 28,000 people, which is a great accomplishment considering that there are fewer than 500,000 potential followers in Nova Scotia. It provides followers with energy saving tips and informs them about special offers, ways to meet with energy-efficiency representatives in person and energy-efficiency contests they can enter. It encourages followers to access all the energy-efficiency services to which they are eligible.
- > **New Website:** ENSC's new website will feature robust categorization (allowing the user to find specific content in a variety of ways), as well as a state-of-the-art predictive index. These combined features will make it easier for the user to locate specific services and for the website to suggest other appropriate services based on the user's needs and online behavioral pattern.
- > **Email Marketing:** Email addresses for e-newsletter communication are collected at various points of contact: home shows, retail in-store engagement events, program application forms and inbound calls.
- > **Customer Relationship Management:** The back-end of the residential services is being re-equipped to fit the customer-centric approach. The systems undergoing development will allow ENSC to call up customer history and provide thoughtful advice on future energy savings, whether through personal contact, direct mail, or online communication.

In addition to the overall residential marketing strategy, RDI also has a specific approach. The pilot projects conducted for Direct Install indicate that there would be little difficulty in promoting the service. Word of mouth accounts for a large amount of uptake, as does viral sharing of the service over Facebook and Twitter. ENSC has designed and developed marketing tools for the DAs, while taking into account the latter's opinions and input. ENSC has designed generic marketing tools to enable rapid movement from one community to another, which is an excellent practice. The program targets low-income households and communities, as well as past participants of other ENSC programs.

The Evaluator has noticed that some upgrades can be sold to the customer at slightly higher prices during the Instant Savings campaigns³ than their respective regular retail prices. When there was no campaign, the prices were comparable. The slightly higher price during campaigns factors in the convenience of the installer coming into the home and performing the installation. This is an appropriate practice.

DAs are responsible for program promotion in their respective areas. Details about their efforts may differ. These activities include making direct contact with customers whose names are provided by ENSC, soliciting in specific areas and responding to participant requests.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that the DAs are monitoring their own marketing activities and that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice, because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

The Evaluator has the following recommendation on the marketing plan:

- > **Make the performance indicators more quantitative:** To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

³ Instant Savings offered discounts on eligible products during two two-month campaigns that took place in the spring and fall of 2012.

3.3 TRACKING SHEET

Econoler reviewed the structure and content of the RDI tracking sheet, which presents information about both the customer and the products installed in one main sheet.

In general, the tracking sheet contains the essential information that the PM and the Evaluator need to continuously monitor the number of participants, the number of each type of product installed and the related energy savings. However, a unique participant identification number is available for only 87 percent of the records. The field reserved for the participant identification number in the tracking sheet should be systematically filled out so that all the participants can be easily identified and tracked.

The tracking sheet also contains fields intended for program administration and evaluation purposes. Participants' names, addresses and contact details (e.g. phone numbers) have been filled out in over 99 percent of the cases, which is really good. In some cases, the information could not be collected because the installation occurred in a vacant multi-residential unit.

In addition, the tracking sheet includes items that collect data critically relevant to the impact evaluation, such as the type of residence, the main and secondary heating sources and the type of hot water heating. The item "county" indicates the participant's geographic location and is very useful for on-site visits planning.

Moreover, for those RDI participants who already participated in another program before RDI, such as Appliance Retirement or Home Energy Assessment, the tracking sheet indicates the name of this previous program. The tracking sheet also indicates if participants were encouraged to take part in other ENSC programs after their participation in RDI. However, ENSC does not track any dedicated identification number that would allow identifying the same participant registered in two different tracking sheets. As a result, it is impossible to keep track of the number of participants who were referred to a specific program and who finally decided to participate in that program.

A significant number of values were missing in the fields used for the impact evaluation or data collection activities, such as on-site visits. Specifically, 30 percent of the rate codes were missing, but ENSC indicated that it had recently started to track this information and that some DAs were having difficulty retrieving this information from participants. Also, when direct installation of products was done in a multi-unit residential building, the tracking sheet did not always give a clear indication about the contact person (landlord or renter) and the number of units visited. ENSC was aware of this issue and is currently working on a way to improve the tracking of multi-residential units for 2013.

The program is aimed at both low-income and non-low-income customers. Since the net-to-gross ratio is different for these two clienteles, it is essential that the tracking sheet allows identifying if the participant is low-income or not. This information was provided for 78 percent of the participants in the tracking sheet, which is sufficient for the Evaluator to establish the respective percentage of low-

income and non-low-income customers. The remaining 22 percent is impossible to determine because these were the participants met during community events where ENSC did not require participants to disclose their income levels. Although ENSC does not confirm the income level of participants during the community events, it uses assumptions based on community averages to determine the low-income factor associated with each community visited. This percentage is then applied to reduce the free-ridership level in the net savings calculations.

In terms of savings, the tracking sheet allows tracking all the calculation details about the gross and net energy savings as well as the parameters used in these calculations. For each category of product, energy savings are calculated with a formula, which makes references to the unitary savings values listed in a separate table. These unitary savings values are mostly based on the 2011 evaluation. The energy savings calculations are based on the quantity of products installed claimed in the tracking sheet. These quantities are clearly identified in the tracking sheet.

Although the tracking sheet is considered relatively complete and sufficient for program monitoring, some improvements could be made to facilitate future program evaluation. The Evaluator recommends the following:

- > **Add a unique identification number for each participant:** For easy identification, each participant needs to have a unique identification number. Without this number, it is more difficult to identify a participant with the available information, such as the name or the address, which can be similar from one participant to another. This information is missing for some participants recorded in the tracking sheet. Therefore, the Evaluator recommends systematically recording a unique identification number for each new participant entered in the tracking sheet.
- > **Identify the products installed in each residential unit:** When direct installation is done in a multi-unit residential building, information should be collected for each individual unit. Currently, the tracking sheet does not provide clear information about this aspect. Neither does it indicate if the contact person is really the program participant, i.e. the renter or the landlord. With the present tracking sheet, the best hope ENSC can have for validation is that, if the entered address shows an apartment number, then the contact person is indeed the program participant. Data collected this way about multi-unit residential buildings could be quite vague and unreliable for field activities (surveys and on-site visits) because it does not allow collecting program participant contact information and monitoring the number of products installed in each unit. In addition, with the present tracking sheet, it is virtually impossible to keep track on the exact number of program participants. Therefore, the PM should have the tracking sheet revised to allow for identifying each individual unit and the participant's name.
- > **Collect information on air conditioning:** The tracking sheet already provides information on the energy source used for space heating and this information is useful for the interactive effects factor calculations. Along these lines, the Evaluator recommends adding a field in the tracking

sheet to collect information on the use of air conditioning units or systems. This additional information would allow more precise estimation of the interactive effects factors.

- > **Make sure that all the fields are systematically filled out:** The tracking sheet is considered relatively complete and sufficient for program monitoring. However, the Evaluator observed that some fields were left blank:
 - Rate code: This field can be used to determine the line loss factor. It was left blank in 35 percent of the records.
 - Heat type: There are two fields, one indicating the main heat type and the other indicating the secondary heat type. The main heat type can be used to establish the interactive effects factor; this field was left blank or listed as “other” in 1 percent of the records. The secondary heat type should also be systematically filled out. When there is no secondary heat type, it should be so stated, thus indicating that the main heat type is used at 100%.

All this information can be useful for field activities (on-site visits and surveys) and impact evaluation. Therefore, it is recommended to ensure that these fields are systematically filled out. A standard procedure should be implemented to ensure that all the information is properly collected and entered in the Tracking Sheet.

- > **Set limitations for entries and develop a validation process:** To ensure the validity of the values entered in the tracking sheet, Econoler recommends that ENSC establishes standard guidelines for information-collecting. For instance, under each category of product, a ‘0’ value should be entered to indicate that no installation has been done. Currently, the tracking sheet presents a mix of ‘0’ values and blank entries. The introduction of such guidelines should also contribute to a better identification process and facilitate the identification of missing entries.

3.4 RELATIONSHIP WITH PARTNERS

As part of the process evaluation, the two DAs involved in the program were interviewed about the transition and transformation that RDI underwent from a pilot program at the beginning of 2012 to a full program in July 2012. According to them, the transition went well, although some issues limited the program delivery.

First, one DA indicated that ramping up to full capacity took longer than expected. DAs need time to plan and carry out their participation process and are often doing this while also maintaining results. Program modifications and their implementation take up the DAs' time and slow down productivity. Moreover, the DAs found that their participation as a program partner was complex because it required incorporating new parameters into a complex and widespread program in a short time-frame, such as managing a large number of office and field staff, ensuring smooth program flow (including ordering, distributing and tracking inventory), meeting results targets weekly and maintaining superior quality assurance throughout. Despite the complexity of the program and the adjustment period required, DAs indicated being satisfied with the overall program and especially with their relationship with ENSC staff and the other DA.

Second, the DAs indicated that the program marketing was one of the major barriers to program delivery. The fact that the program is restricted to certain regions or demographics, as well as the fact that it is available in certain areas at certain times, makes it more difficult to market. Furthermore, it was mentioned that getting marketing materials from idea to product was a lengthy process. Despite this, RDI performed well in terms of participation.

To improve the program, the DAs recommended ramping up outreach and marketing activities. They suggested fixing clear timelines for developing marketing materials as well as conducting more consultations with the DAs in this process. To guarantee success in transition from a pilot to a full program, one DA advised awarding the contract at least one month earlier than the expected start date to allow for planning, particularly when staff additions and changes in program parameters are involved.

3.5 PARTICIPANT PERSPECTIVES

3.5.1 Program Awareness

The RDI-related advertising campaign that ENSC deployed targeted low-income populations in particular (regardless of their geographical locations and property ownership), while also promoting it to participants of other ENSC programs. As part of the telephone survey, RDI non-low-income participants⁴ were asked how they learned about the program to assess ENSC's promotional strategy. As shown by the table below, the promotion efforts did yield positive results.

Advertising (29%), including mailings from ENSC, radio or newspaper commercials or the ENSC website, was the most cited source of awareness. ENSC staff and the DAs (24%) or word of mouth (24%) served as other main sources of awareness. Participation in other ENSC programs (16% - participated in other programs or completed an energy audit) was another source. Overall, almost two thirds (65%) of the non-low-income participants heard about the program through ENSC advertising, through ENSC staff or subcontractors, or as a result of past participation.

Table 5: Sources of Program Awareness

Sources of Program Awareness*	2012
<i>Sample Size</i>	<i>181</i>
TOTAL ADVERTISING	29%
Mailings from ENSC	11%
Radio	8%
Newspaper	6%
ENSC Website	4%
ENSC staff/DA	24%
Co-worker, family, friend	24%
Participated in other programs or completed an energy audit	16%
Brochure/Pamphlet	2%
Other participants	2%
Others	8%
Don't know	5%
*Multiple responses	

⁴ Only non-low-income participants were interviewed as part of the survey. This should be kept in mind while analyzing survey results.

3.5.2 Motivations and Barriers to Participation

When the respondents were asked about their most important motivation for program participation, saving on energy or energy costs was mentioned most frequently (69% of participants offering this as the most important motivation). A small number of participants reported the following as their most important reason for participating: that the program was free (8%); that they wanted to receive CFLs (7%) or LEDs (1%); or that they wanted to contribute to environmental protection (3%).

Table 6: Reasons for Participating

Reasons for Participating	2012	
	Most Important Motivation	Other Important Motivations*
<i>Sample Size</i>	<i>181</i>	<i>179</i>
To save on energy/energy costs	69%	20%
No cost for services/program was free	8%	6%
To receive CFLs	7%	6%
To help protect the environment	3%	7%
To reduce water consumption	1%	2%
To receive LED lights at a discounted price	1%	1%
Comfort	--	1%
Reduce greenhouse gases	--	4%
Others	10%	8%
None/no other reasons	--	41%
Don't know	1%	11%
Refused	--	2%
*Multiple responses		

Most participants (93%) did not have any concerns before participation, while only seven percent had concerns about taking part in the program before participation.

Table 7: Concerns with Program Prior to Taking Part

Concerns with Program Prior to Taking Part	2012
<i>Sample Size</i>	<i>181</i>
No	93%
Yes	7%

A small number of participants reported concerns about the program (n=13), giving various reasons for these concerns. Four participants mentioned that they were uncomfortable about letting strangers into their home or that it could be a scam. Four participants did not believe the program was really free or that they would have to pay some fees. Finally, one participant was worried that the products offered might pose health risks.

Table 8: Concerns about the Program

Concerns about the Program*	2012
<i>Sample Size**</i>	13
It could be a scam/Uncomfortable about letting strangers into home	4
Didn't believe it was really free	4
That I'd have to pay some fees	4
That the products offered might pose health risks	1
Others	3
*Base: Respondents who expressed concerns	
**Multiple responses	

3.5.3 Program Influence

Respondents were asked to rate the importance of various factors in their decision to install energy-efficient products. The results have revealed that free installation of energy-efficient products offered by the program was a major influence on their decision to install energy-efficient products by showing an overall mean of 8.4 on a scale of '0' to '10' with '0' representing "not at all important" and '10' "extremely important". Information or advice provided by the program was also shown as an important factor (with a mean of 7.9), while previous experience with other programs was a less important factor (with a mean of 4.9). These factors have shown relatively consistent ratings across the various products or services.

Table 9: Importance of Factors in Influencing Decision

Importance of Factors in Influencing Decision to Install Energy-Efficient Products	Overall	CFLs	Low Flow Shower-heads	Faucet Aerators	Pipe Insulation, Tank Wraps
<i>Sample Size</i>	181	175	87	60	31
Mean (0 = Not at all important, 10 = Extremely important):					
Free installation of energy-efficient products offered by the program	8.4	8.4	8.6	8.4	8.2
Information or advice provided by the program advisor during the installation	7.9	7.9	8.1	7.5	8.1
Previous experience with a similar program by either Efficiency Nova Scotia or Nova Scotia Power	4.9	4.8	5.2	4.7	4.4

3.5.4 Program Impact

The majority of the households remembered receiving information about energy-efficient products during the installer's visit to their home (75%). One half of the households who received information about energy-efficient products during the installer's visit to their home indicated that this information inspired and caused changes in their behavior in terms of energy use at home (49%). This result shows the importance of giving information to households during the visit, with a view to changing energy consumption behavior.

Table 10: Information Received and Behavioral Changes

Information Received	2012
<i>Sample Size</i>	<i>181</i>
Yes	75%
No	18%
Don't know	8%
Information Led to Behavioral Changes*	2012
<i>Sample Size</i>	<i>135</i>
Yes	49%
No	50%
Don't know	1%
*Base: Respondents who received information	

In terms of the program impact, various changes in participants' behavior have occurred as a result of the information received from the installer about energy-efficient products. To be more specific, almost one half of the participants who received information have indicated turning their lights off (48%). Almost two out of ten now have stronger awareness about power usage or saving energy (18%), while almost one out of ten knows how to use fluorescent lights properly (12%), uses less hot water for laundry (9%), uses energy-efficient light bulbs (9%), has reduced water consumption (9%), or uses appliances more efficiently (8%).

Table 11: Behavioral Changes

Behavioral Changes*	2012
<i>Sample Size**</i>	66
I turn off my lights now	48%
More aware of power usage/saving energy	18%
Aware of how to use CFLs properly/let CFLs warm up	12%
I use less hot water for laundry	9%
I use energy-efficient light bulbs	9%
Reduce water consumption/Not wasting water	9%
Use appliances more efficiently/Run dishwasher at night	8%
I turn off appliances	5%
I set my heating thermostat at lower temperatures	3%
I set my water heater thermostat at lower temperatures	3%
I have decided to participate in ENSC Appliance Retirement	2%
Others	14%
*Base: Respondents who indicated their behavior changed	
**Multiple responses	

3.5.5 Satisfaction with the Program

Participants were highly satisfied with various aspects of the program. Ninety-six percent were satisfied with the program overall, while nearly all of them were satisfied with the time required to complete the work (98%), the quality of the work completed (97%), the energy conservation measures installed (96%), and the communication from the program (95%).

Table 12: Satisfaction with Program

Satisfaction with Program*	2012	
	Sample Size*	%**
Program overall	179	96%
Time required to complete the work	181	98%
Quality of the work completed	181	97%
Energy conservation measures installed	175	96%
Overall communication from the program	181	95%
*Don't know removed from calculations		
**Percentage of respondents who gave a rating of 5 or 4 on a scale where 5= "Very satisfied" and 1= "Not at all satisfied"		

Those who were satisfied with the program mentioned a number of reasons for their satisfaction, including liking the installer who visited their home (35%), good service (28%), energy savings (23%), lowered energy bills (20%), and general satisfaction with the information received (20%).

Table 13: Reasons for Satisfaction with Program

Reasons for Satisfaction*	2012
Sample Size**	171
I liked the installer who visited the home	35%
Good service	28%
Saves energy	23%
Lowered energy bill	20%
Information received/informative	20%
Program was free	8%
Better lights/lighting	8%
Products/services offered through the program	5%
Everything went smooth	4%
Reasonable timeframe	4%
Don't know	2%
Other	5%
*Base: Respondents who were satisfied with the program (giving a rating of '5' or '4')	
**Multiple responses	

A small number of participants were dissatisfied with the program (n=8), giving various reasons for their dissatisfaction. Some did not like the installer who visited their home, some did not like the item installed (including insulation or wrap upgrade, light bulbs, low-flow faucet aerators, or low-flow showerheads), and some others did not see any decrease in their energy bill.

Table 14: Reasons for Dissatisfaction with Program

Reasons for Dissatisfaction*	2012
<i>Sample Size**</i>	8
I don't like the insulation/wrap upgrade	2
I don't like the light bulbs I received	2
Energy bill did not decrease	2
I did not like the installer who visited the home	2
I don't like the low-flow faucet aerators installed	1
I don't like the low-flow showerhead installed	1
Others	2
*Base: Respondents who were dissatisfied with the program (as indicated by a rating of '1', '2' or '3').	
**Multiple responses	

Most participants found it easy to apply to the program, as shown by 92 percent of them giving a rating of '5' or '4' on a 5-point scale with '5' indicating "very easy" and '1' "very difficult".

Table 15: Application Process

Program Application Process	2012
<i>Sample Size*</i>	171
5 - Very easy	81%
4	11%
3	5%
2	2%
1 - Very difficult	2%
*Don't know removed from calculations	

Among the small number of participants with the perception that the program application process was difficult (n=14), six mentioned a lack of adequate advertising or program awareness, while four felt there was a lack of information in general or they were not properly informed about the application process.

Table 16: Causes for Program Application Difficulty

Causes for Program Application Difficulty*	2012
<i>Sample Size</i>	<i>14</i>
Poor advertising/Lack of program awareness	6
Lack of information/not informed about application process	4
Others	2
Nothing	2
*Base: Respondents who had difficulty applying to the program (as indicated by a rating of '1', '2' or '3').	

3.5.6 Participant Recommendations for Improvements

Although the majority (67%) of the participants did not offer any recommendations for improvements, those who did mentioned the following: a better advertising campaign or stronger efforts to build program awareness (13%); a wider range of products or measures installed through the program (6%); more information on products or measures installed (5%); and more effective communication in general (5%).

Table 17: Recommendations for Improvements

Participant Suggestions*	2012
<i>Sample Size</i>	<i>181</i>
Better advertising/program awareness	13%
Offer more products/measures to be installed	6%
Offer more information on the products/measures installed	5%
Improve communication	5%
Rebates for measures already installed/ Compensation for bigger projects	3%
Better/brighter light bulbs	2%
Improve quality of work	1%
Issues with faucet aerator	1%
None/no other recommendations	67%
Others	4%
*Multiple responses	

The products mentioned by those who would have liked to see more products or measures installed through the program (n=5) include solar panels, heat pumps or geothermal, insulation and hot water tank wraps.

Table 18: Energy Efficiency Products that Respondents Would Have Liked Installed

Energy Efficiency Products that Respondents Would Have Liked Installed*	2012
<i>Sample Size**</i>	10
Solar panels	2
Heat pump/Geothermal	2
Insulation	1
Hot water tank wraps	1
No answer	5
Don't know	1
*Base: Respondents who recommended more products/measures to be installed	
**Multiple responses	

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation is aimed at determining the gross and net savings of the program for 2012. Both energy and demand savings were examined in this evaluation. To do so, the following parameters were analyzed by Econoler:

- > unitary savings values used for each category of product;
- > installation rates;
- > demand-to-energy ratio;
- > interactive effects factors;
- > free-ridership; and
- > spillover.

The impact evaluation has resulted from three main activities.

First, Econoler reviewed the unitary savings values used in the program tracking sheet. For each product, Econoler validated the source of data and the parameters used in the calculations. Several unitary savings values were validated last year under the other direct install programs, such as the Low Income Renter program. In these cases, Econoler conducted a literature review to check if more recent studies had been published since then and, if so, validated if updated values should be used to revise the unitary savings calculations.

Second, on-site visits were conducted in order to validate product installation and ensure that there had been no removal. The results of this validation were used to estimate the installation rate for each category of product. These installation rates were then applied to the gross savings calculation. Some technical information obtained from on-site observations and self-declaration, such as the wattages of the lamps replaced, was also used to validate the parameters used in the unitary savings calculations.

Finally, the participant survey was used to measure the free-ridership level of the program and validate whether RDI has generated spillover effects.

4.1.1 On-Site Visit Sampling and Protocol

Sampling Methodology

A total of 100 on-site visits were conducted as part of the 2012 evaluation of ENSC's RDI program. The sampling was carried out in September 2012 based on the tracking sheet, which contained the list of participants and information about all the products installed. The sampling plan included the participants from July to September 2012. The participants from the pilot initiatives that took place at the beginning of the year (January to June 2012) were excluded from the sampling.

The Evaluator's analysis of the tracking sheet showed that the products most commonly installed were CFLs, low-flow showerheads, faucet aerators and LED nightlights. They were installed in more than 1,200 out of a total of 1,937 participating homes and account for 91% of the total tracked energy savings⁵. Therefore, the sampling was made to select households that had at least CFLs, low-flow showerheads, faucet aerators and LED nightlights installed. Once the screening was done on the initial list of participants by applying this criterion, a random selection was made. Afterwards, Econoler ensured that hot water tank wraps, pipe insulation and LEDs were also covered in the sample.

In addition, a list of regions where most of the installations took place was established for the selection. The following areas were considered:

- > Halifax County;
- > Pictou County;
- > Cape Breton County;
- > Lunenburg County.

Finally, Econoler tried to remove from the sample all the multi-unit residential buildings for which the products installed were tracked for the whole building, but no details were recorded on the number of products installed in each individual unit.

On-Site Visit Protocol

The on-site visits were conducted to validate the installation of the products according to the data found in the tracking sheet and to establish the percentage of products removed, if any, and the causes for removing them after installation. Moreover, technical information was collected through on-site observations or homeowner interviews in order to validate the assumptions used to calculate the product unitary savings:

- > lighting products: the type of lamp replaced and the wattage of the lamp replaced;
- > hot water tank wraps: the tank size and the energy source for domestic hot water (DHW) heating;
- > faucet aerators: the location of the units and the energy source for DHW heating; and
- > low-flow showerheads: the energy source for DHW heating.

4.2 GROSS SAVINGS

The quantities of products installed under the program were computed in the tracking sheet. For each product, ENSC uses a unitary savings estimate that is based on past evaluation results, a literature review and technical data collected on-site.

⁵ Information from the preliminary tracking sheet, as per September 2012.

The following sections describe how these unitary savings values were estimated by ENSC and present Econoler's review of these values based on the most recent studies and data collected during the on-site visits. In many cases, Econoler based its review on the 2011 Ontario Power Authority (OPA) Prescriptive Measures and Assumptions report⁶, which is considered as a recent and reliable secondary data source.

4.2.1 CFLs

Tracked Savings

In the tracking sheet, the quantity of CFLs installed was recorded according to the wattages of the old incandescent lamp replaced and the new CFL installed. Therefore, five categories of CFLs are listed in the tracking sheet:

- > 13-watt CFLs replacing a 40-watt incandescent lamp;
- > 13-watt CFLs replacing a 60-watt incandescent lamp;
- > 23-watt CFLs replacing a 60-watt incandescent lamp;
- > 23-watt CFLs replacing a 100-watt incandescent lamp; and
- > specialty CFLs.

ENSC uses a different unitary savings value for each category, based on the difference between the old and new wattages. For instance, the "13-watt CFLs replacing a 40-watt incandescent lamp" category corresponds to a displaced wattage of 27 watts (40W – 13W).

For specialty CFLs, ENSC uses a value from the 2011 evaluation report of the Retail Markdown Program. The displaced wattage was calculated for all the CFLs sold through the program, based on the average wattage of the CFLs sold (14.4 watts) and the average equivalent power of the incandescent lamps replaced (64.9 watts), resulting in a displaced wattage of 50.5 watts.

For all these lighting products, ENSC uses a value of 2.7 hours per day as the number of hours of operation. This value was revised by Econoler in the 2011 evaluation reports of ENSC's residential programs. It is based on a metering study conducted for Hydro-Québec's residential lighting program⁷.

The following equation is used to calculate the unitary savings values based on the real displaced wattage associated with each category of CFL installed and the hours of operation of 2.7 hours per day.

⁶ Ontario Power Authority (OPA), "2011 Prescriptive Measures and Assumptions," Release Version 1, March 2011.

⁷ Econoler, "Evaluation Report: Programme Produits Mieux Consommer – Éclairage résidentiel, presented to Hydro-Québec," Québec, March 30, 2011.

$$\text{Annual Unitary Savings} \left[\frac{\text{kWh}}{\text{yr}} \right] = \frac{(\text{Old Wattage} - \text{New Wattage}) \times 2.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}}$$

The table below summarizes the unitary savings values used by ENSC in the tracking sheet.

Table 19: Tracked Unitary Savings Values for Each Category of CFL

Category of CFL	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)
13W replacing 40W	40	13	27	2.7	26.6
13W replacing 60W	60	13	47	2.7	46.3
23W replacing 60W	60	23	37	2.7	36.5
23W replacing 100W	100	23	77	2.7	75.9
Specialty	64.9	14.4	50.5	2.7	49.8

Revised Savings

All of these values were reviewed by Econoler during this evaluation. To do so, the Evaluator analysed the information on lamp wattages collected during on-site visits and conducted a literature review to validate the hours of operation.

Displaced Wattage

For 13-watt and 23-watt CFLs, Econoler considers that the displaced wattage, based on the real wattage values of the old lamp replaced and the new lamp installed, is adequate. Moreover, the vast majority of participants who remembered the old lamps that were in place before the replacement confirmed the wattage information collected in the tracking sheet during the on-site visits.

According to the light output equivalency between incandescent lamps and CFLs, 13-watt CFLs have a light output level equivalent to that of 40-watt or 60-watt incandescent lamps. This supports the replacements with 13-watt CFLs that were made by ENSC. In the case of 23-watt CFLs, their light output level corresponds to that of 75-watt or 100-watt incandescent lamps. ENSC is aware of that and indicated that it only uses a 23-watt CFL to replace a 60-watt incandescent lamp when it notices that the lamp is located in a high traffic area or in a basement where the participant may need a higher level of lighting. In the tracking sheet, these particular cases occur only in less than 1 percent of the 60-watt incandescent lamp replacements. Therefore, Econoler agrees with the displaced wattage values used by ENSC, and no revision is required for 13-watt and 23-watt CFLs.

For specialty CFLs, the number of sites visited that had these particular products installed was too low to draw any conclusion on the displaced wattage value used by ENSC. Therefore, Econoler considers it justified to continue using the displaced wattage value obtained from Instant Savings (also known as

the Retail Markdown Program). For 2012, a specific displaced wattage was calculated for the specialty CFLs sold through Instant Savings. This value was based on the average wattage of the specialty CFLs sold (14.5 watts) and the average equivalent power of the incandescent lamps replaced (61.4 watts), resulting in a displaced wattage of 46.9 watts.

For the CFLs installed during the pilot initiatives that took place at the beginning of the year, the information provided in the tracking sheet did not include the wattage value of the lamp replaced and, in some cases, did not even specify the wattage of the CFL installed. For 13-watt CFLs, ENSC used the unitary savings value established for a 13-watt CFL replacing a 60-watt incandescent lamp. For 23-watt CFLs and the CFLs without wattage information, ENSC used a unitary savings value of 69.5 kWh, which corresponds to the unitary savings value associated with a 23-watt CFL replacing an incandescent lamp of 93.5 watts on average and with 2.7 hours of operation per day.

Hours of Operation

Econoler considers that metering data, when available, should always be prioritized over self-declaration estimates which may be influenced by respondent behavioural factors. Therefore, Econoler looked for metering studies on the daily usage of residential lighting to validate the hours of operation of CFLs. The table below presents the results of this literature review.

Table 20: Daily Usage of CFLs from Metering Studies

Source	Hours of Use (h/day)		Number of homes	Number of loggers	Metering Period
	Indoor	Outdoor			
BC Hydro, 2009 ⁸	2.43	-	18	77	2004
California, 2005 ⁹	2.28	3.1	375	752	2003-2004
Hydro-Québec, 2011 ¹⁰	2.68	3.6	200	787	2010
Michigan, 2012 ¹¹	2.2	3.0	152	628	2010-2012
New England States, 2009 ¹²	2.8		157	661	2008

Since the last evaluation, new studies have been published, including one for Michigan and an updated one for the New England states. However, the Hydro-Québec study is still considered as the

⁸ Power Smart Evaluation and Research, "Milestone Report: Lighting Program – CFL Component Evaluation for Fiscal Year 2009," Prepared for BC Hydro, September 28, 2009.

⁹ KEMA, "CFL Metering Study – Final Report," Oakland, California, February 25, 2005.

¹⁰ Econoler, "Evaluation Report: Programme Produits Mieux Consommer – Éclairage résidentiel, presented to Hydro-Québec," Québec, March 30, 2011.

¹¹ Opinion Dynamics & The Cadmus Group, "CFL Hours of Use Study Summary of Approach and Results," July, 2012.

¹² Nexus Market Research, RLW Analytics & GDS Associates, "New England Residential Lighting Markdown Impact Evaluation," Submitted to: Markdown and Buydown Program Sponsors in Connecticut, Massachusetts, Rhode Island, and Vermont, January 20, 2009.

most appropriate for Nova Scotia since it was conducted in households located in the province of Québec, i.e. households with similar numbers of hours of illumination per year. Moreover, its study uses one of the largest samples and has one of the biggest numbers of loggers installed.

Therefore, Econoler considers that ENSC should continue using the results from the Hydro-Québec study to estimate the daily CFL usage. As with last year's evaluation, the proportions of CFLs installed inside and outside the residence were used to calculate the overall hours of operation to be applied to all the CFLs installed under RDI. Since this information was not collected in the tracking sheet, Econoler used the proportions estimated for all residential households in Nova Scotia. A socket study conducted for ENSC in 2011 to investigate CFL installations across Nova Scotia revealed that 94 percent of CFLs are installed inside houses and the remaining 6 percent are installed in outdoor sockets. This information comes from a socket study conducted for ENSC in 2011 to investigate CFL installations. Based on these parameters, the estimate of the overall hours of operation used for CFLs remains 2.7 hours per day:

$$\text{Overall Hours of Operation} = \left(94\% \times 2.68 \frac{h}{\text{day}}\right) + \left(6\% \times 3.6 \frac{h}{\text{day}}\right) = 2.7 \frac{h}{\text{day}}$$

Unitary Savings

The unitary savings values were revised according to the Evaluator's review of the displaced wattage values and the hours of operation. The table below presents the final unitary savings values revised for each category of CFL. The last column of the table indicates whether the value is different from the one used in the tracking sheet.

Table 21: Revised Unitary Savings Values for Each Category of CFL

Category of CFL	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)	Tracked Value
13W replacing 40W	40	13	27	2.7	26.6	26.6
13W replacing 60W	60	13	47	2.7	46.3	46.3
23W replacing 60W	60	23	37	2.7	36.5	36.5
23W replacing 100W	100	23	77	2.7	75.9	75.9
Specialty	61.4	14.5	46.9	2.7	46.2	49.8

To establish a unitary savings value for the CFLs installed during the pilot initiatives, Econoler calculated the proportion of CFLs installed in each category through the current program (from July 2012 to December 2012) and used these proportions to establish the quantity of CFLs installed in each category through the pilot initiatives.

4.2.2 LED Lamps

Tracked Savings

LED lamps are also offered to the RDI participants. In the current tracking sheet, the quantity of LED lamps installed is recorded under four different categories:

- > 8-watt LED lamps replacing a 40-watt incandescent lamp;
- > 8-watt LED lamps replacing a 60-watt incandescent lamp;
- > 12-watt LED lamps replacing a 40-watt incandescent lamp; and
- > 12-watt LED lamps replacing a 60-watt incandescent lamp.

As for CFLs, the unitary savings estimate for each category of product is based on the real wattage values of the new LED lamp and the old incandescent lamp it replaces, as well as the hours of operation of 2.7 hours per day.

The unitary savings values presented in Table 22 were calculated by ENSC using the following equation for each category of LED:

$$\text{Annual Unitary Savings} \left[\frac{\text{kWh}}{\text{yr}} \right] = \frac{(\text{Old Wattage} - \text{New Wattage}) \times 2.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}}$$

Table 22: Tracked Unitary Savings Values for Each Category of LED

Category of LED	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)
8W replacing 40W	40	8	32	2.7	31.5
8W replacing 60W	60	8	52	2.7	51.3
12W replacing 40W	40	12	28	2.7	27.6
12W replacing 60W	60	12	48	2.7	47.3

For the LED lamps installed during the pilot initiatives that took place at the beginning of the year, the information provided in the tracking sheet did not include any details on the LED lamp wattage or the wattage of the lamp it replaced. ENSC used a unitary savings value of 39.4 kWh for all LED lamps installed through the pilot initiatives.

Revised Savings

All of these values were reviewed by Econoler during this evaluation. To do so, the Evaluator analysed the information on lamp wattages collected during on-site visits and conducted a literature review to validate the hours of operation.

Displaced Wattage

The different possibilities of replacements proposed by ENSC with LED lamps are consistent with the light output equivalencies defined by the manufacturer for similar products. Therefore, Econoler concludes that ENSC's displaced wattage calculations, based on the real wattage values of the old lamp replaced and the new LED lamp installed, are adequate.

Hours of Operation

To our best knowledge, no organization has measured and released reliable and trustworthy statistics on the hours of operation of LED lamps installed in residential facilities. Since nothing has indicated that the value for LEDs should be significantly different from that for CFLs, Econoler decided that the hours of operation of 2.68 hours per day estimated for indoor CFLs should also be used for LED lamps. This slight difference from the 2.7 hours used for CFLs comes from the fact that 8-watt and 12-watt LEDs are only installed inside the house.

Unitary Savings

The unitary savings values were revised according to the Evaluator's review of the displaced wattage values and the hours of operation. The table below presents the final unitary savings values revised for each category of LED. The last column of the table indicates whether the value is different from the one used in the tracking sheet.

Table 23: Revised Unitary Savings Values for Each Category of LED

Category of LED	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)	Tracked Value
8W replacing 40W	40	8	32	2.68	31.3	31.5
8W replacing 60W	60	8	52	2.68	50.9	51.3
12W replacing 40W	40	12	28	2.68	27.4	27.6
12W replacing 60W	60	12	48	2.68	47.0	47.3

To establish a unitary savings value for the LED lamps installed during the pilot initiatives, Econoler calculated the proportion of LED lamps installed in each category through the current program and used these proportions to establish the quantity of LED lamps installed in each category of product through the pilot initiatives.

4.2.3 LED Nightlights

Tracked Savings

For the LED nightlights installed through RDI, ENSC uses an estimated unitary savings value of 29.3 kWh per year. This value is based on last year's evaluations of ENSC's residential programs¹³. The assumptions used to make the savings calculation are presented in the table below.

Table 24: Tracked Unitary Savings Value for LED Nightlights

Parameter	Value
Old Wattage (incandescent nightlight)	7 W
New Wattage (LED nightlight)	0.3 W
Average Displaced Wattage	6.7 W
Operating Time	12 h/day
Unitary Savings	29.3 kWh/year

Revised Savings

Only one model of LED nightlights is installed under RDI and it has a wattage value of 0.3 W¹⁴, which corresponds to the wattage value used for LED nightlights in the unitary savings calculation.

Under RDI, new LED nightlights installed must replace old traditional nightlights. By investigating the different nightlight models offered on the market, Econoler has found that traditional nightlights generally consist of a 7-watt incandescent light bulb.

Therefore, the average displaced wattage of 6.7 W (7W – 0.3W), revised in last year's evaluation, should remain the same since there have been no changes in the type of LED nightlight installed and the incandescent models available and employed for standard practice.

As for the hours of operation, ENSC uses a value of 12 hours per day, which represents a nightlight remaining turned on all night. This value is based on the Technical Reference Manual used by the Pennsylvania Public Utility Commission¹⁵. Econoler has not found any other studies to support this value. However, the Evaluator considers the value of 12 hours per day to be realistic. The LED nightlights installed through the program are equipped with a photocell that automatically turns on the nightlight when it gets dark. Therefore, the nightlights installed in rooms not affected by daylight are

¹³ LED nightlights were installed under the Low Income Renter, Multi-Unit Residential Renter, EnerGuide for Existing Houses and Low Income programs.

¹⁴ LED Night-Light with Photocell – 0.3 watt, Niagara, SKU: N9277.

¹⁵ Pennsylvania Public Utility Commission, "Technical Reference Manual," State of Pennsylvania, June 2011, pages 42-43.

likely to remain on for several hours during the day. For nightlights installed in rooms affected by daylight, there is a potential operating time of 12 hours per day since the average time of illumination in Halifax is 12.22 hours per day¹⁶.

The Evaluator considers that the displaced wattage of 6.7 W (7W – 0.3W) and the average hours of operation of 12 hours per day are adequate. Consequently, the unitary savings value of 29.3 kWh per year used for LED nightlights remains unchanged.

4.2.4 Faucet Aerators

Tracked Savings

For all faucet aerators installed through RDI, ENSC uses a unitary savings value of 176.3 kWh per year. This value comes from the 2011 OPA Prescriptive Measures and Assumptions report, which is cited at the beginning of this section.

The OPA reports a base flow rate of 2.2 gpm (8.33 L/min) having been reduced to 1.5 gpm (5.68 L/min) as a result of installing the faucet aerator and this represents a reduction of 31.8 percent. The daily use of hot water is estimated at 28.27 liters per day per faucet. It translates into a total amount of 8.81 liters per day in hot water consumption for a typical household with an average of three faucets (one in the kitchen and two in the bathroom). Therefore, the unitary savings value used by ENSC corresponds to an average value per faucet, assuming that all faucets in a household have the same amount of usage.

Revised Savings

The faucet aerators installed through RDI are currently being registered in the tracking sheet with an indication of their respective faucet locations, i.e. the kitchen or the bathroom. Econoler looked up studies that had estimated unitary savings values based on the location of the faucet. This research has failed to find specific savings estimates, or at least specific assumptions on the flow rate and the daily use of hot water, that take into account the faucet locations. Similar to the OPA, most jurisdictions estimate an average annual savings divided equally across all faucets in a household.

Therefore, Econoler decided to keep using the average savings value of 176 kWh per faucet aerator, regardless of the location. The OPA based its savings calculation on a typical household with an average of three faucets, one in the kitchen and two in the bathroom, which is in line with the quantities of faucets installed through RDI. Indeed, slightly more than one third (39%) of the faucet aerators recorded in the tracking sheet were installed in the kitchen. In addition, the flow rate

¹⁶ National Research Council Canada, Sunrise/Sunset Calculator, Standard times of solar rise/set for Halifax NS 2012, Date modified: 2012-08-07, www.nrc-cnrc.gc.ca.

assumptions used by the OPA are considered adequate since they correspond to those found in other reference documents such as the Massachusetts Technical Reference Manual¹⁷.

4.2.5 Low-Flow Showerheads

Tracked Savings

For low-flow showerheads, ENSC uses specific unitary savings values corresponding to one of the following three categories of flow-rate reduction:

- > low-flow showerhead with 0.5 gpm reduction;
- > low-flow showerhead with 0.75 gpm reduction; and
- > low-flow showerhead with 1.0 gpm reduction.

The table below presents the unitary savings value estimated by ENSC for each category of flow-rate reduction. These values were estimated from the unitary savings value of 377 kWh provided in the 2011 OPA Prescriptive Measures and Assumptions report for a flow-rate reduction of 0.75 gpm.

Table 25: Tracked Unitary Savings Values for Low-Flow Showerheads

Parameters	0.5 gpm Reduction	0.75 gpm Reduction	1.0 gpm Reduction
Unitary Savings Value	251 kWh	377 kWh	503 kWh

Revised Savings

Econoler reviewed these unitary savings values, based on the engineering equations used by other jurisdictions to estimate energy savings from the installation of a low-flow showerhead. The conclusion of this analysis is presented in the table below.

Table 26: Revised Unitary Savings Values for Low-Flow Showerheads

Parameters	0.5 gpm Reduction	0.75 gpm Reduction	1.0 gpm Reduction
Old Flow Rate	1.75 gpm	2.00 gpm	2.25 gpm
New Flow Rate	1.25 gpm		
Average Number of Showers	2.3 showers/day		
Average Showering Time	7.5 minutes/shower		
Unitary Savings Value	288 kWh	377 kWh	607 kWh

¹⁷ Mass Save, Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures, 2012 Program Year – Plan Version, October 2011, pages 327-328.

These revised values were used for this year's impact evaluation.

The low-flow showerheads installed during the pilot initiatives were only recorded into one main category, without specifying the flow-rate reduction. Therefore, as with CFLs and LED lamps, Econoler used the proportion of low-flow showerheads installed in each category through the current program (from July 2012 to December 2012) to establish the quantity of each category of low-flow showerheads installed through the pilot initiatives.

4.2.6 Pipe Insulation

Tracked Savings

Pipe insulation is installed under RDI. For each unit of pipe insulated, ENSC uses a savings value of 74 kWh per year. This value comes from the 2009 impact evaluation report of the Low Income Homeowner program. The calculation was based on an insulated pipe 10-foot-long and 0.75-inch in diameter, which were considered as common length and size in residential applications.

Revised Savings

In the tracking sheet, the number of pipe insulation units was reported based on lengths of insulated pipe that varied depending on the DA. For instance, one DA used 15-foot intervals to calculate the number of units installed, while another used 9-foot intervals. Using the detailed assumptions found in the OPA report, the unitary savings value of 74 kWh used by ENSC corresponds approximately to the value calculated for six feet of insulation.

Table 27: Unitary Savings Values by Length of Insulated Pipe

Length of Insulated Pipe	Unitary Savings Value
3 feet	38 kWh/year
6 feet	76 kWh/year
9 feet	114 kWh/year
12 feet	152 kWh/year
15 feet	190 kWh/year

While three feet seems to be a common length when purchasing pipe insulation, the length of pipe insulated for residential applications typically varies between 6 and 15 feet, according to the literature. The length of pipe that can be insulated in a house is often limited, since the largest portion of the pipes is hidden in the walls. In the savings calculation, it is assumed that the pipe insulation is installed immediately downstream of the hot-water storage tank, where most of the heat loss would occur. Moreover, the general equation used to calculate the energy savings cannot be used on an infinite

length of insulated pipe, since it assumes that the water temperature is uniform throughout the insulated portion of the pipe.

For this year's evaluation, since no information on the length of insulation installed was collected in the tracking sheet, Econoler will use a unitary savings value of 76 kWh per year, based on the OPA report and a six-foot insulated pipe (compared to the 74-kWh value currently used and for which we do not have all the calculation details).

Nonetheless, for 2013, Econoler recommends collecting the specific length (in feet) of insulation installed in each unit and limiting the installation of insulation to the first 15 feet.

4.2.7 Hot Water Tank Wraps

Tracked Savings

Hot water tank wraps are also installed under RDI. For this product, ENSC uses a unitary savings value of 270 kWh per year, based on the 2011 OPA Prescriptive Measures and Assumptions report. This value is based on a conductance value of 1.429 W/°C for a heater without a tank wrap and of 0.6348 W/°C for an insulated heater with a tank wrap.

Revised Savings

Econoler reviewed the assumptions and the engineering calculations used by the OPA. The thermal resistances used for the bare tank and the wrapped tank are accurate. The size of the tank in the OPA's scenario (50 gallons) is a little bit larger than what was found during on-site visits (an average tank size of 43 gallons), but this parameter does not have any impact on the unitary savings calculation. Therefore, Econoler concludes that the unitary savings value of 270 kWh per year for hot water tank wraps is adequate.

4.2.8 Programmable Thermostats

Tracked Savings

Programmable thermostats were installed through the pilot initiatives. For this product, ENSC uses a unitary savings value estimated at 221 kWh. This value comes from the 2011 evaluations of some residential programs. It is based on the 2009 evaluation of Hydro-Québec's Residential Electronic Thermostats in New Construction program¹⁸, which includes the estimates of energy savings generated by the thermostat accuracy and the temperature setback, as shown in the table below.

¹⁸ Econoler, "Évaluation du programme thermostats électroniques – Volet nouvelle construction au marché résidentiel," Final Report presented to Hydro-Québec, February 9, 2009.

Table 28: Main Outputs from Hydro-Québec's Evaluation of Electronic Thermostat Savings

Gross Energy Savings per Thermostat	Housing Type		
	Single-Detached	Duplex / Triplex / Townhouse	Apartment
Unitary savings for electronic thermostat accuracy	121 kWh	94 kWh	61 kWh
Unitary savings for temperature setback	100 kWh	201 kWh	118 kWh
Total unitary savings value	221 kWh	295 kWh	179 kWh

The unitary savings value of 221 kWh used by ENSC was calculated based on the gross energy savings generated by the thermostat accuracy and by the temperature setback for single-detached houses since the information on the housing type was not available in last year's tracking sheet. This choice was conservative since single-detached houses represent a large portion of houses in the Nova Scotia market and programmable thermostats installed in single-detached houses generate lower savings than those installed in duplex, triplex or townhouses.

Revised Savings

For the programmable thermostats installed through RDI, information on the housing type was available for more than 85 percent of the installations. Therefore, Econoler adjusted the unitary savings value by taking into account the proportion of each housing type where programmable thermostats were installed. According to the information provided in the tracking sheet for the pilot initiatives, 93 percent of the thermostats were installed in apartments, 4 percent in single-detached houses and 3 percent in duplex/triplex/townhouses. Based on all this information, the unitary savings value for programmable thermostats was adjusted to 184 kWh per year.

4.2.9 Electric Kettles

Tracked Savings

A few electric kettles were installed through the pilot initiatives. The unitary savings value used by ENSC for this product is 49 kWh per year. This value is based on the results from a study conducted by Navigant and for which the calculation details were not available. This value had also been used in previous evaluations of the Low Income program.

Revised Savings

As with the 2011 evaluations, Econoler has not found secondary information on energy savings estimates for electric kettles. Since this product had only been installed during the pilot initiatives, Econoler considers that the unitary savings value of 49 kWh per year should be maintained for gross savings calculations in this year's evaluation.

4.2.10 Installation Rate

During the 2011 evaluation of ENSC's residential direct install programs, a few discrepancies were found in the quantity of products installed when compared to the quantity claimed in the tracking sheet. However, the number of on-site visits was not sufficient to establish installation rates with a sufficient level of precision. The Evaluator has therefore recommended increasing the number of on-site visits to be conducted in future evaluations.

In 2012, the number of on-site visits was set at 100 to better validate whether the products were properly installed according to the information contained in the tracking sheet and, if possible, to establish installation rates with a sufficient level of precision.

For each site visited, the quantity of products installed was recorded and compared to the quantity indicated in the tracking sheet. When the number of products found on-site was different from that in the tracking sheet, the ratio between the two numbers was calculated to establish the installation rate. The percentage of products installed was measured for all the products installed through the program, except thermostats and electric kettles. The installation rate for these products is considered to be 100 percent since they were only installed through the pilot initiatives and since the number of sites where thermostats and electric kettles were installed was really small.

The table below shows the percentages of products installed calculated from the on-site visits and the installation rates applied to the quantity of products installed in the gross savings calculation.

Table 29: Percentages of Products Installed and Installation Rates

Category of Product	Quantity Installed – From Tracking Sheet	Quantity Installed – From On-Site Visits	Percentage of Products Installed	Installation Rate	Error Margin ¹⁹
CFL	1,987	1,936	97%	97%	1.9%
LED Lamp	10	10	100%	100%	0.0%
LED Nightlight	195	186	95%	95%	2.9%
Faucet Aerator	234	227	97%	97%	1.6%
Low-Flow Showerhead	132	131	99%	99%	0.6%
Pipe Insulation	45	44	98%	98%	3.7%
Hot Water Tank Wrap	55	54	98%	98%	3.1%

The on-site visits demonstrated the accuracy of the information collected in the tracking sheet as well as a really low level of product removal by participants. This resulted in very high installation rates.

¹⁹ Calculated with a confidence interval of 90%.

LED nightlights showed the lowest installation rate. Established at 95 percent, this is not considered as problematic by the Evaluator. However, the Evaluator noticed one main issue during the on-site visits that could be addressed in the future in order to avoid LED nightlight removal. In some cases where the LED nightlights installed through the program were removed afterwards, the participants declared that they had removed or given away their nightlights because they did not need them. All of these cases occurred when more than one LED nightlight was installed. In fact, for more than three quarters of the homes visited during this evaluation, two LED nightlights or more were installed. Thus, the Evaluator recommends that before offering a LED nightlight the installer ensure there is a real need for nightlights in the household and that the LED nightlights would replace old incandescent nightlights that are used on a regular basis.

4.2.11 Demand-to-Energy Ratio

Econoler calculated the demand savings for RDI based on an demand-to-energy ratio of 0.228 MW/GWh. This ratio was obtained from the adjusted 2012 program targets, by dividing the target peak demand savings by the target energy savings.

4.2.12 Revised Gross Savings

The annual gross savings for each category of product installed through the program are presented in Table 30. They were calculated using the revised unitary savings values presented in the previous section. Overall, the total gross energy and demand savings amount to 42.207 GWh and 9.623 MW at the meter.

The gross savings at generator level are also estimated in Table 30, using a line loss factor between the meter and the generator of 1.100. This value was provided by Nova Scotia Power for residential customers: more than 99 percent of RDI participants have residential rate codes, and the few remaining participants are multi-unit renters belonging to the commercial sector. They correspond to energy and demand savings of 46.427 GWh and 10.585 MW.

Table 30: Evaluation Results – Gross Energy and Demand Savings by Product (Lighting Products)

Category of Product	CFLs					LED Lamps				LED Night-light
	13W Replacing 40W	13W Replacing 60W	23W Replacing 60W	23W Replacing 100W	Specialty CFLs	8W Replacing 40W	8W Replacing 60W	12W Replacing 40W	12W Replacing 60W	
Energy Savings										
Number of Units (Jan. to June)	1,057	195,848	300	31,303	-	857	1,291	86	615	23,650
Number of Units (July to Dec.)	1,220	225,986	436	45,412	367	73	110	12	86	11,980
Total Number of Units	2,277	421,834	736	76,715	367	930	1,401	98	701	35,630
Installation Rate	97%	97%	97%	97%	97%	100%	100%	100%	100%	95%
Total Number of Units Installed	2,209	409,179	714	74,414	356	930	1,401	98	701	33,849
Unitary Savings Value (kWh)	26.6	46.3	36.5	75.9	46.2	31.3	50.9	27.4	47.0	29.3
Total Gross Energy Savings – at Meter (GWh)	0.059	18.945	0.026	5.648	0.016	0.029	0.071	0.003	0.033	0.992
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Gross Energy Savings – at Generator (GWh)	0.065	20.839	0.029	6.213	0.018	0.032	0.078	0.003	0.036	1.091
Demand Savings										
Demand-to-Energy Ratio (MW/GWh)	0.228	0.228	0.228	0.228	0.228	0.228	0.228	0.228	0.228	0.228
Total Gross Demand Savings – at Meter (MW)	0.013	4.319	0.006	1.288	0.004	0.007	0.016	0.001	0.008	0.226
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Gross Demand Savings – at Generator (MW)	0.015	4.751	0.007	1.417	0.004	0.007	0.018	0.001	0.008	0.249

Table 31: Evaluation Results – Gross Energy and Demand Savings by Product (Other Products)

Category of Product	Faucet Aerator	Low-Flow Showerhead			Pipe Insulation	Hot Water Tank Wrap	Program-mable Thermostat	Electric Kettle	Total for Lighting and Other Product Categories
		0.5 gpm Reduction	0.75 gpm Reduction	1.0 gpm Reduction					
Energy Savings									
Number of Units (Jan. to June)	10,539	475	1,545	3,103	5,551	7,459	630	2,547	-
Number of Units (July to Dec.)	15,845	814	2,648	5,317	5,150	7,093	0	0	-
Total Number of Units	26,384	1,289	4,193	8,420	10,701	14,552	630	2,547	-
Installation Rate	97%	99%	99%	99%	98%	98%	-	-	-
Total Number of Units Installed	25,592	1,276	4,151	8,336	10,487	14,261	630	2,547	-
Unitary Savings Value (kWh)	176	288	377	607	76	270	184	49	-
Total Gross Energy Savings – at Meter (GWh)	4.504	0.368	1.565	5.060	0.797	3.850	0.116	0.125	42.207
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Energy Savings – at Generator (GWh)	4.955	0.404	1.721	5.566	0.877	4.236	0.128	0.137	46.427
Demand Savings									
Demand-to-Energy Ratio (MW/GWh)	0.228	0.228	0.228	0.228	0.228	0.228	0.228	0.228	-
Total Gross Demand Savings – at Meter (MW)	1.027	0.084	0.357	1.154	0.182	0.878	0.026	0.028	9.623
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Gross Demand Savings – at Generator (MW)	1.130	0.092	0.392	1.269	0.200	0.966	0.029	0.031	10.585

4.3 INTERACTIVE EFFECTS

In a residence, interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as heating and cooling. In the case of RDI, replacement of incandescent lighting products with CFLs or LEDs causes an increase in the heating load during winter and a decrease in the cooling load during summer. Indeed, energy-efficient lighting, such as CFLs or LEDs, releases less heat than the less efficient lamp it replaces.

For lighting products, the evaluation of the interactive effects factor is based on a study conducted by ADS in 1992 for Hydro-Québec. The work carried out in this study was intended to modify certain parameters in simulations of an average home in Quebec to determine the impact of these changes on the interactive effects. The simulations were performed with the DOE-2 software²⁰ and focused on homes heated entirely by electricity. The simulations were carried out considering three scenarios for interactive effects: low, moderate and high interactive effects. The scenario with minimum interactive effects was finally selected for the calculation because it reflects the evolution of homes since 1992.

The table below presents the calculation details of the interactive effects factor for indoor CFLs, LED lamps and LED nightlights. It reflects the proportion of RDI participants in 2012 who are heated electrically and the proportion of residences that use air conditioning in Nova Scotia. In fact, the share of participants who are heated electrically (32%) was recorded in the tracking sheet. However, ENSC did not compile any information on air conditioning. As a result, Econoler used the Statistics Canada²¹ figure for the percentage of households using air conditioning in Nova Scotia (18%).

Table 32: Interactive Effects Calculation for Lighting Products

Parameter	% of Residences ²²	Interactive Effects ²³
Electric heating with air conditioning	$32\% \times 18\% = 5.8\%$	-54.4%
Electric heating without air conditioning	$32\% \times 82\% = 26.2\%$	-58.0%
No electric heating with air conditioning	$68\% \times 18\% = 12.2\%$	3.6%
No electric heating without air conditioning	$68\% \times 82\% = 55.8\%$	0.0%
Weighted Interactive Effects Factor	100%	-17.9%

²⁰ DOE-2 is a widely used and accepted software building energy analysis program developed under funding from the U.S. Department of Energy.

²¹ Statistics Canada (CANSIM), Households having air conditioning, Nova Scotia, 2009.

²² From DA information and Statistics Canada.

²³ ADS ASSOCIÉS, "Évaluations des effets énergétiques combinés des mesures d'économies d'énergie – résidence unifamiliale," report presented to Hydro-Québec, 1992.

These interactive effects occur only when the products are installed inside the house. As CFLs installed through the program are also used for outdoor lighting, the interactive effects factor for these products was adjusted to take that into account. To do so, Econoler used the same proportions as those used to calculate the hours of operation, being 94 percent of CFLs installed inside houses and the remaining 6 percent installed in outdoor sockets. This information comes from a socket study conducted for ENSC in 2011 to investigate CFL installations. For LED lamps and LED nightlights, the interactive effects factor remains equal to -17.9 percent.

Table 33: Interactive Effects Factors for CFLs, LED Lamps and LED Nightlights

Category of Product	% Indoor	% Outdoor	Interactive Effects Factor
CFL	94%	6%	$(94\% \times -17.9\%) + (6\% \times 0\%) = \mathbf{-16.8\%}$
LED Lamp	100%	0%	-17.9%
LED Nightlight	100%	0%	-17.9%

For pipe insulation and hot water tank wraps, interactive effects of -100 percent are considered during the heating period in electrically heated houses. This estimation is based on the fact that, when there is no insulation, all the heat lost through the pipes and the hot water tank is released into the room. It means that 100 percent of the energy released from the hot water is used for the heating load. Conversely, during the cooling period, interactive effects are estimated at +100 percent in houses that use air conditioning. Based on the heating and cooling degree-days for the region of Halifax²⁴, Econoler considered an eight-month period of heating and a two-month period of cooling in the interactive effects calculation. The table below presents the details for such calculations. As for lighting products, the table shows the proportion of RDI participants who are heated electrically and the proportion of residences that use air conditioning in Nova Scotia. As a result, a weighted interactive effects factor of -18.3 percent has been considered.

²⁴ RETScreen International, Normalized climate data for Halifax International Airport, Natural Resources Canada, 1997-2010.

Table 34: Interactive Effects Factor for Pipe Insulation and Hot Water Tank Wraps

Parameters	% of Residences ²⁵	Interactive Effects During Heating Period	Interactive Effects During Cooling Period
Electric heating with air conditioning	$32\% \times 18\% = 5.8\%$	$-100\% \times 8/12 = -67\%$	$+100\% \times 2/12 = +17\%$
Electric heating without air conditioning	$32\% \times 82\% = 26.2\%$	$-100\% \times 8/12 = -67\%$	$0\% \times 2/12 = 0\%$
No electric heating with air conditioning	$68\% \times 18\% = 12.2\%$	$0\% \times 8/12 = 0\%$	$+100\% \times 2/12 = +17\%$
No electric heating without air conditioning	$68\% \times 82\% = 55.8\%$	$0\% \times 8/12 = 0\%$	$0\% \times 2/12 = 0\%$
Weighted Interactive Effects Factor	100%	-21.4%	+3.1%
		-18.3%	

Finally, for all other products, the interactive effects are considered as negligible.

4.4 NET-TO-GROSS RATIO

RDI offers free installation of energy efficiency products for low-income residents as well as participants of other ENSC residential programs. The net-to-gross ratio (NTGR) calculations took into consideration both types of customers (low-income and non-low-income).

For the low-income customers, the distortion effects of the program are assumed to be insignificant. Therefore, the NTGR was established at 1.

For the non-low-income customers, the NTGR calculation was based on a self-report approach, which relies on a series of questions designed to measure the influence of the program on customers' decisions to participate in the program. This information was then transformed into distortion effects used to calculate the NTGR. For the non-low-income participants, the NTGR included the assessment of free-ridership and internal spillover. Once each effect was quantified, the NTGR was calculated based on the equation below.

$$NTGR = (1 - \% \text{ free-ridership} + \% \text{ spillover})$$

Subsequently, an overall NTGR was calculated, using the low-income factors provided for each participant in the tracking sheet. This overall NTGR was then used to calculate the net savings of all the products installed through the program, for both low-income and non-low-income participants. This section presents the methodology used to estimate this overall NTGR.

²⁵ From DA information and Statistics Canada.

4.4.1 Free-Ridership

The free-ridership level of the non-low-income customers was measured using the participant survey. The questionnaire included a number of questions to assess the following variables:

- > whether participants had any plans to install energy-efficient products before learning about the program;
- > the probability that participants would have installed the same energy-efficient products if they had not participated in the program;
- > the probability that participants would have installed the same energy-efficient products but at a later date if they had not participated in the program;
- > the probability that participants would have paid the full cost of the energy-efficient products if the program had not been in place; and
- > the level of importance of different factors on their decision to participate in the program.

Each question was transposed into a level of program attribution which was used to calculate the free-ridership level for each non-low-income participant. The algorithm behind this calculation is presented in Appendix VI.

Using this approach, the results revealed a global free-ridership level of 19 percent for non-low-income participants.

The survey results revealed that CFLs are the product that tends to increase the global free-ridership level. Many participants declared that they would have installed CFLs without the program, which tends to indicate the acceptance of CFLs by Nova Scotian households. Moreover, the on-site visits demonstrated that most participants already had CFLs installed in their house before their participation. A socket study conducted in 2011 also indicated that households in Nova Scotia have an average of 36 sockets, of which an average of 16 contained CFLs. Overall, this is good news for ENSC as a promoter of energy-efficient products. However, given the penetration of regular CFLs in the market, Econoler recommends that ENSC follow this evolution in the next years to eventually stop offering the installation of free regular CFLs to non-low-income participants.

4.4.2 Internal Spillover

The internal spillover effects of the program were also measured through the participant survey. Internal spillover can occur when participants purchase eligible energy-efficient products following their previous participation in the program because of its influence, thereby demonstrating the advantages of such products.

During the telephone survey, participants were asked if they had bought and installed additional energy-efficient products following their previous participation in the program. An additional question was used to verify that they had not benefited from any other incentive program for these additional purchases.

Subsequently, other questions were asked to verify the level of influence the program had on the purchases. Depending on the level of influence the survey found out about, a portion of the savings related to the additional purchase was attributed to the program.

The level of internal spillover was calculated for each participant according to the equation below. The energy savings (kWh) associated with the additional purchases were estimated using the unitary savings value revised in this evaluation.

$$\%SO = \frac{kWh \text{ associated with the additional purchase} \times \text{attribution level}}{kWh \text{ associated with the products installed under the program}}$$

The survey results revealed that the program generated internal spillover effects of 3 percent among the non-low-income participants. Indeed, 18 respondents out of 181 declared having purchased additional energy-efficient products or appliances following their participation in the program. They claimed the program had a 76 percent influence on their additional purchases. Once transposed into energy savings, these additional purchases resulted in spillover effects of 3 percent.

4.4.3 NTGR Calculation

Using the free-ridership and internal spillover levels established for non-low-income participants, the NTGR value for this group of participants is estimated at 0.84. Using the proportion of low-income and non-low-income participants, the overall NTGR associated with the program is 0.91. This value was applied to the gross savings calculation.

Table 35: Overall NTGR Calculation for RDI

Group of Participants	Non-Low-Income	Low-Income
NTGR	0.84	1.00
Proportion ²⁶	58%	42%
Overall NTGR	0.91	

²⁶ Weighted average of the Low-Income Factor registered in the tracking sheet with the revised gross savings.

4.5 NET SAVINGS

Net energy savings are estimated by adding the interactive effects and the NTGR to the gross energy savings, using the equation below.

$$\text{Net Energy Savings} = \text{Gross Energy Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

The net energy savings were first calculated separately for each product because the interactive effects differed from one product to another. Table 36 presents the details of the calculation.

Overall, the total net energy and demand savings amount to 33.675 GWh and 7.678 MW at the meter and 37.043 GWh and 8.446 MW at the generator.

Table 36: Evaluation Results – Net Energy and Demand Savings by Product (Lighting Products)

Category of Product	CFLs					LED Lamps				LED Night-light
	13W Replacing 40W	13W Replacing 60W	23W Replacing 60W	23W Replacing 100W	Specialty CFLs	8W Replacing 40W	8W Replacing 60W	12W Replacing 40W	12W Replacing 60W	
Energy Savings										
Total Gross Energy Savings – at Meter (GWh)	0.059	18.945	0.026	5.648	0.016	0.029	0.071	0.003	0.033	0.992
Interactive Effects Factor	-16.8%	-16.8%	-16.8%	-16.8%	-16.8%	-17.9%	-17.9%	-17.9%	-17.9%	-17.9%
NTGR	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Total Net Energy Savings (GWh) – at Meter	0.044	14.344	0.020	4.276	0.012	0.022	0.053	0.002	0.025	0.741
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Net Energy Savings (GWh) – at Generator	0.049	15.778	0.022	4.704	0.014	0.024	0.059	0.002	0.027	0.815
Demand Savings										
Total Gross Demand Savings – at Meter (MW)	0.013	4.319	0.006	1.288	0.004	0.007	0.016	0.001	0.008	0.226
Interactive Effects Factor	-16.8%	-16.8%	-16.8%	-16.8%	-16.8%	-17.9%	-17.9%	-17.9%	-17.9%	-17.9%
NTGR	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Total Net Demand Savings (MW) – at Meter	0.010	3.270	0.004	0.975	0.003	0.005	0.012	0.000	0.006	0.169
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
Total Net Demand Savings (MW) – at Generator	0.011	3.597	0.005	1.072	0.003	0.005	0.013	0.001	0.006	0.186

Table 37: Evaluation Results – Net Energy and Demand Savings by Product (Other Products)

Category of Product	Faucet Aerator	Low-Flow Showerhead			Pipe Insulation	Hot Water Tank Wrap	Program-mable Thermostat	Electric Kettle	Total for Lighting and Other Product Categories
		0.5 gpm Reduction	0.75 gpm Reduction	1.0 gpm Reduction					
Energy Savings									
Total Gross Energy Savings – at Meter (GWh)	4.504	0.368	1.565	5.060	0.797	3.850	0.116	0.125	42.207
Interactive Effects Factor	0%	0%	0%	0%	-18.3%	-18.3%	0%	0%	-
NTGR	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	-
Total Net Energy Savings (GWh) – at Meter	4.099	0.334	1.424	4.604	0.593	2.863	0.105	0.114	33.675
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Net Energy Savings (GWh) – at Generator	4.509	0.368	1.567	5.065	0.652	3.149	0.116	0.125	37.043
Demand Savings									
Total Gross Demand Savings – at Meter (MW)	1.027	0.084	0.357	1.154	0.182	0.878	0.026	0.028	9.623
Interactive Effects Factor	0%	0%	0%	0%	-18.3%	-18.3%	0%	0%	-
NTGR	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	-
Total Net Demand Savings (MW) – at Meter	0.935	0.076	0.325	1.050	0.135	0.653	0.024	0.026	7.678
Line Loss Factor	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	-
Total Net Demand Savings (MW) – at Generator	1.028	0.084	0.357	1.155	0.149	0.718	0.026	0.028	8.446

The table below presents comparisons between the energy and demand savings established by this evaluation and those calculated in the 2012 tracking sheet.

Table 38: Comparisons of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	46.127 GWh	46.127 GWh	39.477 GWh	0.90	35.590 GWh
Evaluation Results	47.660 GWh	46.427 GWh	40.706 GWh	0.91	37.043 GWh
Demand Savings					
Tracked Savings from ENSC	10.517 MW	10.517 MW	9.001 MW	0.90	8.115 MW
Evaluation Results	10.867 MW	10.585 MW	9.281 MW	0.91	8.446 MW

The net energy values calculated were compared to the tracked savings for 2012. The values calculated for the program are slightly higher (4%) than those calculated from the tracking sheet. This can be explained by the difference in some of the parameters used by ENSC and the Evaluator to estimate gross and net savings:

- > Econoler revised some of the unitary savings values used by ENSC in the tracking sheet, some upward, others downward. Overall, these adjustments resulted in a small increase of the initial gross savings.
- > Installation rates were added for all products installed through the program, except for programmable thermostats and electric kettles. Though these installation rates were very high, they had an impact on the installed gross savings, since ENSC used installation rates of 100 percent in the tracking sheet.
- > The NTGR measured during this evaluation is slightly higher than the one used by ENSC. In fact, ENSC estimated a NTGR of 0.83 for non-low-income participants, in comparison to the value of 0.84 measured by Econoler. This higher NTGR is mainly explained by the internal spillover effects of 3 percent that were calculated during this evaluation.

CONCLUSION

The evaluation of RDI revealed that the transition from a pilot to a component of the Existing Houses program in July 2012 was successful. Indeed, participants expressed a high level of satisfaction with the component, as well as with its various aspects. The Evaluator also commends ENSC on its diligence in implementing tools that will help improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual.

This year's evaluation revealed that the main ways non-low-income participants became aware of RDI were ENSC advertising, ENSC staff and the DAs, word of mouth as well as past participation in other ENSC programs. These results highlight the success of the marketing approach, which specifically relies on these media. Nevertheless, according to the DAs, the program marketing was one of the major barriers to program delivery. They felt that the program is more difficult to market, given that it is restricted to certain regions or demographics and that it is only available in certain areas at certain times. The DAs, therefore, both recommended ramping up outreach and marketing activities. This was also suggested by some non-low-income participants surveyed.

As for the DAs satisfaction with the program, they both reported being satisfied with RDI and especially with their relationship with ENSC staff and the other DA. However, they found that their participation as a program partner was complex because it required incorporating new parameters into a complex and widespread program within a short time frame, e.g. managing a large number of office and field staff while meeting weekly result targets.

The program totalled 28,397 participants for the year 2012, which is a very good result for a new program. The evaluation revealed that RDI generated net energy savings of 37.043 GWh and demand savings of 8.446 MW at the generator in 2012. To calculate the net savings of RDI in 2012, Econoler reviewed the gross savings estimated by ENSC and conducted 100 on-site visits to calculate installation rates for each category of product installed. Moreover, Econoler took into consideration the free-ridership and spillover levels associated with the non-low-income participants. These distortion effects were measured as part of the participant survey.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Fine-tune the program marketing approach: The evaluation results indicated that RDI promotional efforts did yield positive results. Nevertheless, according to the DAs, the program marketing was one of the major barriers to program delivery. They felt that the program is more difficult to market, given that it is restricted to certain regions or demographics and that it is only available in certain areas at certain times. As part of the evaluation, DAs as well as some participants suggested improving marketing efforts and communication. Thus, ENSC should continue to conduct consultation with the DAs on this matter and fine-tune the program marketing approach.
	2. Continue informing participants about energy-efficient products: The survey results showed that information or advice provided by the program advisor during the installation had an influence on the decision to install energy-efficient products. They also indicated that three quarters of the households remembered receiving information about energy-efficient products during the installer's visit and that this information encouraged many of them to change their behavior in terms of energy use at home. Thus, the Evaluator recommends continuing to include an educational perspective to the program by providing participants with information and advice on the energy-efficient products installed. This would also address the suggestion made by some participants to offer more information on the products installed and improve communication.
	3. Improve the content of the tracking sheet*: Considering that the program component was launched this year and has never been evaluated before, the tracking sheet was complete and sufficient for the first year of the program. In the future, Econoler recommends the following to facilitate program evaluation: > Add a unique identification number for each participant; > Identify the products installed in each residential unit; > Collect information on air conditioning; > Make sure that all the fields (e.g. rate code, heat type) are systematically filled out; > Set limitations for entries and develop a validation process. *See Section 3.3 Tracking Sheet for more details

Executive Summary	4. Ensure that there is a real need for nightlights in the household before offering LED nightlights to participants*: LED nightlights showed the lowest installation rate. Established at 95 percent, this was not considered as problematic, but the Evaluator noticed one main issue during the on-site visits that could be addressed in the future in order to avoid LED nightlight removal. In some cases, the participants declared that they had removed or given away their nightlights because they did not need them. All of these cases occurred when more than one LED nightlight was installed. In fact, for more than three quarters of the homes visited during this evaluation, two LED nightlights or more were installed. Thus, the Evaluator recommends that before offering a LED nightlight the installer ensure there is a real need for nightlights in the household and that the LED nightlights would replace old incandescent nightlights that are used on a regular basis. *See Section 4.2.10 Installation Rate for more details 5. Follow the penetration of regular CFLs in the next years*: The survey results revealed that CFLs are the product that tends to increase the global free-ridership level of the program. Indeed, many participants declared that they would have installed CFLs without the program, which tends to indicate the acceptance of CFLs by Nova Scotian households. Moreover, the on-site visits demonstrated that most participants already had CFLs installed in their house before their participation. A socket study conducted in 2011 also indicated that households in Nova Scotia have an average of 36 sockets, of which an average of 16 contained CFLs. Overall, this is good news for ENSC as a promoter of energy-efficient products. However, given the penetration of regular CFLs in the market, Econoler recommends that ENSC follow this evolution in the next years to eventually stop offering the installation of free regular CFLs to non-low-income participants. *See Section 4.4.1 Free-Ridership for more details
Program Manual	6. Document major changes in the Document Revision section: In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual. For example, this section should briefly describe the new standardized approach for the program (which is no longer a pilot project), and the use of the term “Efficient Product Installation Service” on the ENSC website (considering that “direct install” is a term unfamiliar to consumers). In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.

Program Charts	7. Provide partners and participants with simplified process charts: The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well designed. Moreover, the partners should be given copies of their process chart. After all, since these charts are intended for the partners and the participants, they must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version date should be indicated in each chart.
Marketing and Outreach Activities	8. Make the performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.
Tracking Sheet	9. Add a unique identification number for each participant: For easy identification, each participant needs to have a unique identification number. Without this number, it is more difficult to identify a participant with the available information, such as the name or the address, which can be similar from one participant to another. This information is missing for some participants recorded in the tracking sheet. Therefore, the Evaluator recommends systematically recording a unique identification number for each new participant entered in the tracking sheet.
	10. Identify the products installed in each residential unit: When direct installation is done in a multi-unit residential building, information should be collected for each individual unit. Currently, the tracking sheet does not provide clear information about this aspect. Neither does it indicate if the contact person is really the program participant, i.e. the renter or the landlord. With the present tracking sheet, the best hope ENSC can have for validation is that, if the entered address shows an apartment number, then the contact person is indeed the program participant. Data collected this way about multi-unit residential buildings could be quite vague and unreliable for field activities (surveys and on-site visits) because it does not allow collecting program participant contact information and monitoring the number of products installed in each unit. In addition, with the present tracking sheet, it is virtually impossible to keep track on the exact number of program participants. Therefore, the PM should have the tracking sheet revised to allow for identifying each individual unit and the participant's name.

Tracking Sheet	11. Collect information on air conditioning: The tracking sheet already provides information on the energy source used for space heating and this information is useful for the interactive effects factor calculations. Along these lines, the Evaluator recommends adding a field in the tracking sheet to collect information on the use of air conditioning units or systems. This additional information would allow more precise estimation of the interactive effects factors.
	12. Make sure that all the fields are systematically filled out: The tracking sheet is considered relatively complete and sufficient for program monitoring. However, the Evaluator observed that some fields were left blank: - Rate code: This field can be used to determine the line loss factor. It was left blank in 35 percent of the records. - Heat type: There are two fields, one indicating the main heat type and the other indicating the secondary heat type. The main heat type can be used to establish the interactive effects factor; this field was left blank or listed as “other” in 1 percent of the records. The secondary heat type should also be systematically filled out. When there is no secondary heat type, it should be so stated, thus indicating that the main heat type is used at 100%. All this information can be useful for field activities (on-site visits and surveys) and impact evaluation. Therefore, it is recommended to ensure that these fields are systematically filled out. A standard procedure should be implemented to ensure that all the information is properly collected and entered in the Tracking Sheet.
	13. Set limitations for entries and develop a validation process: To ensure the validity of the values entered in the tracking sheet, Econoler recommends that ENSC establishes standard guidelines for information-collecting. For instance, under each category of product, a ‘0’ value should be entered to indicate that no installation has been done. Currently, the tracking sheet presents a mix of ‘0’ values and blank entries. The introduction of such guidelines should also contribute to a better identification process and facilitate the identification of missing entries.
Pipe Insulation	14. Collect the specific length (in feet) of insulation installed in each unit and limit the installation of insulation to the first 15 feet.

APPENDIX II – INTERVIEW GUIDE WITH DELIVERY AGENTS

PROGRAM NAME: RESIDENTIAL DIRECT INSTALL (RDI)

How to complete this form

This is a Word document that integrates some form features. To enter your answers, simply position your cursor on the shaded sections and begin typing. Since this is a form, you cannot write anywhere else in the document. For the boxes, just click on the one next to your answer. Click again to uncheck it.

Please complete this form within the next 48 hours, [save the file](mailto:glavigne@econoler.ca) and send it back to us at glavigne@econoler.ca

Thank you!

Part I: General Questions

Please indicate your company name.

Q1a. What is your role(s) as an ENSC partner under this program?

Q1b. How long have you held that role/those roles (specify months or years)?

Q2a. How would you qualify your participation as a partner in this program?

- ☐ Simple
☐ Complex

Q2b. If you checked “Complex,” please indicate which parts of your involvement or participation process have been the most complex.

Q3. On a scale from 1 to 10, where 1 is very poor and 10 is excellent, please rate your satisfaction in regard to the:

Aspects of the program	Score 1 = very poor 10 = excellent NA = Not applicable	Reason If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Program marketing and outreach activities		
Relationship with ENSC staff		
Relationship with other delivery agent		

Part II: Questions Specific to the RDIEP Program

Q4. The RDI Program began as a pilot in January and started officially in July. Has the transition to a full program been successful? Explain.

Q5a. Regarding program modifications (program delivery model, products installed, etc.), do you feel they:

- ☐ Are easily adapted into the way you work
- ☐ Require minor changes in the way you work
- ☐ Require major changes in the way you work
- ☐ Not applicable/No program modifications

Q5b. If you answered “Require major changes in the way you work,” would you say those major changes have caused problems in the way the program is managed or delivered?

- ☐ Yes
- ☐ No

Q5c. If you answered “Yes,” what have those problems been?

Q6. In your opinion, what are the main barriers to the delivery of the program, in order of importance?

Q7a. Approximately how many complaints have you received from participants thus far in 2012?

Number of complaints:

Q7b. What was the complaint/were the complaints about?

Q8. What suggestions do you have to improve program performance?

Q9. More precisely, what suggestions do you have concerning program marketing and outreach activities?

Thank you very much for your time and co-operation.

Your answers will be treated in strict confidence—no names will ever be mentioned in the evaluation report. Our hope is that these results will contribute to improving program performance. You may be contacted by phone if we need to clarify your answers.

Date	
Your name	
Area code and phone number	
Email	

APPENDIX III – ON-SITE VISIT PROTOCOL

1 General Information

Date of visit: _____

ENSC Tracking Number: _____

Contact Name: _____

Address: _____

Telephone: _____

Single-unit: ☐ Semi-attached: ☐ Other: ☐

Type of dwelling: Duplex/Triplex: ☐ Multi-unit: ☐

Main Heat Type: In tracking sheet: _____

On-site observation: _____

Hot Water Heating Type: In tracking sheet: _____

On-site observation: _____

2 Product Installation information

For energy-efficient lighting products:

Product	Number in Tracking Sheet	Number On-Site	Explanation, If Different	Type of Lamp Replaced	Wattage of Lamp replaced
13W CFLs					
23W CFLs					
Specialty CFLs					

Product	Number in Tracking Sheet	Number On-Site	Explanation, If Different	Type of Lamp Replaced	Wattage of Lamp replaced
8W LEDs					
12W LEDs					
LED Nightlights					

Notes:

For energy-efficient domestic water heating products:

Tank Size (in gallons): _____

Product	Number in Tracking Sheet	Number On-Site	Explanation, If Different	Locations
Hot Water Tank Wrap				N/A
Pipe Insulation				N/A
Kitchen Faucet Aerators				
Bathroom Faucet Aerators				
Low Flow Showerheads				

Notes:

APPENDIX IV – DEMOGRAPHICS

The profile of the program participants interviewed for the survey is presented in the following tables.

The majority of participants (90%) lived in a single-family detached house.

Table 39: Type of Home

Type of home	2012
<i>Sample Size</i>	<i>181</i>
Single-family detached house	90%
Semi-detached house	3%
Townhouse or duplex which shares adjacent walls	2%
Mobile home or house trailer	4%
Don't know	1%

Nearly all the participants owned their home (99%).

Table 40: Home Ownership

Home Ownership	2012
<i>Sample Size</i>	<i>181</i>
Own	99%
Rent/lease	1%

The majority of participants were in homes with three or more bedrooms (85%), while just over one in ten (14%) resided in a two-bedroom home.

Table 41: Number of Bedrooms in Home

Number of Bedrooms	2012
<i>Sample Size</i>	<i>181</i>
1	1%
2	14%
3	50%
4 or more	35%

Six in ten participants had a college or university certificate/diploma (59%). One in ten had a trade certificate (10%) and one-quarter had a high school or some post-secondary diploma (24%), while less than one in ten had a less than high school education (7%).

Table 42: Highest Level of Education

Level of Education	2012
<i>Sample Size</i>	<i>181</i>
Less than high school graduate certificate	7%
High school graduate certificate and/or some post-secondary education	24%
Trade certificate/diploma	10%
College certificate/diploma	18%
University certificate/diploma	41%
Refused	1%

Six in ten participants were in households with 1 to 2 people (61%).

Table 43: Household Size

Household Size	2012
<i>Sample Size</i>	<i>181</i>
1	15%
2	46%
3	18%
4	15%
5	4%
6	2%

Although the age of the participants was varied, over half of them (57%) were 55 years of age or older.

Table 44: Age of Respondent

Age of Respondent	2012
<i>Sample Size</i>	<i>181</i>
18 to 24	--
25 to 34	7%
35 to 44	14%
45 to 54	22%
55 to 64	26%
65 or over	31%

Nearly all the participants paid the electricity bills themselves (98%).

Table 45: Party Who Pay Electricity Bills

You Pay Electricity Bills	2012
<i>Sample Size</i>	<i>181</i>
Yes	98%
No	2%
Don't know/refused	1%

The majority (56%) of participants had a household income of \$50,000 or more.

Table 46: Household Income

Household Income	2012
<i>Sample Size</i>	<i>181</i>
Less than \$15,000	1%
\$15,000 - \$24,999	2%
\$25,000 - \$34,000	5%
\$35,000 - \$49,000	16%
\$50,000 - \$69,000	20%
\$70,000 - \$79,000	9%
\$80,000 or more	27%
Don't know/Refused	21%

The participants were almost evenly divided between the genders with 53% being male and 47% being female.

Table 47: Gender

Gender	2012
<i>Sample Size</i>	<i>181</i>
Male	53%
Female	47%

APPENDIX V – PARTICIPANT SURVEY QUESTIONNAIRE

Participant Questionnaire

Residential Direct Installation of Efficient Products

October 5, 2012

V1. Hello may I please speak with [INSERT NAME]?

1. Yes [GOTO INTRODUCTION]

2. No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

INTRODUCTION

V2. Hello, my name is _____ and I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you or your household recently participated in the Residential Direct Installation of Efficient Products (RDIEP) program. As part of this program, someone would have come to your house and installed new lighting or domestic water heating energy efficiency products, such as compact fluorescent light bulbs (CFLs) and faucet aerators, at no charge. We would appreciate your collaboration in answering questions related to your participation in this program. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve the program. The survey will take about fifteen minutes. Is this a good time for you?

1. Yes [CONTINUE]

2. No, I don't remember the program / Don't know [PROMPT: “Are you sure? Someone would have come to your house and installed free energy-efficient products for you to save energy and money?” RECODE AS “YES” IF THE PROMPT WORKS; IF RESPONDENT STILL SAYS NO: Is there someone else in the household who would know about having participated in the Efficiency Nova Scotia program? THANK AND TERMINATE.]

a. Yes: [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]

b. No [THANK & TERMINATE]

3. No, but they came to my previous home CONTINUE

99. Refused [THANK AND TERMINATE]

[IF REFUSED, ASK “Can we schedule a more convenient time for you to conduct this survey?”]

[SCHEDULED, IF NECESSARY, FOR: _____]

Verification and Recall [V Series]

V3. I am going to read you a list of energy-efficient products that, according to our records, were installed in your house by the program: [READ WHAT IS ON RECORD (MEASURE#0 IN THE DATABASE)]. For each one, can you please verify that this information is correct and that the product was installed? [1=YES, INSTALLED, 2=NO, NOT INSTALLED, 98=DON'T KNOW, 99=REFUSED]?

[NOTE FOR PROGRAMMER: DO NOT PUT THE NUMBER OF EACH MEASURE]

- a) CFL bulbs (CFLs 13W – CFLs 23W – Specialty CFLs)
- b) LED Bulbs (LEDs 8W – LEDs 12W)
- c) LED Nightlights
- d) Low flow showerheads (LFS)
- e) Faucet aerators (Faucet Aerator)
- f) Pipe insulation/Tank Wraps

V4. [FOR EACH OF V3a TO V3f = NO AND RECORD = YES] Are you sure? According to our records someone would have come to your place and installed ... [READ WHAT IS ON RECORD] [1=YES] [2=NO, 98=DON'T KNOW, 99=REFUSED → RECORD AS NO]

- V4a. [CFL bulbs (CFL's 13W – CFL's 23W – Specialty CFLs)]
- V4b. [LED Bulbs (LEDs 8W – LEDs 12W)]
- V4c. [LED Nightlights]
- V4d. [Low flow showerheads]
- V4e. [Faucet aerators]
- V4f. [Pipe insulation/Tank Wraps]

[THANK AND TERMINATE IF RESPONDENT SAY "NO", "DK" OR "REF" TO ALL QUESTIONS FROM V3 TO V4]

Program Awareness and Participation [P Series]

P1. Do you still live in the same residence where these installations were made as part of the program?

1. Yes [GO TO P2]
2. No – [CONTINUE] _____
98. (Don't Know) [ASK FOR THE PERSON WHO WOULD KNOW]
99. (Refused) [THANK AND TERMINATE]

[IF P1 = 2 'NO'] Please answer the survey questions based on the house that went through the program.

P2. How did you find out about this program? [DON'T READ; ALLOW MULTIPLE RESPONSE BUT DO NOT PROBE FOR MULTIPLE]

1. (Efficiency Nova Scotia staff)
2. (Mailing from Efficiency Nova Scotia)
3. (ENSC Website)
4. (Co-worker, family, or friend)
5. (Other participants)
96. (Other [SPECIFY _____])
98. (Don't know)
99. (Refused)

P3. What was the SINGLE most important reason you agreed to participate in the program? [ACCEPT ONE RESPONSE] [DO NOT READ]

1. (To save on energy/to save on energy costs)
2. (Comfort)
3. (To receive free compact fluorescent bulbs)
4. (To receive LED lights at a discounted price)
5. (To help the environment)
6. (Reduce greenhouse gases)
7. (No cost for services/program was free)
8. (To reduce my water consumption)
96. (Other) [SPECIFY _____]
98. (Don't know) [GO TO P5]
99. (Refused) [GO TO P5]

P4. Were there any other reasons? [DO NOT READ. ACCEPT MULTIPLE. SAME LIST AS P3]

P5. Before participating, did you have any concerns about taking part in the program?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

P6. [IF P5 = 1] What were those concerns? [DO NOT READ. ACCEPT ALL RESPONSES]

- 1. (That I wouldn't be eligible)
- 2. (That I'd have to pay something)
- 3. (Didn't believe it was really free)
- 4. (Wouldn't like what they gave me)
- 5. (That products offer would cause health risks)
- 6. (Concern that participation will affect eligibility for other assistance programs – social assistance, heating assistance rebate)
- 96. (Other) [SPECIFY _____]
- 98. (Don't know)
- 99. (Refused)

Satisfaction with the Program [S Series]

S1. Using a scale from 1 to 5, where 1 means "very dissatisfied" and 5 means "very satisfied", please tell me how satisfied you are with your OVERALL experience with the program. [97 = Not Applicable, 98 = Don't know/Don't recall, 99 = Refused] [DO NOT ACCEPT A RANGE]

S2. [IF DISSATISFIED—S1=1, 2 or 3] You indicated a score of [ANSWER S1] on a 5-point scale for your overall satisfaction with the program. For what reasons were you not satisfied with the program overall? Probe: Any other reasons? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]

- 1. (The installation took too long)
- 2. (I expected more)
- 3. (Energy bill did not decrease)
- 4. (I don't like the light bulbs I received)
- 5. (I don't like the insulation/wrap upgrade)
- 6. (I don't like the low flow showerhead installed)
- 7. (I don't like the low flow faucet aerators installed)
- 8. (I did not like the installer who visited the home)

- 96. (Other) [SPECIFY _____]
- 98. (Don't know)
- 99. (Refused)

S3. [IF SATISFIED S1=4 or 5] What was the most important reason why you were satisfied with the program overall? PROBE: Anything else? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE.]

- 1. (Lowered energy bill)
- 2. (Good service)
- 3. (Saves energy)
- 4. (Better lights/lighting)
- 5. (Informative/Information received)
- 6. (I liked the installer who visited the home)
- 96. (Other) [SPECIFY _____]
- 98. (Don't know)
- 99. (Refused)

Now I am going to read a list of specific aspects of the program. Using a scale from 1 to 5, where 1 means "very dissatisfied" and 5 means "very satisfied", please tell me how satisfied you are with your experience with each aspect of the program. [DO NOT RANDOMIZE] [97 = Not Applicable, 98 = Don't know/Don't recall, 99 = Refused] [DO NOT ACCEPT A RANGE]

S4.	Overall communication from the program	1	2	3	4	5	97/98/99
S5.	Time Required to Complete Work	1	2	3	4	5	97/98/99
S6.	Energy conservation measures installed	1	2	3	4	5	97/98/99
S7.	Quality of the work completed	1	2	3	4	5	97/98/99

S8. Using a 5-point scale, where '1' is very difficult and '5' is very easy, how would you rate the process to apply to the program? [1-5 scale, 98 = Don't know/Don't recall, 99 = Refused]]

S9. [IF S8=1, 2 or 3] What was difficult about applying to the program? [MULTIPLE RESPONSE – RECORD VERBATIM] Probe: Anything else?

- 96. (Record answer)
- 97. (Don't know)
- 98. (Refused)

- S10. Did your household receive information during the visit from the installer about energy-efficient products?
- 1. Yes
 - 2. No
 - 98. (Don't know)
 - 99. (Refused)
- S11. [IF S10=1] Did the information your household received during the visit from the installer change your behavior in terms of how you use energy at home?
- 1. Yes
 - 2. No
 - 98. (Don't know)
 - 99. (Refused)
- S12. [IF S11=1] How did your behavior change? PROBE: Anything else? [DO NOT READ. ACCEPT ALL RESPONSES]
- 1. (I turn off my lights now)
 - 2. (I set my heating thermostat lower)
 - 3. (I set my water heater thermostat lower)
 - 4. (I hang my clothes to dry)
 - 5. (I use less hot water to wash my clothes)
 - 6. (I use fans instead of air conditioning)
 - 7. (I close doors and windows)
 - 8. (I turn off appliances)
 - 9. (I decided to participate in ENSC's Appliance Retirement program)
 - 10. (I decided to participate in ENSC's Home Energy Assessment program)
 - 96. (Other) [SPECIFY_____])
 - 98. (Don't know)
 - 99. (Refused)

Recommendations (R Series)

R1. Do you have any recommendations that you think would help improve the program? PROBE:
Anything else? [DO NOT READ, ACCEPT MULTIPLE]

1. (Offer more products/measures to be installed)
2. (Offer more information on the products/measures installed)
3. (Complete work faster)
4. (Improve quality of work)
5. (Improve communication)
6. (No recommendation)
96. (Other [SPECIFY _____])

[IF R1= 1]

R2. Which energy efficiency products would you like to have had installed through the program?
[DO NOT READ. ACCEPT MULTIPLE]

1. (dishwasher)
2. (washing machine)
3. (dryer)
4. (windows/envelope)
5. (refrigerator)
6. (freezer)
7. (ventilation)
8. (thermostats)
9. (air sealing/weather stripping)
10. (toilets)
96. Other [SPECIFY _____])
98. (Don't know)
99. (Refused)

Free-Ridership [FR Series]

INSTRUCTION:

[FOR RESPONDENTS WITH MORE THAN TWO (“YES”) MEASURES VERIFIED IN V3 AND V4, CHOOSE TWO MEASURES VERIFIED, EXCEPT LEDs. THE RESPONDENT WILL ANSWER ACCORDING TO THESE TWO MEASURES THROUGHOUT SECTION FR WHEN IDENTIFIED LIKE SO: [MEASURE 1 or 2].]

SELECTION METHOD FOR THE TWO MEASURES:

- IF CFL ARE VERIFIED IN V3 AND V4, RESPONDENT WILL AUTOMATICALLY ANSWER ACCORDING TO CFL
- THEN, CHOOSE ANOTHER MEASURE VERIFIED IN V3 AND V4 AT RANDOM, AMONG THE FOLLOWING:
 - Low flow showerheads (LFS)
 - Faucet aerators (Faucet Aerator)
 - Pipe insulation/Tank Wraps
- LEDs ARE EXCLUDED OF THE FREE-RIDERSHIP SECTION. SO NO RESPONDENT WILL ANSWER ABOUT LEDs IN THE FREE-RIDERSHIP SECTION.

NOTE: IF AMONG THE MEASURES VERIFIED IN V3 AND V4, THERE IS NO CFL, RESPONDENT WILL ANSWER ACCORDING TO OTHER MEASURES VERIFIED IN V3 AND V4, EXCEPT LEDs.

The next questions will be about the [MEASURE 1] you had installed through the program.

FR1M1. Did you or anyone in your household have specific plans to purchase and install [MEASURE 1] prior to talking with anyone about the Residential Direct Installation Program?

1. Yes
2. No
98. (Don't know)
99. (Refused)

FR1aM1. IF FR1M1=YES, THEN ASK: I just want to make sure I understand - Before you decided to participate in the Residential Direct Installation Program, you had already made the decision to purchase and install [MEASURE 1]?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Residential Direct Installation Program.

If you had not participated in the Residential Direct Installation Program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action." [AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT. In the absence of the Program, would you have . . . DO NOT ACCEPT A RANGE – POSE FR2M1 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FR2aM1. . . . installed the [MEASURE 1] that was installed through the Program?

___ Response ___ 98 Don't Know ___ 99 Refused

FR2cM1. . . . installed the [MEASURE 1] that was installed through the Program *but at a later date*?

___ Response ___ 98 Don't Know ___ 99 Refused

IF FR2cM1 > 5, THEN ASK:

[DO NOT ASK IF FR2cM1=98 OR 99]

FR2ccM1. You indicated in your previous response that if the Residential Direct Installation program had not been available there was an [FR2cM1] in 10 likelihood that you would have installed the same energy-efficient products *but at a later date*. Approximately how many months later would you have installed these products? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. _____ months later
2. (Never)
3. (At the same time)
98. (Don't know)
99. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2ccM1 ANSWER IN MONTHS, READ]: Would it have been within . . .

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FR3M1. If Efficiency Nova Scotia had not installed [MEASURE 1] for free, would you have paid the full cost of the [MEASURE 1]?

1. Yes
2. No
97. (Depends on the cost)
98. (Don't know)
99. (Refused)

[IF ONLY ONE MEASURE VERIFIED IN V3-V4, SKIP TO FR4]

The next questions will be about the [MEASURE 2] you had installed through the program.

FR1M2. Did you or anyone in your household have specific plans to purchase and install [MEASURE 2] prior to talking with anyone about the Residential Direct Installation Program?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

FR1aM2. [IF FR1M2=YES, THEN ASK: I just want to make sure I understand - Before you decided to participate in the Residential Direct Installation Program, you had already made the decision to purchase and install [MEASURE 2]?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Residential Direct Installation Program.

If you had not participated in the Residential Direct Installation Program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action." [AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT. In the absence of the Program, would you have . . . DO NOT ACCEPT A RANGE – POSE FR2M2 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FR2aM2. . . . installed the [MEASURE 2] that was installed through the Program?

___ Response ___ 98 Don't Know ___ 99 Refused

FR2cM2. . . . installed the [MEASURE 2] that was installed through the Program *but at a later date*?

___ Response ___ 98 Don't Know ___ 99 Refused

IF FR2cM2 > 5, THEN ASK:

[DO NOT ASK IF FR2cM2=98 OR 99]

FR2ccM2. You indicated in your previous response that if the Residential Direct Installation program had not been available there was an [FR2cM2] in 10 likelihood that you would have installed the same energy-efficient products *but at a later date*. Approximately how many months later would you have installed these products? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. _____ months later
2. (Never)
3. (At the same time)
98. (Don't know)
99. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2ccM2 ANSWER IN MONTHS, READ]:

Would it have been within . . .

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FR3M2. If Efficiency Nova Scotia had not installed [MEASURE 2] for free, would you have paid the full cost of the [MEASURE 2]?

1. Yes
2. No
97. (Depends on the cost)
98. (Don't know)
99. (Refused)

[ASK FR4 ONCE, NOT FOR EACH MEASURE VERIFIED IN V3-V4]

FR4. Next, I'm going to ask you to rate the importance of factors that might have influenced your decision to install energy-efficient products through the Residential Direct Installation program. Using a scale from 0 to 10 where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of each of the following in your decision to implement the energy-efficient products you installed through the Program. [DO NOT ACCEPT A RANGE]

Factor (READ AND RANDOMIZE)	Responses
a. The free installation of energy-efficient products offered by the program	___ Response ___ 98 Don't Know ___ 99 Refused ___ 97 Not applicable
b. Information or advice provided by the program advisor during the installation	___ Response ___ 98 Don't Know ___ 99 Refused ___ 97 Not applicable
c. Previous experience with a similar program either from Efficiency Nova Scotia or Nova Scotia Power	___ Response ___ 98 Don't Know ___ 99 Refused ___ 97 Not applicable

Spillover [SO Series]

SO1. Now I'd like you to think of the time since you participated in the Residential Direct Installation Program. Have you installed any additional energy-efficient products or retired any old appliances on your own?

1. Yes
2. No [GO TO D SERIES]
98. (Don't know/Don't recall) [GO TO D SERIES]
99. (Refused) [GO TO D SERIES]

SO2. [IF SO1= YES, THEN ASK] I just want to make sure I understand - After you participated in the Residential Direct Installation Program, you installed additional energy-efficient products or retired old appliances on your own. Is that correct?

1. Yes
2. No [GO TO D SERIES]
98. (Don't know) [Go To D Series]

99. (Refused) [GO TO D SERIES]

Now, I will specifically talk about the additional actions you took on your own after participating in the Residential Direct Installation Program.

SO3. [IF SO2 = 1 "YES"] Have you benefited from any other financing or rebates from any other Efficiency Nova Scotia program for these additional energy-efficient products or appliance retirement, or do you plan to submit a funding request for these actions in the future?

1. Yes [GO TO D SERIES]

2. No

98. (Don't know [GO TO D SERIES])

99. (Refused) [GO TO D SERIES]

SO4a. [IF SO3 = 2 'NO'] What additional energy-efficient products have you installed on your own after participating in the program? [DO NOT READ, ALLOW MULTIPLE] Probe: Any others?

1. (CFLs)

2. (LEDs)

3. (Low flow showerheads)

4. (Faucet aerators)

5. (Pipe insulation/tank wrap)

96. (Other [SPECIFY _____])

97. (Don't know)

98. None

SO4b. [IF SO3 = 2 'NO'] What appliances you have retired on your own after participating in the program? [DO NOT READ, ALLOW MULTIPLE] Probe: Any others?

1. (Refrigerators)

2. (Freezers)

3. (Room AC units)

4. (Dehumidifiers)

96. (Other [SPECIFY _____])

97. (Don't know)

98. None

SO5. [IF SO3 = 2 'NO'] How influential was your experience with the Residential Direct Installation Program on your decision to install these additional energy-efficient products or retire these appliances on your own? Please, give your answer on a scale of 0 to 10, where 0 indicates

that the Residential Direct Installation Program “had no influence at all on your decision” and 10 indicates that the program was “extremely influential to your decision.” [RECORD RESPONSE 0-10, 98 = Don’t know, 99 = REFUSED] [DO NOT ACCEPT A RANGE]

Demographic Characteristics (D Series)

[ASK ALL RESPONDENTS]

These final questions are asked for statistical purposes only. The information collected is strictly confidential.

D1. What type of residence do you live in? [READ RESPONSES 1-7, THEN 96; SELECT ONE RESPONSE]

1. Apartment building that has fewer than five stories
2. Apartment building that has five to twenty stories
3. Row house (Single story apartment building)
4. Detached single-family home
5. Semi-detached house
6. Mobile home or house trailer
7. Townhouse or duplex which shared adjacent walls
96. Or some other type [SPECIFY: _____]
98. (Don’t know)
99. (Refused)

D2. How many bedrooms are in your home? [98=DK; Enter zero for a studio apartment with no bedrooms]

D3. Do you own or rent this home?

1. Own/buying
2. Rent/lease
3. Other (Describe) _____
99. (Refused)

D4. Do you pay the electric bills for your home?

1. Yes
2. No
96. (Other) [Specify _____]
98. (Don’t Know)
99. (Refused)

- D5. Including yourself, how many people live in this residence on a full-time basis?
- Number of people: _____
- [NOTE: DON'T ALLOW ZERO FOR A RESPONSE]
99. (Refused)
- D6. What is your age group? Are you: [READ]
1. 18 to 24
 2. 25 to 34
 3. 35 to 44
 4. 45 to 54
 5. 55 to 64
 6. 65 or over
99. (Refused)
- D7. What is the highest grade of schooling completed by the head of your household? [READ IF NECESSARY]
1. (Less than high school graduation diploma)
 2. (High school graduation diploma and/or some post secondary)
 3. (Trades certificate or diploma)
 4. (College certificate or diploma)
 5. (University degree, certificate or diploma)
97. Other (SPECIFY: _____)
98. (Don't know)
99. (Refused)
- D8. Which of the following income categories best describes your total annual household income before taxes in 2011? Stop me when I reach the right category. [READ LIST; SELECT ONE RESPONSE]
1. Less than \$15,000
 2. \$15,000 - \$24,999
 3. \$25,000 - \$34,999
 4. \$35,000 - \$49,999
 5. \$50,000 - \$69,999
 6. \$70,000 - \$79,999
 8. \$80,000 or more
98. (Don't know)
99. (Refused)

D9. [DO NOT READ] Gender:

1. Male
2. Female

END: THAT IS ALL THE QUESTIONS I HAVE FOR YOU. THANK YOU FOR TAKING THE TIME TO RESPOND TO THIS SURVEY.

APPENDIX VI – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

FR2a. If you had not participated in the program, what is the likelihood that you would have installed the same energy-efficient products that you installed through the program? (Scale 0 to 10)	FR2a = Answer x 10%
PA1 Score:	FR2a
FR1. Did you or anyone in your household have specific plans to purchase and install the energy-efficient products prior to talking with anyone about the program?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just want to make sure I understand - Before you decided to participate in the program, you had already made the decision to purchase and install the energy-efficient products?	IF 1. Yes: FR1 = 100% IF 2 OR 9 : FR1 = 0%
FR3. If ENSC had not installed energy-efficient products for free, would you have paid for the full cost of the products? (Scale 0 to 10)	FR3 = Answer x 10%
PA2 Score:	IF FR1 = 0% : FR3 / 2 IF FR1 = 100% : FR3
FR4. Level of influence (Scale 0 to 10) Factors a, b and c = Program factors	FR4_P = Max(a ; b ; c)
PA3 Score:	(10 – FR4_P) x 10%
FR2c. If you had not participated in the program, what is the likelihood that you would have installed the energy-efficient products but at a later date? (Scale 0 to 10)	IF FR2c > 5 : ASK FR2cc Otherwise: PA4 = EMPTY
FR2cc. Approximately how many months later would you have installed these products? 1. Less than 6 months? 2. 6 months to less than 1 year later? 3. 1 to less than 2 years later? 4. 2 to less than 3 years later? 5. 3 to less than 4 years later? 6. 4 or more years later? 7. (Never) 9. (Don't know / Refused)	IF 1. : FR2cc = 100% IF 2. : FR2cc = 50% IF 3. : FR2cc = 25% IF 4. : FR2cc = 0% IF 5. : FR2cc = 0% IF 6. : FR2cc = 0% IF 7. : FR2cc = 0% IF 9. : FR2cc = 0%
PA4 Score:	FR2cc
Final Free-Ridership	MEAN VALUE OF : (PA1 ; PA2 ; PA3 ; PA4)
Inconsistency Test	IF FR3 ≤ 70% AND IF FR2a > 70%: PA1 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)



MULTI-UNIT RESIDENTIAL BUILDINGS IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 6, 2013



ECONOLER

ACRONYMS

CATI	Computer-Assisted Telephone Interviewing
CFL	Compact Fluorescent Lamp
BES	Business Energy Solutions
CDI	Commercial Direct Install
CRA	Corporate Research Associates
DA	Delivery Agent
LED	Light Emitting Diode
DHW	Domestic Hot Water
DI	Direct Install
ENSC	Efficiency Nova Scotia Corporation
MURR	Multi-Unit Residential Renters
MURB	Multi-Unit Residential Buildings
NTGR	Net-to-Gross Ratio
PM	Program Manager

DEFINITIONS

Base Case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Demand-to-energy ratio	A ratio obtained by dividing the target peak demand savings by the target energy savings of a given program for a given year.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.

Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Multi-Unit Residential Buildings (MURB), which is a component of the Existing Houses program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM) and a delivery agent, 31 on-site visits and a telephone survey of 37 participants.

PROGRAM COMPONENT OVERVIEW

Initially implemented in August 2011 as a pilot project, MURB was launched by Efficiency Nova Scotia Corporation (ENSC) in April 2012. MURB offers direct installation of energy-efficient products in both common space areas and rental units, at no charge to landlords, renters or condominium owners.

ENSC has contracted one delivery agent (DA), the Summerhill Group, to provide installation services across the province. The DA directly contacts building managers to invite them to participate in the program. The DA carries out installations that generate cost-effective energy savings, while also noting and reporting the areas of energy-saving opportunities offered through other ENSC programs.

The following are the products installed through MURB:

Common Areas

- > CFLs;
- > LED lamps;
- > LED exit signs; and
- > hot water tank wraps.

Rental Units

- > CFLs;
- > LED nightlights;
- > faucet aerators;
- > low-flow showerheads;
- > pipe insulation; and
- > hot water tank wraps.

MURB aimed to achieve net electricity savings of 2.6 GWh and demand savings of 0.6 MW for 2012.¹

KEY FINDINGS

The evaluation revealed that, in spite of necessary adjustments at the start of the program, the transition from a pilot to a full program has been successful overall. The program is well designed and shows good results. In terms of net energy savings, MURB generated 2.314 GWh, compared to 0.651 GWh in the 2011 pilot. It also generated 0.534 MW peak demand savings compared to 0.104 MW in 2011.

¹ These targets only cover products installed in residential units. Products installed in common areas through MURB are to be claimed in Commercial Direct Install (CDI).

Participation

The marketing strategy of the program has been changed to include distinct approaches for tenants or condo owners who pay their own bills, and for property owners. The new marketing strategy, under which the DA contacts property owners who inform their tenants about the visits, has significantly contributed to the success of the program. Indeed, collaborating with landlords to perform installations in units in which tenants are not responsible for paying the electricity bills resulted in a participation rate jump from 30 to 80 percent. In that context, one of the barriers to program delivery is the on-site support received from superintendents, which can make all the difference in the number of installations completed. The DA suggested finding ways to tie the success of the installations to recognition or performance of building superintendents.

Satisfaction

Satisfaction with the program is very high among the landlords or landlords' representatives. Indeed, most of them expressed their satisfaction with the overall program, as well as with the following aspects of the program: the time required to complete the work, the program representative and the products installed. Moreover, most participants found it easy to participate in the program. Participants are not the only ones satisfied with the MURB program, the DA also shared positive comments.

Participants surveyed through the 2012 evaluation mentioned suggestions to improve the program. The main recommendations made were to offer a wider variety of products and offer more information on the products. On this subject, the DA also recommended implementing an optional LED upgrade package for condo owners. Survey results showed that 70 percent of participants remembered receiving information about energy efficiency or energy savings as part of the program.

Installation of Products

The 2011 evaluation revealed some issues associated with the installation rate of certain products, such as power bars. This product was removed from the program in 2012 and, for this year's evaluation, the on-site visits showed very high installation rates. In the vast majority of cases, the products installed through the program were still in place when the Evaluator conducted the visit.

Program Energy Savings

To calculate the net savings of the MURB program in 2012, Econoler reviewed the parameters and the source of data used in Efficiency Nova Scotia Corporation's (ENSC) unitary savings estimates for each product category. Moreover, Econoler calculated installation rates using results from the on-site visits and included interactive effects. The free-ridership level measured through interviews with tenants during the on-site visits was also taken into account in the evaluation of net savings. A free-ridership level of 16 percent was captured. This relatively low level of free-ridership can be explained by the fact that the program reaches customers that are less interested in energy efficiency and proves to ENSC the necessity to continue targeting multi-unit market.

Table 1: Distortion Effects and Net-to-Gross Ratio

	2012
Free-Ridership Level	16%
Net-to-Gross Ratio	0.84

Using the revised unitary savings values, the installation rates and the interactive effects factors, the evaluation revealed that the MURB program generated net energy savings of 2.314 GWh and demand savings of 0.534 MW at the generator in 2012.

Table 2: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	3.185 GWh	3.185 GWh	2.784 GWh	0.83	2.311 GWh
Evaluation Results	3.164 GWh	3.130 GWh	2.754 GWh	0.84	2.314 GWh
Demand Savings					
Tracked Savings from ENSC	0.736 MW	0.736 MW	0.643 MW	0.83	0.534 MW
Evaluation Results	0.731 MW	0.723 MW	0.636 MW	0.84	0.534 MW

The net evaluated savings were slightly higher than those tracked by ENSC. Some unitary savings values were revised during this evaluation. However, the main factors that explain the difference in savings are the review of the interactive effects for regular CFLs to take into account that part of them were installed outdoors and the fact that a free-ridership level of 16 percent was measured for this evaluation (compared to 17 percent in 2011).

RECOMMENDATIONS

Econoler finds that the program is well designed and shows good results. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- MURB-R1. Analyze the possibility of rewarding building superintendents' support:** The new marketing strategy, which involves direct collaboration with landlords or landlords' representatives to perform installations, has significantly contributed to the success of the program. However, in that context, one of the barriers to program delivery is the on-site support received from superintendents, which can make all the difference in the

number of installations completed. Therefore, the Evaluator recommends analyzing the possibility to tie the success of the installations to recognition or performance of building superintendents. For example, this could be done by launching a contest among landlords or landlords' representatives in order to reward collaboration.

- MURB-R2. Continue offering information about products installed and energy efficiency:** There is a need for an energy efficiency program in the multi-unit renter market, as multi-unit renters are often less interested in energy efficiency and are less likely to install energy-efficient products in a home they do not own and where, in some cases, they are not responsible for paying the electricity bills. Moreover, the low level of free-ridership measured through the participant interviews reveals that most participants would not have installed any energy-efficient products in the absence of the program. These findings highlight the importance of educating this market about energy efficiency. Survey results showed that 70 percent of participants remembered receiving information about energy efficiency or energy savings as part of the program. This is a good result, on which ENSC should continue to build.
- MURB-R3. Collect quantity of products installed in the tracking sheet for each individual tenant unit:** In 2012, the quantity of products installed in each individual unit was only collected on paper forms from mid-August. In the future, Econoler recommends keeping track of this information in the tracking sheet, using the unit number instead of the tenant name, since it is rarely possible to collect tenants' names and phone numbers due to tenant privacy issues and the high percentage of tenant turnover in the rental sector. These data would be useful for planning on-site visits with the landlords. The landlords can inform selected tenants of the upcoming visit and ask for their consent to enter their unit. Then, tenants could be visited for validating the installation of products, and a short survey could be completed to learn more about their satisfaction and free-ridership level.
- MURB-R4. Improve the tracking sheet to facilitate field activities and provide a more precise evaluation of savings:** Besides the fact that the information should be collected on a unit basis, the tracking sheet review also demonstrated that some improvements could be done to facilitate the field activities (participant survey and on-site visits) and the impact evaluation. First, the Evaluator recommends implementing a protocol to ensure that all the relevant information is collected and systematically recorded in the tracking sheet. In the 2012 tracking sheet, some fields, such as the landlord's name, phone number and rate code, contained a few blank entries. Secondly, the Evaluator identified additional information that could be collected in the future tracking sheet to allow for a more precise evaluation of savings. More particularly, Econoler recommends including the location (indoors or outdoors) of CFLs installed, as well as the energy source used for space heating and the use of air conditioning. Such information would be useful for evaluating the hours of operation and interactive effects for CFLs.

1 COMPONENT DESCRIPTION

Initially implemented in August 2011 as a pilot project, Multi-Unit Residential Buildings (MURB) was launched as a component of the Existing Houses program by Efficiency Nova Scotia Corporation (ENSC) in April 2012. MURB offers direct installation of energy-efficient products in both common space areas and rental units at no charge to landlords, renters or condominium owners.

ENSC has contracted one delivery agent (DA), the Summerhill Group, to provide installation services primarily in buildings with 20 or more residential units across the province. Buildings with fewer than 20 residential units may also be eligible. The DA directly contacts building managers to invite them to participate in the program. The DA carries out installations that generate cost-effective energy savings, while also noting and reporting the areas of energy-saving opportunities offered through other ENSC programs. More precisely, a checklist is to be filled out during the installation process as part of a scoping study to identify areas of special interest and potential improvements for energy efficiency within the building. The scoping study is expected to provide ENSC with a better idea about how the building operates and if other programs are available for the property owner. When areas for improvement have been identified, other program managers will assess and quantify these opportunities and then communicate all this information to the MURB team, who serves as a single point of contact between ENSC and the property owner.

Although this service combines several incentives provided by ENSC, clients are offered the options that best suit their individual buildings through a package of energy conservation measures. The following are the products installed through MURB:

Common Areas

- > CFLs;
- > LED lamps;
- > LED exit signs; and
- > hot water tank wraps.

Rental Units

- > CFLs;
- > LED nightlights;
- > faucet aerators;
- > low-flow showerheads;
- > pipe insulation; and
- > hot water tank wraps.

In 2011, under the pilot initiative, programmable thermostats and power bars with timer were also installed, but they are no longer provided in the full program. In addition, lobby events held in the buildings' common areas are no longer part of the program.

Depending on the type of product installed, funding could come from two different sources. Upgrades that reduce electricity use are paid for by ENSC with funds from electricity rate-payers. Upgrades that reduce the use of other fuels are paid for by ENSC with funds from the Province of Nova Scotia.

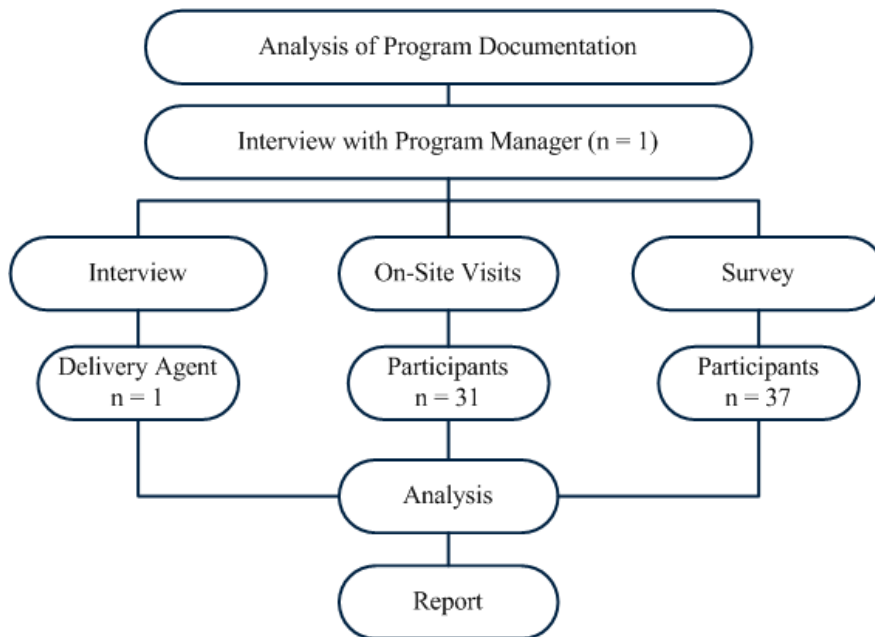
MURB aims to achieve net electricity savings of 2.6 GWh and demand savings of 0.6 MW for 2012. Savings from common areas are included in the Commercial Direct Install targets. Savings generated by the products installed in rental and condo units are accounted for under the Existing Houses program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for MURB. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was obtained primarily from the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews in July and August 2012 with the Program Manager (PM). Among other things, these interviews were intended to follow up on the 2011 evaluation

recommendations regarding process issues, as well as to understand the main changes in program delivery in 2012. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 Interview with Delivery Agent

In October 2012, one interview was conducted with the program DA in order to understand, among other things, their involvement in the program, their participation process, as well as their perception of and satisfaction with the program.

The protocol used for the interview with the DA is presented in Appendix II for reference.

2.2.4 On-Site Visits

In October and November 2012, a total of 31 on-site visits were conducted in individual tenant units where energy-efficient products had been installed. These visits were conducted by Econoler's subcontractor, Equilibrium Engineering. Their purpose was to validate whether the products were properly installed according to the information contained in the paper forms and, when differences were noticed, to establish the reason for removing the products after their installation. Technical information such as lamp wattages and energy type for domestic hot water (DHW) heating was also collected through on-site observations to validate the unitary savings assumptions used for each category of product.

In addition, some in-depth interviews with tenants were conducted during the on-site visits. The main objective of these interviews was to measure the free-ridership level for the products installed in the tenant units.

Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix III.

2.2.5 Participant Survey

A telephone survey with a total of 37 landlords or property managers participating in the program was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in October 2012 using computer-assisted telephone interviewing (CATI) technology. The average length of the survey was 12 minutes.

The participant survey was meant to generate feedback on the following aspects of MURB:

- > program awareness;
- > participant motivations, concerns and barriers;
- > satisfaction with the program; and
- > recommendations for improvements.

The demographic profile of the survey respondents and the survey questionnaire are shown in Appendices IV and V respectively. The table below shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2012 telephone survey.

Table 3: Sample Size and Sampling Error

Survey	Population	Sample Size (n)	Sampling Error at 90% Confidence Interval
2012 Participants	256 ²	37	± 12.7%

² The final 2012 tracking sheet contained 256 different company names in which products were installed in building(s). The population of MURB landlord participants for the 2012 survey was 95 at the time the survey was being conducted.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

In 2011, Econoler performed a process evaluation of this program in its pilot version and therefore had limited documentation. The program manual, the logic model and the program theory were among the program elements examined in the process evaluation. The PM was interviewed along with program partner and participants. The 2011 approach generated a series of recommendations for improving program performance and management.

The 2012 process evaluation is a continuation of the 2011 evaluation and covers the following aspects:

- > follow-up on the 2011 evaluation recommendations regarding process issues;
- > new and/or updated program documentation including program modifications since the last evaluation;
- > program tracking sheet;
- > program partner's perspectives on process issues; and
- > program participants' perspectives on process issues.

Recommendations and follow-ups regarding impact evaluation (energy or demand) will be presented in the Impact Evaluation section of this report.

3.2 PROGRAM DOCUMENT ANALYSIS AND INTERVIEW WITH THE PROGRAM MANAGER

The following section describes the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interview with the PM. It also covers the follow-up on recommendations from last year in each applicable section.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory, in which all the information about a program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program, based on a template provided by the Evaluator.

In 2012, the Evaluator noted that MURB has a program memory in the form of a program manual and its various Appendices. The Evaluator is also pleased to report that MURB now has an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff, as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The program manual is intended to capture information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The MURB program manual is now presented in a standardized template which applies to all ENSC programs and includes the same table of contents with 10 sections. This is a considerable improvement on the 2011 format and follows one of the Evaluator's major recommendations.

With this new format, most recommendations regarding the program manual, such as providing a base case and the parameters used to estimate program objectives, are now covered in the program manual and its attached files and Appendices.

The following table shows the program manual content, which could not be compared to the 2011 version since the latter was a pilot and featured very little information. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 4: Program Manual Content – MURB

Program Manual Content	2012
Document revisions	✓
Program description (including nature or type of program)	✓
Program justification	✓
Program objectives	✓
Incentives	✓
Eligibility criteria	✓
Program partners and their roles	✓
Program barriers	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	✓
Details about the savings calculations and types of measure	✓
Annual budget	✓
Cost-effectiveness test results	✓
Market study or technical study supporting program elements or assumptions	✓
Marketing plan	✓
Evaluation plan	✓
Program theory	✓
Logic model	✓
Program process flow chart	✓
Partner or participant process flow chart	✓
Program forms	N/A
 Information included in the program manual  Information partially included in the program manual  No Information	

Although the new version of the program manual uses a standardized format and is complete in general, the Evaluator has a few minor recommendations for its improvement.

- > **Document the major characteristics of the program:** MURB has provincial funding this year. Thus, the installation of products that aim at reducing hot water consumption when a non-electric energy source is used for DHW is now covered by the program. The Evaluator recommends including this information in the program manual.
- > **Document major changes in the Document Revision section:** In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual. For example, this section should briefly describe the addition of new energy efficiency products or subtraction of old ones. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual.
- > **Be consistent in the program name formulation across all residential programs:** ENSC increases focus on serving customers through a one-window service approach and is therefore planning to market all residential activities as services instead of programs. So far, this change has already been implemented for MURB and Home Energy Assessment (HEA), which are now presented as services. The Evaluator recommends that consistency be maintained in the program names in internal and external documents (e.g. on the ENSC website). All activities should therefore be named only as a service or as a program, thus avoiding the confusion caused by two sets of names in the same portfolio. In a view to offer a one-window service approach, the program portfolio names should be planned carefully and globally, and not one program at a time. This latter approach would ensure that participants have all the necessary information to understand ENSC's offer, starting with the names of the different services. It would also prevent confusion among participants as to the difference between a service and a program, especially given that several programs already changed names a few times in the past.

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program's logic model. Econoler is currently working with ENSC to make sure that each program's updated logic model reflects the current program strategy, and the performance indicators established based on the program theory. The programs' logic models will all be finalized and included in the programs' manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the Evaluator's recommended template for an evaluation plan, which is included as an Appendix of the MURB program manual. The PM provided positive feedback on this important tool that complements the program manual and makes it possible to evaluate the program. The addition of the evaluation plan to the program documentation is a great improvement from last year.

3.2.4 Program Charts

The program now has two process charts: one for the partner and the participants and the other for the PM. These charts were recommended in the 2011 evaluation and are very informative for any new staff responsible for the program as well as for program partners and participants.

Econoler has the following recommendation on the program charts:

- **Provide the partner and participants with a simplified process chart:** The Evaluator recommends developing a simplified participant process chart and posting it on the program website (in the "How to Participate" section), which is comprehensive, clear and well designed. Moreover, the partner should be given copies of the process chart. After all, this chart is intended for the partner and the participants. Hence, it must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version number and revision date should be indicated in the chart.

3.2.5 Marketing and Outreach Activities

Due to the restructuring of the residential sector, to avoid program silos and to provide a one-window approach for participants, an integrated marketing plan has been drawn up and is being implemented for this sector. Indeed, ENSC is moving away from program-specific marketing towards a more all-inclusive approach, which offers a full suite of energy-saving services and rebates for customers.

In addition to the overall residential marketing strategy, MURB also has a specific approach to fit the nature of the targeted participants, who are building owners, renters and condo owners. The program manual provides in-depth details to serve two different marketing strategies: one for tenants and the other for property owners. If tenants or condo owners pay their own bills, then ENSC will convince them through several activities including Facebook events to install products to save energy and costs. In 2012, the lobby events used to promote the program were discontinued and replaced with a strategy, under which the DA contacts property owners who inform their tenants about the visits. The DA can enter the premises accompanied by the building manager without the occupants being present. Collaborating with landlords to perform installations provides easy access to units in which tenants are not responsible for paying the electricity bills. With this new approach, the participation rate has jumped from 30 to 80 percent.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

The Evaluator has the following recommendation on the marketing plan:

- > **Make the performance indicators more quantitative:** To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

3.3 TRACKING SHEET

Econoler reviewed the content of the tracking sheet for MURB. The tracking sheet presents all the program information in one sheet. Each line corresponds to a project and lists relevant information on both the landlord and the products installed in tenant units and common areas of the building. Each project has a unique identification number.

In general, the tracking sheet is clear and concise. Firstly, it provides information on the building, including the company name, building address, as well as the landlord name and phone number. Secondly, it presents the quantity of products installed in each category; for those categories of product suitable for both individual tenant units and common areas, it specifies if the installation is done in individual tenant units or common areas. Finally, the tracking sheet includes a field to indicate the source of energy used for domestic hot water heating, which was filled out for all the cases where DHW heating measures were installed. So the MURB tracking sheet contains the necessary fields for program administration and provides the PM with a way to continuously monitor the number of installed products by category and the number of participating buildings.

In terms of evaluation needs, the tracking sheet does not provide exactly all the necessary information. The most important element missing is the information on the tenants for whom products are installed and the quantity of products installed in each of these individual units. This information is essential for validating the installation of products during on-site visits and for evaluating the tenants' free-ridership level. It was present in last year's tracking sheet, but, since the process is quite different this year by having the landlord arrange the installation of energy-efficiency products, it could not be tracked the same way. Due to tenant privacy, landlords are not always able to provide ENSC with

tenants' names, phone numbers and rate codes. Another issue is the high percentage of tenant turnover in the rental sector. Still, ENSC tries to get this information when possible. However, it would be important to at least track the quantity and type of products installed in each individual unit. This information has been tracked only on paper forms since mid-August 2012.

Another missing element that could be useful for impact evaluation, particularly for interactive effects calculation, is the information on the space heating energy source and air conditioning.

Moreover, some fields, that are required for the impact evaluation or data collection activities like participant survey, were left blank with no values. For example, the fields for the landlord's last name and phone number contain blank entries in 22 and 18 percent of cases, respectively. A smaller number of rate codes were missing (12 percent), so the Evaluator had sufficient information to estimate the line loss factor associated with MURB.

In terms of savings, only products installed in tenant units should be claimed in MURB; savings from the products installed in common areas are being claimed in the Commercial Direct Install (CDI) component of Business Energy Solutions (BES) even if the products themselves are inputted in MURB. In the tracking sheet, savings from tenant units and common areas are calculated separately by multiplying the number of products installed in each category with the unitary savings values from the base cases presented in the evaluation plan. The tracking sheet includes a column where some energy savings are calculated by the DA using old energy savings values, but this column is only used for establishing the DA's targeted performance.

In the light of these observations, the Evaluator has some recommendations to facilitate program evaluation in the future:

- > **Collect quantity of products installed in each individual tenant unit:** In 2012, the quantity of products installed in each individual unit was only collected on paper forms from mid-August. In the future, Econoler recommends keeping track of this information in the tracking sheet, using the unit number instead of the tenant name, since it is rarely possible to collect tenants' names and phone numbers due to tenant privacy issues and the high rate of tenant turnover in the rental sector. These data would be useful for planning on-site visits with the landlords. The landlords can inform selected tenants of the upcoming visit and ask for their consent to enter their unit. Then, tenants could be visited to validate the installation of products, and a short survey could be completed to learn more about their satisfaction and free-ridership level.
- > **Make sure that all fields are systematically filled out:** The tracking sheet is considered relatively sufficient for program monitoring. However, the Evaluator found that some fields were left blank:
 - Landlord information: There were a few blank entries in landlord information, such as last name (22%) and phone number (18%). Also, no field has been included to indicate the postal code of each participating building; the postal code facilitates grouping participants by region for on-site visits.

- Rate code: This field is used to determine the line loss factor. It was empty in 12 percent of the records.

All this information is necessary for field activities (on-site visits and surveys) and is often essential for impact evaluation. A protocol could be implemented to ensure that all the information is collected and systematically recorded in the tracking sheet.

- > **Collect information on the location of the CFLs installed:** Regular CFLs can be installed indoors or outdoors. Some parameters useful to the impact evaluation, such as the hours of operation and the interactive effects, vary according to the location of the CFLs. Therefore, Econoler recommends adding a field in the tracking sheet to identify whether the CFLs were installed inside or outside each unit. This additional information would allow for a more precise evaluation of savings.
- > **Collect information on the heating energy source and air conditioning:** The tracking sheet should include information on the energy source used for space heating and indicate if tenants use air conditioning. This information is useful for the interactive effects factor calculations.
- > **Set limitations for entries and develop a validation process:** To ensure the validity of the values entered in the tracking sheet, Econoler recommends that ENSC establish a validation process to collect information in a standard way, facilitate the identification of blank entries and limit errors. For instance, under each category of product, a "0" value should be entered when no installation is done. Currently, the tracking sheet presents a mix of "0" values and blank entries.

3.4 RELATIONSHIP WITH PARTNER

As part of the process evaluation, the DA involved in MURB was interviewed. The latter indicated strong satisfaction with the program and their relationship with ENSC's team.

When asked about the transition from a pilot to a full program, the DA noted that booking installations was challenging at the start of the program in the spring of 2012. In addition, the DA stated that savings opportunities for the products offered in common areas were overestimated, resulting in a reallocation of the GWh target to Commercial Direct Install, which had a greater demand for products. Since the pilot was launched, the DA has learned a great deal about seasonal ups and downs in the property management industry. The lessons learned will allow honing program delivery for next year. The DA is planning to deliver a "pulse" strategy next year to increase efficiencies and to provide a better customer experience by avoiding doing installations in the peak move season of September. Thus, in spite of necessary adjustments at the start of the program, the transition from a pilot to a full program has been successful overall, as evidenced by the participation rate.

According to the DA, the major barrier to program delivery is the on-site support received from superintendents, which can make all the difference in the number of installations completed. The DA must also deal with legal obligations such as 24 hours' notice requirement for apartments or explicit permission requirement for condo owners.

Since the fall of 2012, the DA responsible for both MURB and CDI has indicated receiving a total of 61 complaints in the Direct Install stream encompassing both Commercial Direct Install and MURB Direct Install. While the number of complaints may seem high, it should be noted that it represents 3.5%³ of the installations performed in the Direct Install stream for this period. The complaints were about dislikes for the products, product failure, damaged property or missed appointment.

To improve the program, the DA recommended implementing an optional LED upgrade package for condo owners to make LED technology available at a cost/kWh level that will work with the funding available. The DA also suggested finding ways to tie the success of the installations to recognition or performance of building superintendents. On-site support is a prerequisite to successful installations.

Regarding the outreach and marketing activities, although the DA feedback shows good appreciation of program marketing, it still leaves room for improvement. The DA suggested holding more engagement and education events such as giveaways tied with the season (i.e. weather-stripping or indoor clothes drying racks) and lobby fairs to promote direct installation and sign people up individually in buildings where tenants pay their own power bills.

³ In September 2012, respectively 282 and 1446 installations have been performed in the MURB Direct Install and Commercial Direct Install programs.

3.5 PARTICIPANT PERSPECTIVES

3.5.1 Program Awareness

Survey respondents, who were landlords or landlords' representatives, were asked how they found out about the program. The results indicate that participants found out about MURB in a number of ways. The landlord or building management was mentioned most frequently (24%), although many found out about the program through ENSC initiatives including direct contact with ENSC staff (19%), the ENSC website (5%), ENSC mailings (5%), or newspaper advertising (5%). Word of mouth was mentioned by under two in ten (16%), while the Investment Property Owners Association was mentioned by eight percent.

Table 5: Sources of Program Awareness

Sources of Program Awareness	2012
<i>Sample Size*</i>	37
Landlord/Building management	24%
ENSC staff	19%
Co-worker, family or friend	16%
Investment Property Owners Association	8%
ENSC website	5%
Mailing from ENSC	5%
Newspaper	5%
Others	14%
Don't know	3%
*Multiple responses	

3.5.2 Motivations and Barriers to Participation

The table below presents the characteristics of participation, showing some building participants having products installed in both dwelling units and common areas (24%) while some others having products installed only within dwelling units (76%).

Table 6: Characteristics of Participation

Participation	2012
<i>Sample Size</i>	37
Did not have products installed in common area	76%
Did have products installed in common area	24%

Saving on energy and energy costs was mentioned as the single most important reason for participating in MURB by two-thirds of the participants (65%). Other reasons included: that the program is free (5%); that participants were thinking of undertaking upgrades anyway (3%); that they wanted to find out how energy-efficient their buildings were (3%). A small number of respondents noted that they were not directly involved in making the decision whether to participate in the program; in other words, the building management made the decision (16%).

Table 7: Reasons for Participating in Program

Reasons for Participating	Single Most Important Reason	Other Reasons*
<i>Sample Size</i>	37	37
To save on energy/To save on energy costs	65%	16%
Building management made decision	16%	3%
Program was free	5%	3%
Thinking about/planning to get energy efficient upgrades anyway	3%	5%
To find out how energy-efficient building was/ To have building evaluated	3%	3%
To help the environment	--	11%
Others	8%	3%
None/No other reasons	--	54%
Don't know	--	3%
*Multiple responses		

Very few participants had concerns prior to participating in the program. The only respondent who had concerns about the program was worried about tenants being unavailable when products were being installed.

Table 8: Concerns with Program Prior to Taking Part

Concerns with Program Prior to Taking Part	2012
<i>Sample Size</i>	37
Yes	3%
No	97%

Only one participant who had products installed in the common areas of their building noted they later removed some of them. This participant removed the CFLs, which did not work as expected.

Table 9: Products Installed but Later Removed

Products that were Removed	2012
<i>Sample Size</i>	9*
Yes	1
No	8
*Base: Respondents who had products installed in common areas of building	

Just fewer than one in ten participants noted that there were products recommended through the program that they opted not to have installed (8%). Of these three participants, two felt the products were too complicated to have installed, while one felt they did not need the products.

Table 10: Recommended but not Installed

Products that were Recommended but not Installed	2012
<i>Sample Size</i>	37
Yes	8%
No	92%

3.5.3 Program Influence

The participants who had products installed in the common areas were asked to indicate the level of importance of various factors in influencing their decision whether to install energy-efficient products through the program. The free installation factor was extremely important to participants in this decision, with a mean of 9.3. The information provided by program staff (8.4) and previous experience with a similar program (8.3) were also considered important.

Table 11: Importance of Factors in Influencing Decision

Importance of Factors in influencing Decision to Install Energy-Efficient Products	2012
<i>Sample Size*</i>	9
Mean (0=Not at all important, 10=Extremely important)**	
The free installation of energy-efficient products offered by the program	9.3
Information or advice provided by program staff throughout the upgrade process	8.4
Previous experience with a similar program either from ENSC, Nova Scotia Power or Conserve Nova Scotia	8.3
*Base: Respondents who had products installed in common areas of building	
**Mean excludes responses of 'Refused' and 'Don't know'	

3.5.4 Program Impact

A small majority of participants have indicated increased interest in energy efficiency since participating in the program (63%). Almost one-half felt their knowledge of energy efficiency has improved as a result of participation (45%).

Table 12: Improvements since Participating in Program

Improvements Since Participation	<i>Sample Size*</i>	2012 Improved**
Interest in energy efficiency	35	63%
Knowledge of energy efficiency	33	45%
*Don't know removed from calculations		
**Percentage of respondents who gave a rating of 5 or 4 on a scale where 5= 'Considerable improvement' and 1 = 'No improvement'		

As part of the program, most participants received information about energy efficiency or energy savings (70%).

Table 13: Information Received about Energy Efficiency

Information Received about Energy Efficiency	2012
<i>Sample Size</i>	37
Yes	70%
No	24%
Don't know/Don't recall	5%

3.5.5 Satisfaction with the Program

The majority of participants were satisfied with the overall experience with MURB (89%).

Table 14: Satisfaction with Overall Experience

Satisfaction with Overall Experience	2012
<i>Sample Size*</i>	36
Very satisfied – 5	56%
4	33%
3	8%
2	3%
Very dissatisfied – 1	--
*Don't know removed from calculations	

Those who were overall satisfied with MURB mentioned the following reasons for their satisfaction: satisfaction with the service (38%); lower energy bills (25%); saving energy (22%); satisfaction with the products and services offered through the program (16%); the free program aspect (9%); the good relationship with the evaluator who visited the building (9%); or the information received (3%).

Table 15: Reasons for Satisfaction with Program

Reasons for Satisfaction*	2012
<i>Sample Size**</i>	32
Good service	38%
Lowered energy bill	25%
Saves energy	22%
Products/services offered through the program	16%
Program was free	9%
Liked the evaluator/program representative who visited the building	9%
Information received/informative	3%
Others	6%
*Base: Respondents who gave a rating of 5 or 4 on a scale where 5= 'Very satisfied' and 1 = 'Not at all satisfied'	
**Multiple Responses	

Among the four participants who were dissatisfied with the program, three indicated that the products installed did not suit their needs.

Table 16: Reasons for Dissatisfaction with Program

Reasons for Dissatisfaction	2012
<i>Sample Size*</i>	4
Products installed don't suit my needs	3
Other	1
*Base: Number of respondents who gave a rating of 2 or 3 on a scale where 5= 'Very satisfied' and 1 = 'Not at all satisfied'	

There was a high level of satisfaction with various aspects of the program. Specifically, nine in ten participants were satisfied with the time required to complete the work (92%), and with the program representative overall (89%). Almost nine in ten were satisfied with the energy conservation products installed in the units (86%), while over three quarters were satisfied with the information received about energy efficiency or energy savings (77%). Finally, of the nine participants who had products installed in common areas, seven were satisfied with these energy conservation products.

Table 17: Satisfaction with Aspects of the Program

Aspect of Program	Sample Size*	2012 Satisfied**
The time required to complete work	37	92%
The program representative overall	37	89%
The energy conservation products installed in units (apartments)	35	86%
The information received about energy efficiency or energy savings	35	77%
[Common area only] The energy conservation products installed in common areas	9	7
*Don't know removed from calculations		
**Percentage or number of respondents who gave a rating of 5 or 4 on a scale where 5 = 'Very satisfied' and 1 = 'Not at all satisfied'		

Most participants found it easy to participate in the program, as shown by 86 percent of them giving a rating of '5' or '4' on a 5-point scale with '5' indicating "very easy" and '1' "very difficult".

Table 18: Participation Process

Participation Process	2012
<i>Sample Size*</i>	37
5 - Very easy	62%
4	24%
3	11%
2	3%
1 - Very difficult	--
*Don't know removed from calculations	

Of the five participants who found it difficult to participate in the program, two felt the paperwork was time-consuming, and two were not able to decide whether to participate as it was the landlord's decision.

Table 19: Causes for Program Participation Difficulty

Causes for Program Participation Difficulty	2012
<i>Sample Size*</i>	5
Paperwork/process was time consuming/required too much work	2
Landlord's decision/Didn't have a choice	2
Other	1
*Base: Respondents who had difficulty with participation (as indicated by a rating of '1', '2' or '3')	

3.5.6 Participant Recommendations for Improvements

Although the majority (59%) of the participants did not offer any recommendations for improvements, those who did offered various recommendations to improve MURB. Just over one in ten participants would like to see a wider variety of products (14%), while one in ten would like more information on the products installed through the program (11%). A small number mentioned scheduling to be improved or wait times to be shortened (5%), or faster service when on-site (3%). The one respondent who specified which additional products they would like to see mentioned toilets.

Table 20: Recommendations to Improve Program

Recommendations to Improve Program	2012
<i>Sample Size*</i>	37
Offer a wider variety of products	14%
Offer more information on the products	11%
Improve scheduling/Shorten wait for visit	5%
Faster service on-site at the building	3%
Others	14%
No recommendation	59%
*Multiple responses	

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation is aimed at determining the gross and net savings of the program for 2012. Both energy and demand savings were examined in this evaluation. To do so, the following parameters were analyzed by Econoler:

- > unitary savings values used for each category of product;
- > installation rates;
- > demand-to-energy ratio;
- > interactive effects factors; and
- > free-ridership.

The impact evaluation is the result of two main activities.

First, Econoler reviewed the unitary savings values used in the tracking sheet. For each product, Econoler validated the source of data and the parameters used in the calculations. Several unitary savings values were validated during last year's evaluation of the Multi-Unit Residential Renter (MURR) program. In these cases, Econoler conducted a literature review to check if more recent studies had been published since then and, if so, it validated if updated values should be used to revise the unitary savings calculations.

Second, on-site visits were conducted in order to validate product installation and ensure that there had been no removal. The results of this validation were used to estimate the installation rate for each category of product. These installation rates were then applied to the gross savings calculation. Some technical information obtained from on-site observations and self-declaration, such as the wattages of the lamps replaced, was also used to validate the parameters used in the unitary savings calculations. In-depth interviews with tenants were also conducted during these visits to evaluate the free-ridership level for the products installed inside each individual unit.

Only savings generated by products installed in tenant units are claimed under MURB. Products installed in common areas are claimed under BES, since conditions of operation for those products differ from a residential usage. Therefore, this impact evaluation will only target savings from products installed in tenant units.

4.1.1 On-Site Visit Sampling and Protocol

Sampling Methodology

A total of 31 on-site visits were conducted for this evaluation with a focus on products installed in individual tenant units.

The sampling was carried out in September 2012 using the MURB tracking sheet which contained the list of buildings where direct installations took place. The installation details for individual units were available in paper forms and only for installations that occurred after mid-August. Therefore, the sampling was limited in terms of building selection, but the Evaluator was able to ensure that the buildings selected had at least CFLs installed in tenant units. Indeed, the Evaluator's analysis of the tracking sheet⁴ showed that CFLs were installed in the vast majority of buildings (90%) and in large quantities (83% of installed products were CFLs).

The Evaluator selected 10 projects implemented in 7 different buildings with the biggest quantities of CFLs installed in tenant units. For each building selected, the Evaluator used the paper forms with the detailed list of measures installed in each unit to select up to 7 units in each building for on-site visits. The selection was made to ensure to the greatest extent possible that all kinds of product were covered in the sample.

On-Site Visit Protocol

The on-site visits were conducted to validate the installation of the products according to the data found in the paper forms and to establish the percentage of products removed, if any, and the causes for removing them after installation. Technical information was also collected through on-site observations or homeowner declarations in order to validate the assumptions used to calculate the product unitary savings. At the end of the visit, tenants were interviewed to evaluate their level of free-ridership.

4.2 GROSS SAVINGS

The quantities of products installed in participating tenant units are computed in the tracking sheet. For each product, ENSC uses a unitary savings estimate that is based on past evaluation results and the real wattage values collected on-site.

The following sections describe how these unitary savings values were estimated by ENSC and present Econoler's review of these values based on the most recent studies and data collected during the on-site visits. In many cases, Econoler based its review on the 2011 Ontario Power

⁴ As of September 2012.

Authority (OPA) Prescriptive Measures and Assumptions report⁵, which is considered as a recent and reliable secondary data source.

4.2.1 CFLs

Tracked Savings

In the tracking sheet, the quantity of CFLs installed is recorded according to the types of lamp (dimmable or not) and the wattage of the new CFL installed. Therefore, five categories of CFLs are listed in the tracking sheet:

- > 13-watt CFLs;
- > 23-watt CFLs;
- > 8-watt dimmable CFLs;
- > 14-watt dimmable CFLs; and
- > 16-watt dimmable CFLs.

ENSC uses a specific unitary savings value for each category, based on the difference between the real wattage of the CFL installed and the average equivalent wattage of the replaced incandescent lamp with equivalent light output. For instance, 13-watt CFLs typically replace 60-watt incandescent lamps, so the displaced wattage for this category of CFL corresponds to 47 watts.

For 23-watt CFLs, ENSC uses a value from the 2011 evaluation report of the MURR program. The displaced wattage was estimated at 93.5 watts by the Evaluator. This value was based on the data collected in 2011 through the Efficient Products – Direct Install program for residential buildings and the wattage values found on the market. In fact, the Evaluator found in the ENERGY STAR light output equivalency table that 23-watt CFLs are comparable to 75- or 100-watt incandescent lamps, but also observed that incandescent lamps of 75 watts are rarely available on the market. Manufacturers also indicated that the light output of a 23-watt CFL is sufficient to replace a 100-watt incandescent lamp.

For all these lighting products, ENSC uses hours of operation of 2.7 hours per day. This value was revised by Econoler in the 2011 evaluation reports of ENSC's residential programs. It is based on a metering study conducted for Hydro-Québec's residential lighting program⁶.

⁵ Ontario Power Authority (OPA), "2011 Prescriptive Measures and Assumptions," Release Version 1, March 2011.

⁶ Econoler, "Evaluation Report: Programme Produits Mieux Consommer – Éclairage résidentiel, presented to Hydro-Québec," Québec, March 30, 2011.

The following equation is used to calculate the unitary savings values based on the real displaced wattage associated with each category of CFL installed and the hours of operation of 2.7 hours per day.

$$\text{Annual Unitary Savings} \left[\frac{kWh}{yr} \right] = \frac{(\text{Old Wattage} - \text{New Wattage}) \times 2.7 \frac{h}{day} \times 365 \frac{day}{yr}}{1000 \frac{W}{kW}}$$

The table below summarizes the unitary savings values used by ENSC in the tracking sheet.

Table 21: Tracked Unitary Savings Values for Each Category of CFL

Category of CFL	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)
13W CFL	60	13	47	2.7	46.3
23W CFL	93.5	23	70.5	2.7	69.5
8W Dimmable CFL	40	8	32	2.7	31.5
14W Dimmable CFL	60	14	46	2.7	45.3
16W Dimmable CFL	60	16	44	2.7	43.4

Revised Savings

Both the displaced wattage values and the hours of operation were reviewed by Econoler during this evaluation.

Displaced Wattage

The displaced wattages estimated by ENSC were revised according to the on-site visit results and by comparing the wattage value of each type of CFL installed through the program with the average equivalent wattage of incandescent lamps it should replace, using the light output equivalency presented in the figure below.

Figure 2: Light Output Equivalency for Incandescent Lamps to CFLs⁷

LIGHT OUTPUT EQUIVALENCY		
INCANDESCENT BULBS (WATTS)	MINIMUM LIGHT OUTPUT (LUMENS)	COMMON ENERGY STAR QUALIFIED LIGHT BULBS (WATTS)
40	450	9 TO 13
60	800	13 TO 15
75	1,100	18 TO 25
100	1,600	23 TO 30
150	2,600	30 TO 52

The analysis revealed that, according to the light output equivalency table, the displaced wattages estimated for each type of CFL installed through the program are adequate. Participant declarations obtained during on-site visits confirmed these assumptions for 13-watt and 23-watt CFLs. Indeed, 92 percent of participants visited were able to confirm that 60-watt incandescent lamps were replaced by the new 13-watt CFLs installed inside their unit. In the case of 23-watt CFLs, the answers varied between 100-watt incandescent lamps and a mix of 60-watt and 100-watt incandescent lamps, which confirms the accuracy of the 93.5-watt value used as the baseline for this product.

Hours of Operation

Econoler considers that metering data, when available, should always be prioritized over self-declaration estimates which may be influenced by respondent behavioural factors. Therefore, Econoler looked for metering studies on the daily usage of residential lighting to validate the hours of operation of CFLs. The table below presents the results of this literature review.

⁷ ENERGY STAR, "ENERGY STAR Qualified Light Bulbs – 2006 Partner Resource Guide."

Table 22: Daily Usage of CFLs from Metering Studies

Source	Hours of Use (h/day)		Number of homes	Number of loggers	Metering Period
	Indoor	Outdoor			
BC Hydro, 2009 ⁸	2.43	-	18	77	2004
California, 2005 ⁹	2.28	3.1	375	752	2003-2004
Hydro-Québec, 2011 ¹⁰	2.68	3.6	200	787	2010
Michigan, 2012 ¹¹	2.2	3.0	152	628	2010-2012
New England States, 2009 ¹²	2.8		157	661	2008

Since the last evaluation, new studies have been published, including one for Michigan and an updated one for the New England states. However, the Hydro-Québec study is still considered as the most appropriate for Nova Scotia since it was conducted in households located in the province of Québec, i.e. households with similar number of hours of illumination per year. Moreover, it is a study with one of the largest samples and one of the biggest numbers of loggers installed.

Therefore, Econoler considers that ENSC should continue using the results from the Hydro-Québec study to estimate the daily usage of CFLs. Since regular CFLs can also be installed outdoors, the proportions of CFLs installed inside and outside the residence were used to calculate the overall hours of operation for 13-watt and 23-watt CFLs. Since this information is not collected in the tracking sheet, Econoler used the proportions estimated for all the residential households in Nova Scotia, i.e. 94 percent of CFLs installed inside houses and the remaining 6 percent installed in outdoor sockets. This information comes from a socket study conducted for ENSC in 2011 to investigate CFL installations. Based on these parameters, the estimate of the overall hours of operation used for CFLs remains at 2.7 hours per day:

$$\text{Overall Hours of Operation} = \left(94\% \times 2.68 \frac{h}{day}\right) + \left(6\% \times 3.6 \frac{h}{day}\right) = 2.7 \frac{h}{day}$$

⁸ Power Smart Evaluation and Research, "Milestone Report: Lighting Program – CFL Component Evaluation for Fiscal Year 2009," Prepared for BC Hydro, September 28, 2009.

⁹ KEMA, "CFL Metering Study – Final Report," Oakland, California, February 25, 2005.

¹⁰ Econoler, "Evaluation Report: Programme Produits Mieux Consommer – Éclairage résidentiel, presented to Hydro-Québec," Québec, March 30, 2011.

¹¹ Opinion Dynamics & The Cadmus Group, "CFL Hours of Use Study Summary of Approach and Results," July, 2012.

¹² Nexus Market Research, RLW Analytics & GDS Associates, "New England Residential Lighting Markdown Impact Evaluation," Submitted to: Markdown and Buydown Program Sponsors in Connecticut, Massachusetts, Rhode Island, and Vermont, January 20, 2009.

For dimmable CFLs, Econoler assumes that these products are all used for indoor applications. Therefore, their hours of operation were revised to 2.68 hours per day, instead of the rounded value of 2.7 hours per day calculated to take into account outdoor installations.

Unitary Savings

The unitary savings values were revised according to the Evaluator's review of the displaced wattage values and the hours of operation. The table below presents the final unitary savings values revised for each category of CFL. The last column of the table indicates if the value is different from the one used in the tracking sheet.

Table 23: Revised Unitary Savings Values for Each Category of CFL

Category of CFL	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)	Comparison with Tracked Value
13W CFL	60	13	47	2.7	46.3	46.3
23W CFL	93.5	23	70.5	2.7	69.5	69.5
8W Dimmable CFL	40	8	32	2.68	31.3	31.5
14W Dimmable CFL	60	14	46	2.68	45.0	45.3
16W Dimmable CFL	60	16	44	2.68	43.0	43.4

4.2.2 LED Nightlights

Tracked Savings

For the LED nightlights installed through MURB, ENSC uses a unitary savings value of 29.3 kWh per year. This value is based on last year's evaluations of ENSC's residential programs¹³. The assumptions used to make the savings calculation are presented in the table below.

Table 24: Tracked Unitary Savings Value for LED Nightlights

Parameter	Value
Old Wattage (incandescent nightlight)	7 W
New Wattage (LED nightlight)	0.3 W
Average Displaced Wattage	6.7 W
Operating Time	12 h/day
Unitary Savings	29.3 kWh/year

¹³ LED nightlights were installed under the Low Income Renter, MURR, EnerGuide for Existing Houses and Low Income programs.

Revised Savings

Two models of LED nightlight are installed under MURB. Both models have a wattage value of 0.3 W^{14} , which corresponds to the wattage value used for LED nightlights in the unitary savings calculation.

Under MURB, new LED nightlights installed must replace old traditional nightlights. By investigating the different nightlight models offered on the market, Econoler has found that traditional nightlights generally consist of a 7-watt incandescent light bulb.

Therefore, the average displaced wattage of 6.7 W ($7\text{ W} - 0.3\text{ W}$) revised in last year's evaluation should remain the same since there have been no changes in the types of LED nightlight installed, or the incandescent models available and employed for standard practice.

As for the hours of operation, ENSC uses a value of 12 hours per day, which represents a nightlight turned on all night. This value is based on the Technical Reference Manual used by the Pennsylvania Public Utility Commission¹⁵. Econoler has not found any other studies to support this value. However, the Evaluator considers that the value of 12 hours per day is realistic. The LED nightlights installed through the program are equipped with a photocell that automatically turns on the nightlight when it gets dark. Therefore, the nightlights installed in rooms unaffected by daylight are likely to remain on for several hours during the day. For nightlights installed in rooms affected by daylight, there is a potential operating time of 12 hours per day since the average time of illumination in Halifax is 12.22 hours per day¹⁶.

The Evaluator considers that the displaced wattage of 6.7 W ($7\text{ W} - 0.3\text{ W}$) and the average hours of operation of 12 hours per day are adequate. Consequently, the unitary savings value of 29.3 kWh per year used for LED nightlights remains unchanged.

¹⁴ LED Night-Light with Photocell – 0.3 watt, Niagara, SKU: N9277 and CFL light bulb shape night light with light sensor, 120V-60Hz MAX 0.3W, Item #B8479.

¹⁵ Pennsylvania Public Utility Commission, "Technical Reference Manual," State of Pennsylvania, June 2011, pages 42-43.

¹⁶ National Research Council Canada, Sunrise/Sunset Calculator, Standard times of solar rise/set for Halifax NS 2012, Date modified: 2012-08-07, www.nrc-cnrc.gc.ca.

4.2.3 Faucet Aerators

Tracked Savings

For all the faucet aerators installed through MURB, ENSC uses a unitary savings value of 176 kWh per year. This value comes from the 2011 OPA Prescriptive Measures and Assumptions report cited at the beginning of this section.

The OPA reports a base flow rate of 2.2 gpm (8.33 L/min) having been reduced to 1.5 gpm (5.68 L/min) as a result of installing the faucet aerator and this represents a reduction of 31.8 percent. The daily use of hot water is estimated at 28.27 liters per day per faucet. It translates into a total amount of 8.81 liters per day in hot water consumption for a typical household with an average of three faucets (one in the kitchen and two in the bathroom). Therefore, the unitary savings value used by ENSC corresponds to an average value per faucet, assuming that all faucets in a household have the same amount of usage.

Revised Savings

Econoler conducted a literature review to validate the assumptions used by the OPA. The studies found provided very few details on the savings calculations and assumptions used by other jurisdictions. Therefore, as in the 2011 evaluation report, Econoler considers it adequate to continue using the average unitary savings value of 176 kWh estimated by the OPA for faucet aerators.

4.2.4 Low-Flow Showerheads

Tracked Savings

For low-flow showerheads, ENSC uses a unitary savings value of 377 kWh, based on a flow-rate improvement of 0.75 gpm (from 2 gpm with an old showerhead to 1.25 gpm with the new low-flow product). This unitary savings value comes from the OPA report.

Revised Savings

Econoler reviewed this unitary savings value by conducting a literature review to validate the assumptions used by the OPA. As for faucet aerators, no more recent studies with energy savings calculation details could be found for low-flow showerheads. Nevertheless, Econoler was able to validate the flow-rate assumptions used by the OPA. While most low-flow showerheads found on the market have a flow rate of 1.5 gpm (compared to 1.25 gpm used by the OPA), the baseline flow rate of 2 gpm seems conservative. Most standard showerheads sold on the market these days have a flow rate of around 2.5 gpm and, according to Environment Canada, conventional showerheads found in

Canadian homes can have flow rates of up to 4 to 5 gpm.¹⁷ Therefore, Econoler concludes that the unitary savings value of 377 kWh from the OPA report is largely acceptable.

4.2.5 Pipe Insulation

Tracked Savings

Pipe insulation is installed under MURB for tenants who have an individual DHW tank. For each unit of pipe insulated, ENSC uses a savings value of 74 kWh per year. This value comes from the 2009 impact evaluation report of the Low Income Homeowner program. Econoler does not have all the calculation details used to establish this value, but knows that the calculation was based on an insulated pipe 10-foot-long and 0.75-inch in diameter, which were considered as common length and size in residential applications.

Revised Savings

In the tracking sheet, the number of “pipe insulation” units is currently reported in length of pipe insulated by different foot intervals, depending on the Delivery Agent. Using the detailed assumptions used in the OPA report, the unitary savings value of 74 kWh used by ENSC corresponds approximately to the value calculated for 6 feet of insulation.

Table 25: Unitary Savings Values by Length of Insulated Pipe

Length of Insulated Pipe	Unitary Savings Value
3 feet	38 kWh/year
6 feet	76 kWh/year
9 feet	114 kWh/year
12 feet	152 kWh/year
15 feet	190 kWh/year

While 3 feet seems to be a common length when purchasing pipe insulation, the length of pipe insulated for residential applications typically varies between 6 to 15 feet, according to what was found in the literature. The length of pipe that can be insulated in a house is often limited, since the largest portion of the pipes is hidden in the walls. In the savings calculation, it is assumed that the pipe insulation is installed immediately downstream of the hot water storage tank, where most of the heat loss would occur. Moreover, the general equation used to calculate the energy savings cannot be

¹⁷ Environment Canada, “Wise Water Use,” Web, January 21, 2013, <<http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=F25C70EC-1>>.

used on an infinite length of insulated pipe, since it uses the assumptions that the water temperature is uniform throughout the insulated portion of the pipe.

For this year's evaluation, since no information on the length of insulation installed was collected in the tracking sheet, Econoler will use a unitary savings value of 76 kWh per year, based on the OPA report and a 6-foot insulated pipe (compared to the 74-kWh value currently used and for which we do not have all the calculation details).

Nonetheless, for 2013, Econoler recommends collecting the specific length (in feet) of insulation installed in each unit and limiting the installation of insulation to the first 15 feet.

4.2.6 Hot Water Tank Wraps

Tracked Savings

Hot water tank wraps are also installed under MURB. For this product installed in tenant units on individual DHW tanks, ENSC uses a unitary savings value of 270 kWh per year. This value comes from the 2011 OPA Prescriptive Measures and Assumptions report, and is based on a conductance value of 1.429 W/°C for a heater without a tank wrap and of 0.6348 W/°C for an insulated heater with a tank wrap.

Revised Savings

Econoler reviewed the assumptions and the engineering calculations used by the OPA and concludes that the unitary savings value of 270 kWh per year is adequate.

4.2.7 Installation Rate

In 2012, Econoler conducted 31 on-site visits in individual tenant units that participated in MURB. The main purpose of these visits was to validate whether the products were properly installed according to the information contained in the paper forms and, if possible, establish installation rates with a sufficient level of precision.

For each unit visited, the quantity of products installed was recorded and compared to the quantity indicated in the paper forms. When the number of products found on-site was different from that in the paper forms, the ratio between the two numbers was calculated to establish the installation rate. The percentage of products installed was measured for all the product categories installed through the program.

The table below shows the percentages of products installed calculated from the on-site visits and the installation rates applied to the quantity of products installed in the gross savings calculation.

Table 26: Percentage of Products Installed and Installation Rate

Category of Product	Quantity Installed – From Paper Forms	Quantity Installed – From On-Site Visits	Percentage of Products Installed	Installation Rate	Error Margin ¹⁸
Regular CFL (13W and 23W)	221	221	100%	100%	0%
Dimmable CFL (8W, 14W and 16W)	30	29	97%	97%	7.1%
LED Nightlight	2	2	100%	100%	0%
Faucet Aerator	31	31	100%	100%	0%
Low-Flow Showerhead	22	21	95%	95%	7.8%
Pipe Insulation	9	9	100%	100%	0%
Hot Water Tank Wrap	9	9	100%	100%	0%

The results revealed very high installation rates. In most cases, the products installed through the program were still in place when the Evaluator conducted the visit. Only one dimmable CFL was removed by a participant and one low-flow showerhead by another participant. Moreover, one CFL that had been installed through the program was burned out at the time of the visit, but should be replaced by the participant, so the Evaluator did not take that into account in the installation rate calculation.

The on-site visits also showed the accuracy of information collected in the tracking sheet, as well as on paper copies.

4.2.8 Demand-to-Energy Ratio

Econoler calculated the demand savings for MURB based on a demand-to-energy ratio of 0.231 MW/GWh. This ratio was obtained from the adjusted 2012 program targets by dividing the target peak demand savings by the target energy savings.

¹⁸ Calculated for a confidence interval of 90%.

4.2.9 Revised Gross Savings

The annual gross savings for each category of product installed through the program are presented in Table 27. They were calculated using the revised unitary savings values presented in the previous section. Overall, the total gross energy and demand savings amount to 2.863 GWh and 0.661 MW at the meter.

The gross savings at the generator level are also presented in Table 27 using a line loss factor between the meter and the generator of 1.093. This value was estimated by using the participants' rate code included in the tracking sheet. MURB targets the multi-unit buildings, of which 44 percent are commercial customers (buildings with one meter for all the renters) and 56 percent are residential customers (one meter for each renter). The line loss factor for MURB was calculated using these proportions and the values provided by Nova Scotia Power. Based on these input values, the gross energy and demand savings at the generator for MURB were evaluated at 3.130 GWh and 0.723 MW.

Table 27: Evaluation Results – Gross Energy and Demand Savings by Product

Category of Product	13-Watt CFL	23-Watt CFL	8-Watt Dimm. CFL	14-Watt Dimm. CFL	16-Watt Dimm. CFL	LED Nightlight	Faucet Aerator	Low-Flow Shower-head	Pipe Insulation	Hot Water Tank Wrap	Total
Energy Savings											
Number of units	38,193	1,653	149	128	415	204	1,814	1,611	107	157	-
Installation rate	100%	100%	97%	97%	97%	100%	100%	95%	100%	100%	-
Total number of units installed	38,193	1,653	145	124	403	204	1,814	1,530	107	157	-
Unitary savings value (kWh)	46.3	69.5	31.3	45.0	43.0	29.3	176	377	76	270	
Total Gross Energy Savings – at Meter (GWh)	1.768	0.115	0.005	0.006	0.017	0.006	0.319	0.577	0.008	0.042	2.863
Line loss factor	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	-
Total Gross Energy Savings – at Generator (GWh)	1.933	0.126	0.005	0.006	0.019	0.007	0.349	0.631	0.009	0.046	3.130
Demand Savings											
Demand-to-energy ratio	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	-
Total Gross Demand Savings – at Meter (MW)	0.408	0.027	0.001	0.001	0.004	0.001	0.074	0.133	0.002	0.010	0.661
Line loss factor	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	-
Total Gross Demand Savings – at Generator (MW)	0.446	0.029	0.001	0.001	0.004	0.002	0.081	0.146	0.002	0.011	0.723

4.3 INTERACTIVE EFFECTS

In a residence, interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as heating and cooling. In the case of MURB, replacement of incandescent lighting products with CFLs or LED nightlights causes an increase in the heating load during winter and a decrease in the cooling load during summer. Indeed, energy-efficient lighting releases less heat than the less efficient lamps it replaces.

For lighting products, the evaluation of the interactive effects factor is based on a study conducted by ADS in 1992 for Hydro-Québec. The work carried out in this study was intended to modify certain parameters in simulations of an average home in Quebec to determine the impact of these changes on the interactive effects. The simulations were performed with the DOE-2 software¹⁹ and only focused on homes heated entirely by electricity. The simulations were carried out based on three scenarios for interactive effects: low, moderate and high interactive effects. The scenario with minimum interactive effects was finally selected for the calculation because it reflects the evolution of homes since 1992.

The table below presents the calculation details of the interactive effects factor for CFLs and LED nightlights. It reflects the proportions of Nova Scotia residences heated electrically²⁰ and using air conditioning units or systems²¹. Econoler had to rely on the values for all of Nova Scotia since the information on the heating energy source and the use of air conditioning was not included in the tracking sheet.

Table 28: Interactive Effects Calculation for Lighting Products

Parameter	% of Residences	Interactive Effects ²²
Electric heating with air conditioning	$33\% \times 18\% = 5.9\%$	-54.4%
Electric heating without air conditioning	$33\% \times 82\% = 27.1\%$	-58.0%
No electric heating with air conditioning	$67\% \times 18\% = 12.1\%$	3.6%
No electric heating without air conditioning	$67\% \times 82\% = 54.9\%$	0%
Weighted Interactive Effects Factor	-	-18.5%

These interactive effects occur only when the products are installed inside the house. As regular CFLs (13-watt and 23-watt CFLs) can also be used for outdoor lighting (some cases were observed during

¹⁹ DOE-2 is a widely used and accepted software building energy analysis program developed under funding from the U.S. Department of Energy.

²⁰ ENSC from socket study.

²¹ Statistics Canada (CANSIM), Households having air conditioning, Nova Scotia, 2009.

²² ADS ASSOCIÉS, "Évaluations des effets énergétiques combinés des mesures d'économies d'énergie – résidence unifamiliale," report presented to Hydro-Québec, 1992.

on-site visits), the interactive effects factor for these products was adjusted to take that into account. To do so, Econoler used the same proportions as those used to calculate the hours of operation, being 94 percent of CFLs installed inside houses and the remaining 6 percent installed in outdoor sockets. This information comes from a socket study conducted for ENSC in 2011 to investigate CFL installations.

Table 29: Interactive Effects Factors for Regular CFLs, Dimmable CFLs and LED Nightlights

Category of Product	% Indoor	% Outdoor	Interactive Effects Factor
Regular CFL (13W and 23W)	94%	6%	$(94\% \times -18.5\%) + (6\% \times 0\%) = -17.4\%$
Dimmable CFL (8W, 14W and 16W)	100%	0%	-18.5%
LED Nightlight	100%	0%	-18.5%

For pipe insulation and hot water tank wraps, interactive effects of -100 percent are considered during the heating period in electrically heated houses. This estimation is based on the fact that, when there is no insulation, all the heat lost through the pipes and the hot water tank is released into the room. It means that 100 percent of the energy released from the hot water is used for the heating load. Conversely, during the cooling period, interactive effects are estimated at +100 percent in houses that use air conditioning. Based on the heating and cooling degree-days for the region of Halifax²³, Econoler considered an eight-month heating period and a two-month cooling period in the interactive effects calculation. The table below presents the details for such calculations. As for lighting products, the table shows the proportions of Nova Scotia residences heated electrically and using air conditioning, which resulted in a weighted interactive effects factor of -19.0 percent.

Table 30: Interactive Effects Factor for Pipe Insulation and Hot Water Tank Wraps

Parameters	% of Residences ²⁴	Interactive Effects During Heating Period	Interactive Effects During Cooling Period
Electric heating with air conditioning	$33\% \times 18\% = 5.9\%$	$-100\% \times 8/12 = -67\%$	$+100\% \times 2/12 = +17\%$
Electric heating without air conditioning	$33\% \times 82\% = 27.1\%$	$-100\% \times 8/12 = -67\%$	$0\% \times 2/12 = 0\%$
No electric heating with air conditioning	$67\% \times 18\% = 12.1\%$	$0\% \times 8/12 = 0\%$	$+100\% \times 2/12 = +17\%$
No electric heating without air conditioning	$67\% \times 82\% = 54.9\%$	$0\% \times 8/12 = 0\%$	$0\% \times 2/12 = 0\%$
Weighted Interactive Effects Factor	100%	-22.1%	+3.1%
		-19.0%	

Finally, for all other products, interactive effects are considered as negligible.

²³ RETScreen International, Normalized climate data for Halifax International Airport, Natural Resources Canada, 1997-2010.

²⁴ From DA information and Statistics Canada.

4.4 NET-TO-GROSS RATIO

The net-to-gross ratio (NTGR) is based on a self-report approach which relies on a series of questions designed to measure the influence of the program on end-users' decisions whether to participate in the program. This section presents the methodology used to calculate the NTGR. For MURB, the NTGR only includes the assessment of free-ridership. Once this effect has been quantified, the NTGR is calculated based on the following equation:

$$NTGR = (1 - \% \text{ free-ridership})$$

4.4.1 Free-Ridership

In the case of MURB, tenants are not initially involved in the decision process to participate in the program. At first, the landlord or building owner is contacted by the DA to get his or her approval on implementing program energy efficiency measures in the building. Then, tenants are informed and are free to choose to participate in the program or not.

However, since the free-ridership level is directly applied on the savings generated by the products installed in the individual tenant units, the free-ridership level had to be measured through interviews with tenants during the on-site visits, rather than using the participant survey with landlords and building owners.

The interview questionnaire included different questions that attempted to assess the following variables:

- > if tenants had any plans to install energy-efficient products before learning about the program;
- > the probability that tenants would have installed the same energy-efficient products if they had not participated in the program;
- > the probability that tenants would have installed the same energy-efficient products but at a later date if they had not participated in the program; and
- > the probability that tenants would have paid the full cost of the energy-efficient products if the program had not been in place.

Questions were asked separately for lighting products and DHW related products. For each category of product, responses to these questions were transposed into a level of program attribution, and then used to calculate an average free-ridership level based on the proportion of gross energy savings generated by each category of product. The algorithm behind this calculation is presented in Appendix VI.

With this approach, the average level of free-ridership obtained is 16 percent. The relatively low level of free-ridership can be explained by the fact that MURB targets multi-unit renters, which often represent customers that are less interested in energy efficiency and are less disposed to install

energy-efficient products in the absence of a program. This indicates to ENSC the necessity to continue targeting multi-unit customers.

The free-ridership result is similar to the one obtained last year (17% in 2011). However, results are hardly comparable due to changes in the methodology. Indeed, in 2012, the free-ridership level was assessed through interviews with tenants during the on-site visits, rather than through a tenant phone survey as it was done in 2011.

4.4.2 NTGR Calculation

Using the free-ridership level established, the NTGR value for the program is estimated at 0.84. This value is applied to the gross savings.

4.5 NET SAVINGS

Net energy savings are estimated by adding the interactive effects and the NTGR to the gross energy savings, based on the following equation:

$$\text{Net Energy Savings} = \text{Gross Energy Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}.$$

The net energy savings were first calculated separately for each product because the interactive effects differed from one product to another. Table 31 presents the details of the calculation.

Overall, the total net energy and demand savings amount to 2.117 GWh and 0.489 MW at the meter, and 2.314 GWh and 0.534 MW at the generator.

Table 31: Evaluation Results – Net Energy and Demand Savings by Product

Category of Product	13-Watt CFL	23-Watt CFL	8-Watt Dimm. CFL	14-Watt Dimm. CFL	16-Watt Dimm. CFL	LED Nightlight	Faucet Aerator	Low-Flow Shower-head	Pipe Insulation	Hot Water Tank Wrap	Total
Energy Savings											
Total gross energy savings – at meter (GWh)	1.768	0.115	0.005	0.006	0.017	0.006	0.319	0.577	0.008	0.042	2.863
Interactive effects factor	-17.4%	-17.4%	-18.5%	-18.5%	-18.5%	-18.5%	0%	0%	-19.0%	-19.0%	-
NTGR	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	-
Total Net Energy Savings (GWh) – at Meter	1.227	0.080	0.003	0.004	0.012	0.004	0.268	0.485	0.006	0.029	2.117
Line loss factor	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	-
Total Net Energy Savings (GWh) – at Generator	1.341	0.087	0.003	0.004	0.013	0.004	0.293	0.530	0.006	0.032	2.314
Demand Savings											
Total gross demand savings – at meter (MW)	0.408	0.027	0.001	0.001	0.004	0.001	0.074	0.133	0.002	0.010	0.661
Interactive effects factor	-17.4%	-17.4%	-18.5%	-18.5%	-18.5%	-18.5%	0%	0%	-19.0%	-19.0%	-
NTGR	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	-
Total Net Demand Savings (MW) – at Meter	0.283	0.018	0.001	0.001	0.003	0.001	0.062	0.112	0.001	0.007	0.489
Line loss factor	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	1.093	-
Total Net Demand Savings (MW) – at Generator	0.310	0.020	0.001	0.001	0.003	0.001	0.068	0.122	0.001	0.007	0.534

The table below presents comparisons between the energy and demand savings established by this evaluation and those claimed in the 2012 tracking sheet.

Table 32: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	3.185 GWh	3.185 GWh	2.784 GWh	0.83	2.311 GWh
Evaluation Results	3.164 GWh	3.130 GWh	2.754 GWh	0.84	2.314 GWh
Demand Savings					
Tracked Savings from ENSC	0.736 MW	0.736 MW	0.643 MW	0.83	0.534 MW
Evaluation Results	0.731 MW	0.723 MW	0.636 MW	0.84	0.534 MW

The net evaluated savings were slightly higher than those tracked by ENSC. The unitary savings values estimated for dimmable CFLs and pipe insulation were revised during this evaluation. However, the main factors that explain the difference in savings are the review of the interactive effects for regular CFLs to take into account that a portion were installed outdoors and the fact that a free-ridership level of 16 percent was measured for this evaluation, compared to 17 percent in 2011. A small difference can also be found in the line loss factor. ENSC used the line loss factor for the residential sector (1.100) while the Evaluator revised this value to 1.093, in accordance with the participant rate codes collected in the tracking sheet.

CONCLUSION

The 2012 evaluation of MURB demonstrated that the transition from a pilot to a component of the Existing Houses program has been successful overall. The Evaluator found major improvements to the program since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving little time to follow up on all the process and impact recommendations prior to the new evaluation window, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management such as the various process charts, the evaluation plan and a standardized program manual.

The marketing strategy of the program was changed to include distinct approaches for tenants or condo owners who pay their own bills, and for property owners. For tenants or condo owners who pay their own bills, ENSC tried convincing them through several activities, including Facebook events, to install products to save energy and costs. In other cases, the DA directly contacts property owners who inform their tenants about the visits. Collaborating with landlords to perform installations provides easy access to units in which tenants are not responsible for paying the electricity bills.

In 2012, the DA identified on-site support received from superintendents as a barrier to the program's delivery. Without being problematic, on-site support can make all the difference in the number of installations completed. The DA suggested finding ways to tie the success of the installations to recognition or performance of building superintendents. Nevertheless, the DA was very satisfied with the overall program, as were the participants that were interviewed.

The survey results demonstrated the accuracy of the information found in the tracking sheet. Very few discrepancies were observed between survey results and the tracking sheet, as respondents were asked to confirm the products that had been installed through the program. Moreover, no removal phenomenon for a particular product was identified during the survey.

These survey results are in line with the information collected during on-site visits. In the vast majority of cases, the products installed through the program were still in place when the Evaluator conducted the visit. This resulted in very high installation rates, including an installation rate of 100 percent for regular CFLs, the product installed the most, and contributes to more than 60 percent of the program savings.

For the impact evaluation, the unitary savings values were reviewed based on a literature review and the validation of the engineering calculations used by ENSC to estimate savings. Installation rates, interactive effects factors and free-ridership were also evaluated to establish the net savings generated by the program in 2012. Thus, the evaluation revealed that MURB generated net energy savings of 2.314 GWh and demand savings of 0.535 MW at the generator in 2012, compared to 0.654 GWh and 0.104 MW in 2011.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Analyze the possibility of rewarding building superintendents' support*: The new marketing strategy, which involves direct collaboration with landlords or landlords' representatives to perform installations, has significantly contributed to the success of the program. However, in that context, one of the barriers to program delivery is the on-site support received from superintendents, which can make all the difference in the number of installations completed. Therefore, the Evaluator recommends analyzing the possibility to tie the success of the installations to recognition or performance of building superintendents. For example, this could be done by launching a contest among landlords or landlords' representatives in order to reward collaboration. *See Section 3.4 Relationship With Partners for more details
	2. Continue offering information about products installed and energy efficiency: There is a need for an energy efficiency program in the multi-unit renter market, as multi-unit renters are often less interested in energy efficiency and are less likely to install energy-efficient products in a home they do not own and where, in some cases, they are not responsible for paying the electricity bills. Moreover, the low level of free-ridership measured through the participant interviews reveals that most participants would not have installed any energy-efficient products in the absence of the program. These findings highlight the importance of educating this market about energy efficiency. Survey results showed that 70 percent of participants remembered receiving information about energy efficiency or energy savings as part of the program. This is a good result, on which ENSC should continue to build.

Executive Summary	3. Collect quantity of products installed in the tracking sheet for each individual tenant unit*: In 2012, the quantity of products installed in each individual unit was only collected on paper forms from mid-August. In the future, Econoler recommends keeping track of this information in the tracking sheet, using the unit number instead of the tenant name, since it is rarely possible to collect tenants' names and phone numbers due to tenant privacy issues and the high percentage of tenant turnover in the rental sector. These data would be useful for planning on-site visits with the landlords. The landlords can inform selected tenants of the upcoming visit and ask for their consent to enter their unit. Then, tenants could be visited for validating the installation of products, and a short survey could be completed to learn more about their satisfaction and free-ridership level. *See Section 3.3 Tracking Sheet for more details 4. Improve the tracking sheet to facilitate field activities and provide a more precise evaluation of savings*: Besides the fact that the information should be collected on a unit basis, the tracking sheet review also demonstrated that some improvements could be done to facilitate the field activities (participant survey and on-site visits) and the impact evaluation. First, the Evaluator recommends implementing a protocol to ensure that all the relevant information is collected and systematically recorded in the tracking sheet. In the 2012 tracking sheet, some fields, such as the landlord's name, phone number and rate code, contained a few blank entries. Secondly, the Evaluator identified additional information that could be collected in the future tracking sheet to allow for a more precise evaluation of savings. More particularly, Econoler recommends including the location (indoors or outdoors) of CFLs installed, as well as the energy source used for space heating and the use of air conditioning. Such information would be useful for evaluating the hours of operation and interactive effects for CFLs. *See Section 3.3 Tracking Sheet for more details
Program Manual	5. Document the major characteristics of the program: MURB has provincial funding this year. Thus, the installation of products that aim at reducing hot water consumption when a non-electric energy source is used for DHW is now covered by the program. The Evaluator recommends including this information in the program manual.

Program Manual	6. Document major changes in the Document Revision section: In the Document Revision section, it is advisable to give a brief description of the major changes incorporated into the new version of the program manual. For example, this section should briefly describe the addition of new energy efficiency products or subtraction of old ones. In this way, it would give the reader a quick overview of the changes made to the program, saving them the trouble of having to read both the old and new versions of the program manual. 7. Be consistent in the program name formulation across all residential programs: ENSC increases focus on serving customers through a one-window service approach and is therefore planning to market all residential activities as services instead of programs. So far, this change has already been implemented for MURB and Home Energy Assessment (HEA), which are now presented as services. The Evaluator recommends that consistency be maintained in the program names in internal and external documents (e.g. on the ENSC website). All activities should therefore be named only as a service or as a program, thus avoiding the confusion caused by two sets of names in the same portfolio. In a view to offer a one-window service approach, the program portfolio names should be planned carefully and globally, and not one program at a time. This latter approach would ensure that participants have all the necessary information to understand ENSC's offer, starting with the names of the different services. It would also prevent confusion among participants as to the difference between a service and a program, especially given that several programs already changed names a few times in the past.
Program Charts	8. Provide the partner and participants with a simplified process chart: The Evaluator recommends developing a simplified participant process chart and posting it on the program website (in the "How to Participate" section), which is comprehensive, clear and well designed. Moreover, the partner should be given copies of the process chart. After all, this chart is intended for the partner and the participants. Hence, it must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version number and revision date should be indicated in the chart.

Marketing and Outreach Activities	9. Make the performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.
Tracking Sheet	10. Make sure that all fields are systematically filled out: The tracking sheet is considered relatively sufficient for program monitoring. However, the Evaluator found that some fields were left blank: - Landlord information: There were a few blank entries in landlord information, such as last name (22%) and phone number (18%). Also, no field has been included to indicate the postal code of each participating building; the postal code facilitates grouping participants by region for on-site visits. - Rate code: This field is used to determine the line loss factor. It was empty in 12 percent of the records. All this information is necessary for field activities (on-site visits and surveys) and is often essential for impact evaluation. A protocol could be implemented to ensure that all the information is collected and systematically recorded in the tracking sheet.
	11. Collect information on the location of the CFLs installed: Regular CFLs can be installed indoors or outdoors. Some parameters useful to the impact evaluation, such as the hours of operation and the interactive effects, vary according to the location of the CFLs. Therefore, Econoler recommends adding a field in the tracking sheet to identify whether the CFLs were installed inside or outside each unit. This additional information would allow for a more precise evaluation of savings.
	12. Collect information on the heating energy source and air conditioning: The tracking sheet should include information on the energy source used for space heating and indicate if tenants use air conditioning. This information is useful for the interactive effects factor calculations.

Tracking Sheet	13. Set limitations for entries and develop a validation process: To ensure the validity of the values entered in the tracking sheet, Econoler recommends that ENSC establish a validation process to collect information in a standard way, facilitate the identification of blank entries and limit errors. For instance, under each category of product, a “0” value should be entered when no installation is done. Currently, the tracking sheet presents a mix of “0” values and blank entries.
Revised Savings	14. Collect the specific length (in feet) of insulation installed in each unit and limit the installation of insulation to the first 15 feet.

APPENDIX II – INTERVIEW WITH DELIVERY AGENT

PROGRAM NAME: MULTI-UNIT RESIDENTIAL BUILDINGS

How to complete this form

This is a Word document that integrates some form features. To enter your answers, simply position your cursor on the shaded sections and begin typing. Since this is a form, you cannot write anywhere else in the document. For the boxes, just click on the one next to your answer. Click again to uncheck it.

Please complete this form within the next 48 hours, save the file and send it back to us at glavigne@econoler.ca

Thank you!

Part I: General Questions

Please indicate your company name.

Q1a. How would you describe your role(s) as an ENSC energy efficiency program partner?

Q1b. How long have you held that role/those roles (specify months or years)?

Q2a. How would you qualify your participation process in this program?

☐ Simple

☐ Complex

Q2b. If you checked “Complex,” please indicate which parts of your involvement or participation process have been the most complex.

Q3. On a scale from 1 to 10, where 1 is very poor and 10 is excellent, please rate your satisfaction in regard to the:

Aspects of the program	Score 1 = very poor 10 = excellent	Reason If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Program marketing and outreach activities		
Relationship with ENSC staff		

Part II: Questions Specific to the Multi-Unit Residential Building Program

Q4. The Multi-Unit Residential Building Program worked as a pilot last year. Has the transition to a full program been successful? Explain.

Q5a. Regarding program on-course modifications (program delivery model, products installed, etc.), do you feel they:

- ☐ Are easily adapted into the way you work
- ☐ Require minor changes in the way you work
- ☐ Require major changes in the way you work
- ☐ Not applicable/No program on-course modifications

Q5b. If you answered “Require major changes in the way you work,” would you say those major changes have caused problems in the way the program is managed or delivered?

- ☐ Yes
- ☐ No

Q5c. If you answered “Yes,” what have those problems been?

Q6. In your opinion, what are the main barriers to the delivery of the program, in order of importance?

Q7a. Approximately how many complaints have you received from participants thus far in 2012?

Number of complaints:

Q7b. What was the complaint/were the complaints about?

Q8. What suggestions do you have to improve program performance?

Q9. More precisely, what suggestions do you have concerning program marketing and outreach activities?

Thank you very much for your time and co-operation.

Your answers will be treated in strict confidence—no names will ever be mentioned in the evaluation report. Our hope is that these results will contribute to improving program performance. You may be contacted by phone if we need to clarify your answers.

Date	
Your name	
Area code and phone number	
Email	

APPENDIX III – ON-SITE VISIT PROTOCOL

1 General Information

Date of visit: _____

Building ID Number: _____

Building address: _____

Tenant name: _____

Apartment number: _____

Telephone: _____

Electricity Bills: Paid by the property owner: ☐ Paid by the tenant: ☐

2 Product Installation information

For lighting products (Based on on-site observation and contact declaration):

Product	Number in Tracking Sheet	Number On-Site	Explanation, If Different	Type of Lamp Replaced	Wattage of Lamp replaced
13W CFLs					
23W CFLs					
Dimmable CFLs (14W and/or 16W)					
LED Nightlights					

Notes:

For domestic hot water (DHW) related products (Based on on-site observation and contact declaration):

Water Heating Type: ☐ Electric ☐ Non-Electric

Tank Size (in gallons): _____

Product	Number in Tracking Sheet	Number On-Site	Explanation, If Different	Locations
Hot Water Tank Wrap				N/A
Pipe Insulation				N/A
Faucet Aerators				
Low Flow Showerheads				

Notes:

3 Participation questions (Free-ridership)

This section is an interview with the on-site contact.

S1. Thinking of your OVERALL experience with the Multi-Unit Residential Buildings program, including any services or energy efficient products received and installed, how satisfied were you overall with the program on a scale from 0 to 10, where 0 indicating "Not at all satisfied" and 10 "Very satisfied"?

___ Response ___98 Don't Know ___99 Refused

SECTION M1: Lighting Products → ASK IF CFLs AND/OR LED NIGHTLIGHTS WERE INSTALLED IN THE UNIT. ADAPT THE QUESTIONS DEPENDING ON THE PRODUCTS INSTALLED.

My first questions will be about the energy-efficient lighting products, i.e. CFLs and/or LED nightlights that were installed in your unit through the program.

FR1M1. Did you or anyone in your household have any specific plans to install [CFLs AND/OR LED NIGHTLIGHTS] prior to learning about the Multi-Unit Residential Buildings program?

1. Yes
2. No → GO TO SECTION M2
98. (Don't know)
99. (Refused)

Now I would like to ask you to consider what actions you would have taken in the absence of the Multi-Unit Residential Buildings program.

FR2M1. If you had not participated in the program, what is the likelihood that you would have installed the [CFLs AND/OR LED NIGHTLIGHTS] that were installed in your unit through the Program? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Installed These Products" and a 10 indicating that you "Definitely **Would Have** Installed These Products".

___ Response ___98 Don't Know ___99 Refused

FR3M1. In the absence of the program, when would you have installed the [CFLs AND/OR LED NIGHTLIGHTS] that were installed through the program?

1. Definitely today
2. Probably today
3. Probably at a later date
4. Definitely at a later date
5. Never
98. (Don't know)
99. (Refused)

FR4M1. If Efficiency Nova Scotia had not installed [CFLs AND/OR LED NIGHTLIGHTS] in your unit for free, what is the likelihood that you would have paid to install these products in your unit? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Paid for These Products” and a 10 indicating that you “Definitely **Would Have** Paid for These Products”.

___ Response

___98 Don't Know

___99 Refused

SECTION M2: Domestic Hot Water (DHW) Related Products → ASK IF LOW-FLOW SHOWERHEADS, FAUCET AERATORS, HOT WATER TANK WRAPS AND/OR PIPE INSULATION WERE INSTALLED IN THE UNIT. ADAPT THE QUESTIONS DEPENDING ON THE PRODUCTS INSTALLED.

My first questions will be about the energy-efficient products related to domestic hot water heating, i.e. low-flow showerheads, faucet aerators, hot water tank wrap and/or pipe insulation that were installed in your unit through the program.

FR1M2. Did you or anyone in your household have any specific plans to install [LOW-FLOW SHOWERHEADS, FAUCET AERATORS, HOT WATER TANK WRAPS AND/OR PIPE INSULATION] prior to learning about the Multi-Unit Residential Buildings program?

1. Yes
2. No → END THE INTERVIEW
98. (Don't know)
99. (Refused)

Now I would like to ask you to consider what actions you would have taken in the absence of the Multi-Unit Residential Buildings program.

FR2M2. If you had not participated in the program, what is the likelihood that you would have installed the [LOW-FLOW SHOWERHEADS, FAUCET AERATORS, HOT WATER TANK WRAPS AND/OR PIPE INSULATION] that were installed in you unit through the Program? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Installed These Products” and a 10 indicating that you “Definitely **Would Have** Installed These Products”.

___ Response

___98 Don't Know

___99 Refused

FR3M2. In the absence of the program, when would you have installed the [LOW-FLOW SHOWERHEADS, FAUCET AERATORS, HOT WATER TANK WRAPS AND/OR PIPE INSULATION] that were installed through the program?

1. Definitely today
2. Probably today
3. Probably at a later date
4. Definitely at a later date
5. Never
98. (Don't know)
99. (Refused)

FR4M2. If Efficiency Nova Scotia had not installed [LOW-FLOW SHOWERHEADS, FAUCET AERATORS, HOT WATER TANK WRAPS AND/OR PIPE INSULATION] in your unit for free, what is the likelihood that you would have paid to install these products in your unit? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Paid for These Products” and a 10 indicating that you “Definitely **Would Have** Paid for These Products”.

___ Response

___98 Don't Know

___99 Refused

APPENDIX IV – DEMOGRAPHICS

The demographic profile of the program participants interviewed for the survey is presented in the following tables.

Many participants in this program had large apartment buildings, with one-half having 50 or more apartments, and a further one-third having buildings with 11-49 units.

Table 33: Number of Apartments in Building

Number of Apartments in Building	2012
<i>Sample Size</i>	<i>37</i>
1-5	8%
6-10	5%
11-49	35%
50 or more	49%
Don't know	3%

One-third of the participants owned just one multi-unit residential building, while two in ten had 2 or 3 buildings, and a similar number had 4 or more. The others were representatives of the owners, as superintendent or janitor.

Table 34: Number of Multi-Residential Buildings Owned

Number of Multi-Residential Buildings Owned	2012
<i>Sample Size</i>	<i>37</i>
1	35%
2-3	22%
4 or more	19%
Other	24%

In most cases, the tenants were responsible for paying the electricity bills in the building (76%).

Table 35: Party Who Paid Electricity Bills

Pay Electric Bills	2012
<i>Sample Size</i>	<i>37</i>
Tenants	76%
Some tenants pay, while in other cases, the landlord pays	14%
Landlord	8%
Don't know	3%

Approximately one-half of the respondents were male (51%) and one-half were female (49%).

Table 36: Gender

Gender	2012
<i>Sample Size</i>	<i>37</i>
Male	51%
Female	49%

APPENDIX V – PARTICIPANT SURVEY QUESTIONNAIRE

Participant Survey

ENSC – Multi-Unit Residential Building Program

October 15, 2012

Could I speak with [INSERT NAME]?

1. Yes [GO TO INTRODUCTION]
2. No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

[INTRODUCTION]

Hello, my name is _____ and I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you recently participated in Efficiency Nova Scotia Corporation's Multi-Unit Residential Program. We would appreciate your collaboration in answering questions related to your participation in this program. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve the program.

In the Multi-Unit Residential Program, someone would have come to your building to install energy conservation measures in common spaces and individual residential units at no charge. Do you recall participating in this program?

- 1 Yes [CONTINUE]
- 2 No [PROMPT: “Is there someone else in your organization who would know about having participated in the Multi-Unit Residential Program?”]
 __ Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
 __ No [THANK & TERMINATE]
- 3 Don't know [PROMPT: “Is there someone else in your organization who would know about having participated in the Multi-Unit Residential Program?”]
 __ Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
 __ No [THANK & TERMINATE]
4. Refused [THANK AND TERMINATE]

The survey will take about ten minutes. Is this a good time for you?

[IF REFUSED, ASK “Can we schedule a more convenient time for you to conduct this survey?”]

[SCHEDULED, IF NECESSARY, FOR: _____]

VERIFICATION AND RECALL [V series]

[ASK IF COMMON AREA=YES, IF NOT SKIP TO P SERIES]

V3. I am going to read you a list of measures that, according to our records, were installed in the common area of your building by the program: [READ WHAT IS ON RECORD (MEASURE#0 IN THE DATABASE)]. For each one, can you please verify that this information is correct and that the measure was installed? [1=YES, INSTALLED, 2=NO, NOT INSTALLED, 98=DON'T KNOW, 99=REFUSED]

NOTE FOR PROGRAMMER: DO NOT PUT THE NUMBER OF EACH MEASURE

- a) CFL bulbs
- b) LED bulbs
- c) LED Exit Signs
- d) Pipe insulation/Tank wraps

V4. [FOR EACH OF V3a to V3d = NO and RECORD = YES] Are you sure? According to our records someone would have come to your building and installed ... [READ WHAT IS ON RECORD] [1=YES → RECORD AS YES] [2=NO, 98=DON'T KNOW, 99=REFUSED → RECORD AS NO]

- V4a. [CFL bulbs]
- V4b. [LED bulbs]
- V4c. [LED Exit Signs]
- V4d. [Pipe insulation/Tank wraps]

PROGRAM AWARENESS AND PARTICIPATION [P series]

[ASK ALL RESPONDENTS]

P0. How did you find out about this program? (DON'T READ; ALLOW MULTIPLE RESPONSE BUT DO NOT PROBE FOR MULTIPLE.)

- 1. (Efficiency Nova Scotia staff)
- 2. (Mailing from Efficiency Nova Scotia)
- 3. (Co-worker, family, or friend)
- 4. (Other participants)
- 96. (Other [SPECIFY _____])
- 98. (Don't know)
- 99. (Refused)

P1. Now I'm going to ask you to think back to when you decided to participate in the Multi-Unit Residential Program. What was the SINGLE most important reason you agreed to participate in the program? [DO NOT READ]

- 1. (To save on energy/to save on energy costs)
- 2. (I was thinking about/planning to get energy efficient upgrades anyway)
- 3. (To find out how energy efficient my building was/to get my building evaluated)
- 4. (To get expert's advice about what upgrades to get/how to make building more energy efficient)
- 5. (To help the environment)
- 96. (Other [SPECIFY _____])
- 98. (Don't know) (Go to P3)
- 99. (Refused) (Go to P3)

- P2. Were there any other reasons? [DO NOT READ. ACCEPT MULTIPLE RESPONSES] [SAME LIST AS IN P1 ABOVE]
97. No other reasons
- P3. Before participating, did you have any concerns about taking part in the program?
1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)
- P4. [IF P3 = 1] What were those concerns? [DO NOT READ. ACCEPT ALL RESPONSES]
PROBE: Anything else?
1. (That my building would be very inefficient)
2. (That improvements would cost a lot)
3. (That the audit wouldn't find anything / my building was too efficient)
4. (That I wouldn't like what they recommended)
5. (That I wouldn't like the products installed)
6. (The process would take too long)
96. (Other [SPECIFY _____])
98. (Don't know)
99. (Refused)
- P5. As part of the program, did you receive information about energy efficiency or energy savings?
1. Yes
2. No
98. (Don't know/Don't recall)
99. (Refused)

**SATISFACTION WITH THE PROGRAM [S series]
[ASK ALL RESPONDENTS]**

- S1. Thinking of your OVERALL experience with the Multi-Unit Residential Program, including any services or energy efficient products received and installed, how satisfied were you overall with the program on a scale from 1 to 5, where 1='not at all satisfied' and 5='very satisfied'? [RECORD NUMBER, DO NOT ACCEPT A RANGE, 98 = Don't know, 99 = Refused]
- S2. [IF DISSATISFIED, S1 = 1, 2 or 3] You indicated that you were not satisfied with the program overall. What was the SINGLE most important reason you were dissatisfied with the program overall? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT ONE RESPONSE]
1. (The energy evaluation took too long)
 2. (Products installed don't suit my needs)
 3. (I expected more savings)
 4. (I did not like the evaluator/program representative who visited the building)
 5. (We ended up removing some/all of the installed products)
 96. (Other [SPECIFY: _____])
 98. (Don't know) (Go to S5)
 99. (Refused) (Go to S5)
- S3. [IF DISSATISFIED, S1 = 1, 2 or 3] Were there any other reasons you were dissatisfied? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE] [SAME LIST AS S2 ABOVE]
- 97 No other reasons
- S4. [IF SATISFIED S1=4 or 5] What was the most important reason why you were satisfied with the program overall? PROBE: Anything else? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE.]
1. (Lowered energy bill)
 2. (Good service)
 3. (Saves energy)
 4. (Better lights/lighting)
 5. (Informative/Information received)
 6. (I liked the evaluator/program representative who visited the building)
 96. (Other) [SPECIFY _____]
 98. (Don't know)
 99. (Refused)
- S5. Now I'm going to ask you about your experience with specific aspects of the Multi-Unit Residential Program. Using a scale from 1 to 5, where 1 means "not at all satisfied" and 5 means "very satisfied", please tell me how satisfied you are with your experience with each aspect of the program. [DO NOT RANDOMIZE. DO NOT ACCEPT A RANGE] [97 = Not Applicable, 98 = Don't know/Don't recall, 99 = Refused]
- a) [SKIP IF COMMON AREA=NO] The energy conservation measures installed in common area
 - b) The energy conservation measures installed in units (apartments)
 - c) The time required to complete work
 - d) The program representative overall
 - e) The information you received about energy efficiency or energy savings

- S6. Using a 5-point scale, where '1' is very difficult and '5' is very easy, how would you rate the process to participate in the program? [1-5 scale, 98 = Don't know/Don't recall, 99 = Refused]
- S7. [IF S6 = 1, 2 or 3] What was difficult about participating in the program? [MULTIPLE RESPONSE – RECORD VERBATIM] Probe: Anything else?
- 96. (Record answer)
 - 97. (Don't know)
 - 98. (Refused)
- S8. Do you have any recommendations for improving the Multi-Unit Residential Program? PROBE: Anything else?
- 1. (Offer a wider variety of products)
 - 2. (Improve scheduling/shorten wait for visit)
 - 3. (Offer more information on the products/measures)
 - 4. (No recommendation)
 - 5. (Faster decisions about whether we qualified)
 - 6. (Faster service on-site at our building)
 - 96. (Other [SPECIFY _____])
 - 97. (Don't know)
 - 98. (Refused)
- S9. [IF S8 =1] Which additional products or measures would you like to be eligible in the Multi-Unit Residential Program? [MULTIPLE RESPONSE – RECORD VERBATIM]
- 96. (Record answer)
 - 97. (Don't know)
 - 98. (Refused)

**IMPACT OF THE PROGRAM [IM series]
[ASK ALL RESPONDENTS]**

- IM1. Please indicate how, if at all, each of the following has changed since participating in the Multi-Unit Residential Program. On a scale of 1 to 5, where 1 means "no improvement" and 5 means a "considerable improvement") how much has _____ improved? [97 = Not Applicable, 98 = Don't know/Don't recall, 99 = Refused] RANDOMIZE
- a. Your interest in Energy efficiency
 - b. Your knowledge of Energy efficiency

BARRIERS TO ACTION [B series]

- B1. [ASK IF YES TO AT LEAST ONE QUESTION FROM V3(a-d) or V4(a-d)] Were there any energy efficiency measures installed through the Multi-Unit Residential Program that you later chose to remove from your building?
1. Yes
 2. No [SKIP TO B4]
 98. (Don't know) [SKIP TO B4]
 99. (Refused) [SKIP TO B4]
- B2. [ASK IF B1 = 1] Which measures did you choose to remove from your building? [READ IF NECESSARY, ACCEPT MULTIPLE]
1. (CFLs (compact fluorescent bulbs))
 2. (LED Bulbs)
 3. (LED Exit Signs)
 4. (Pipe insulation/tank wraps)
 96. (Other [SPECIFY: _____])
 97. No, did not remove
 98. (Don't know) (Go to B4)
 99. (Refused) (Go to B4)
- B3a/b/c/d. [ASK FOR EACH MEASURE RESPONDENT CHOSE TO REMOVE (B2)] Why did you choose to remove [INSERT, IN TURN, EACH RESPONSE FROM B2, EXCEPT NOT 97, 98, OR 99] from your building? PROBE: Anything else? [DO NOT READ]
1. (Did not work like I thought it would)
 2. (Too complicated to use)
 3. (Did not believe any changes will result in lower energy bills)
 4. (Did not trust in energy professionals installing new measures)
 96. (Other [SPECIFY: _____])
 98. (Don't know)
 99. (Refused)
- B4. [ASK ALL RESPONDENTS] Were there any energy efficiency measures recommended through the Multi-Unit Residential Program that you chose not to install or implement in your building?
1. Yes
 2. No
 98. (Don't know)
 99. (Refused)

- B5. [ASK IF B4 = 1] Why did you choose not to install or implement these energy efficiency measures in your building? PROBE: Anything else? [DO NOT READ]
1. (Too complicated to install or implement)
 2. (Did not need these measures)
 3. (Did not want to change, actual equipment works fine)
 4. (Did not believe any changes will result in lower energy bills)
 5. (Did not trust in energy professionals installing new measures)
 96. (Other [SPECIFY: _____])
 98. (Don't know)
 99. (Refused)

FREE-RIDERSHIP [FR series]**[ASK IF COMMON AREA=YES, IF NOT SKIP TO D SERIES]****INSTRUCTION:**

(FOR RESPONDENTS WITH MORE THAN TWO ("YES") MEASURES VERIFIED IN V3 AND V4, CHOOSE TWO MEASURES VERIFIED. THE RESPONDENT WILL ANSWER ACCORDING TO THESE TWO MEASURES THROUGHOUT SECTION FR WHEN IDENTIFIED LIKE SO: [MEASURE 1 or 2].)

SELECTION METHOD FOR THE TWO MEASURES:

- IF CFL ARE VERIFIED IN V3 AND V4, RESPONDENT WILL AUTOMATICALLY ANSWER ACCORDING TO CFL
- THEN, CHOOSE ANOTHER MEASURE VERIFIED IN V3 AND V4 AT RANDOM, AMONG THE FOLLOWING:
 - LED bulbs
 - LED Exit Signs
 - Pipe insulation/Tank Wraps

NOTE: IF THERE ARE ONLY TWO MEASURES VERIFIED IN V3 AND V4, RESPONDENT WILL AUTOMATICALLY ANSWER ACCORDING TO THESE TWO MEASURES. IF THERE IS ONLY ONE MEASURE VERIFIED IN V3 AND V4, RESPONDENT WILL ANSWER ABOUT THIS UNIQUE MEASURE ONLY.

The next questions will be about the [MEASURE 1] you had installed through the program.

FR1M1. Did you have any specific plans to install [MEASURE 1] in the common areas of your building prior to talking with anyone about the Multi-Unit Residential Program?

3. Yes
4. No
98. (Don't know)
99. (Refused)

FR1aM1. IF FR1M1=YES, THEN ASK: I just want to make sure I understand - **Before** you decided to participate in the Multi-Unit Residential Program, you had already made the decision to install [MEASURE 1]?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Multi-Unit Residential Program.

If you had not participated in the Multi-Unit Residential Program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action." AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT. In the absence of the Program, would you have . . . DO NOT ACCEPT A RANGE – POSE FR2M1 SEQUENCE IN ORDER/DO NOT RANDOMIZE

FR2aM1. . . . installed the [MEASURE 1] that was installed through the Program?

___ Response ___98 Don't Know ___99 Refused

FR2bM1... . . installed standard equipment instead of energy-efficient [MEASURE 1]?

___ Response ___98 Don't Know ___99 Refused

FR2cM1... . . installed the [MEASURE 1] that was installed through the Program *but at a later date*?

___ Response ___98 Don't Know ___99 Refused

IF FR2cM1 > 5, then ask:

[DO NOT ASK IF FR2cM1=98 OR 99]

FR2ccM1. You indicated in your previous response that if the Multi-Unit Residential program had not been available there was an [FR2cM1] in 10 likelihood that you would have installed the same energy-efficient products *but at a later date*. Approximately how many months later would you have installed these products? DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE

1. _____ months later
2. (Never)
3. (At the same time)
98. (Don't know)
99. (Refused)

IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2ccM1 ANSWER IN MONTHS, READ:

Would it have been within . . .

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FR3M1. If Efficiency Nova Scotia had not installed [MEASURE 1] for free, would you have paid the full cost of the [MEASURE 1]?

1. Yes
2. No
97. (Depends on the cost)
98. (Don't know)
99. (Refused)

[IF ONLY ONE MEASURE VERIFIED IN V3-V4, SKIP TO FR4]

The next questions will be about the [MEASURE 2] you had installed through the program.

FR1M2. Did you have any specific plans to install [MEASURE 2] in the common area of your building prior to talking with anyone about the Multi-Unit Residential Program?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

FR1aM2. IF FR1M2=YES, THEN ASK: I just want to make sure I understand - **Before** you decided to participate in the Multi-Unit Residential Program, you had already made the decision to install [MEASURE 2]?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Multi-Unit Residential Program.

If you had not participated in the Multi-Unit Residential Program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action." AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR

SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT. In the absence of the Program, would you have . . . DO NOT ACCEPT A RANGE – POSE FR2M2 SEQUENCE IN ORDER/DO NOT RANDOMIZE

FR2aM2. . . . installed the [MEASURE 2] that was installed through the Program?

___ Response ___98 Don't Know ___99 Refused

FR2bM2... . . installed standard equipment instead of energy-efficient [MEASURE 2]?

___ Response ___98 Don't Know ___99 Refused

FR2cM2... . . installed the [MEASURE 2] that was installed through the Program *but at a later date*?

___ Response ___98 Don't Know ___99 Refused

IF FR2cM2 > 5, then ask:

[DO NOT ASK IF FR2cM2=98 OR 99]

FR2ccM2. You indicated in your previous response that if the Multi-Unit Residential program had not been available there was an [FR2cM2] in 10 likelihood that you would have installed the same energy-efficient products *but at a later date*. Approximately how many months later would you have installed these products? DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE

1. _____ months later
2. (Never)
3. (At the same time)
98. (Don't know)
99. (Refused)

IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2ccM2 ANSWER IN MONTHS, READ:

Would it have been within . . .

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FR3M2. If Efficiency Nova Scotia had not installed [MEASURE 2] for free, would you have paid the full cost of the [MEASURE 2]?

1. Yes
2. No
97. (Depends on the cost)
98. (Don't know)
99. (Refused)

[ASK FR4 ONCE, NOT FOR EACH MEASURE VERIFIED IN V3-V4]

FR4. Next, I'm going to ask you to rate the importance of the Program as well as other factors that might have influenced your decision to install energy efficient measures through the Multi-Unit Residential program. Using a scale from 0 to 10 where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of each of the following in your decision to install the energy-efficient products you installed through the Program. **DO NOT ACCEPT A RANGE**

Factor (READ AND RANDOMIZE)	Responses
a. The free installation of energy-efficient products offered by the program	___ Response ___98 Don't Know ___99 Refused
b. Information or advice provided by program staff throughout the upgrade process	___ Response ___98 Don't Know ___99 Refused
c. Previous experience with a similar program either from Efficiency Nova Scotia, Nova Scotia Power or Conserve Nova Scotia	___ Response ___98 Don't Know ___99 Refused

DEMOGRAPHICS [D series]
[ASK ALL RESPONDENTS]

These final questions are asked for statistical purposes only. The information collected is strictly confidential.

D2. How many apartments are in your building? [98=DK]

D4. Do tenants or does the landlord pay the electric bills for this building?

1. Tenants
2. Landlord
3. Some tenants pay, while in other cases the landlord pays
98. (Don't Know)
99. (Refused)

D7. How many other multi-residential buildings do you own? [98=DK]

D10. **[DO NOT READ]** Gender

1. Male
2. Female

[READ: THAT IS ALL THE QUESTIONS I HAVE FOR YOU. THANK AND TERMINATE.]

APPENDIX VI – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

FR1. Did you have any specific plans to install energy-efficient products prior to learning about the program?	IF 2. No: FR1 = 0% AND STOP OTHERWISE CONTINUE
PA1 Score:	FR1
FR2. If you had not participated in the program, what is the likelihood that you would have installed the energy-efficient products that you installed through the program? (Scale 0 to 10)	FR2 = Answer x 10%
PA2 Score:	FR2
FR3. In the absence of the program, when would you have installed the energy-efficient products that were installed through the program? 1. Definitely today 2. Probably today 3. Probably at a later date 4. Definitely at a later date 5. Never 9. (Don't know / Refused)	IF 1. : FR3 = 100% IF 2. : FR3 = 50% IF 3. : FR3 = 25% IF 4. : FR3 = 0% IF 5. : FR3 = 0% IF 9. : FR3 = 0%
PA3 Score:	FR3
FR4. If ENSC had not installed energy-efficient products for free, what is the likelihood that you would have paid for the full cost of these products? (Scale 0 to 10)	FR4 = Answer x 10%
PA4 Score:	FR4
Final Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)
Inconsistency Test #1	IF PA2 ≥ 70% AND PA4 < 70%: PA2 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)

Note: These questions were asked twice, for lighting measures and for DHW measures.





SOLAR

IMPACT EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

February 21, 2013



ECONOLER

ACRONYMS

DHW	Domestic Hot Water
EDSM	Electricity Demand Side Management
ENSC	Efficiency Nova Scotia Corporation
NTGR	Net-to-Gross Ratio
NRCan	Natural Resources Canada
PM	Program Manager

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.
Tracked savings	Gross savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 impact evaluation of the electricity savings generated by Solar; Residential Solar and Commercial Solar being components of the Existing Houses and Prescriptive Rebate programs respectively. This evaluation was based on the discussion with the Program Manager (PM) and five on-site visits.

PROGRAM COMPONENT OVERVIEW

Solar provides rebates to encourage the adoption of solar thermal (water and air heating) installations in homes and businesses across Nova Scotia. Solar heating systems convert the sun's energy into thermal energy. Solar water and air heating systems are used to supplement traditional home or business heating methods.

Solar rebates have been available over the past seven years; first under Conserve Nova Scotia and now Efficiency Nova Scotia Corporation (ENSC). In addition to the stand-alone solar rebates, additional solar rebates were also available for some time under the EnerGuide for Houses and Performance Plus programs. Starting from fall 2012, residential solar water heating participants can choose either the rebate option or the zero-interest financing option to complete the work. Financing for residential solar air systems or commercial systems was not offered as an option in 2012.

Although no target was established for Solar, net energy savings of 0.099 GWh were expected for 2012.

KEY FINDINGS

To calculate the net savings of Solar for 2012, Econoler first reviewed the parameters used for estimating the unitary savings values of each type of equipment installed and then completed some RETScreen simulations to validate whether the savings were acceptable to residential and commercial participants. Furthermore, five on-site visits were completed to validate solar system installations and the consistency between the information presented in the tracking sheet and that found on site.

Due to the low level of participation and energy savings, no survey was conducted. Therefore, the Evaluator has assumed that the free-ridership is null for the 2012 evaluation and that the net-to-gross ratio (NTGR) for Solar is 1.

Table 1: Comparison of Tracked and Evaluated Savings at the Generator

	Gross Savings	NTGR	Net Savings
Energy Savings			
Tracked Savings from ENSC	0.120 GWh	0.70	0.084 GWh
Evaluation Results	0.120 GWh	1.00	0.120 GWh
Demand Savings			
Tracked Savings from ENSC	0 GWh	0.70	0 GWh
Evaluation Results	0 GWh	1.00	0 GWh

The evaluation revealed that Solar generated net energy savings of 0.120 GWh at the generator in 2012.

RECOMMENDATIONS

Econoler has found that the program is working well overall with satisfactory results. Apart from the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 Demand-side Management (DSM) programs, the Evaluator has the following recommendations to make to help optimize specific aspects of the program:

- SOLAR-R1. Complete a RETScreen simulation for all the projects to improve the accuracy of the deemed savings:** The RETScreen simulation tool is very easy to use and understand. With adequate input data (such as the number of occupants, the collector slope, the collector azimuth, etc.), the PM could quickly simulate each project and produce a precise savings estimate for each participant.
- SOLAR-R2. Consider requiring solar installers to complete a RETScreen simulation for all the projects:** In relation with the preceding recommendation, participants might have difficulty finding all the required technical information about their solar system. Since solar installers have a better technical knowledge about their products and visit every house to install the equipment, they could collect all the necessary information to complete the RETScreen simulations. Therefore, they could be put in charge of providing the information to ENSC and even completing the RETScreen simulations themselves. Since the software is free and very simple to use, ENSC would only need to provide some simple instructions on information collection and inputting.
- SOLAR-R3. Include a participant survey to estimate free-ridership (FR) if participation level is high enough to justify doing so:** Participants' responses to ENSC's screening question revealed that a certain level of FR could be expected for Solar. Since the participation level was low this year, no survey was conducted to collect the information required to determine a statistically sound FR level. In the future, if a greater number of participants and a more significant energy savings impact are expected, the evaluation should include quantification of an accurate FR based on a participant survey.

1 COMPONENT DESCRIPTION

Solar is aimed to encourage the adoption of solar thermal (water and air heating) installations in homes and businesses (Business, Non-profit and Institutional) across Nova Scotia. Solar heating systems convert the sun's energy into thermal energy. Solar water and air heating systems are used to supplement traditional home or business heating methods.

Solar rebates have been available in different forms over the past seven years under Conserve Nova Scotia (2005-2011), and ENSC (since 2011). These included a stand-alone solar rebate, rebates under the EnerGuide for Houses program and under Performance Plus. Since April 2012, there has been only one solar rebate available via the stand-alone ENSC Solar component.

ENSC administers this Solar internally. All participants must be pre-approved before purchasing and installing their system. Since the fall of 2012, residential solar water heating participants could choose either the rebate option or the zero-interest financing option to complete the work. Financing for residential solar air systems or commercial systems was not offered as an option in 2012.

Funding for Solar comes from two sources: Electricity Demand Side Management (EDSM) funds are the source of funding for solar water and solar air systems that offset electricity, and the Province of Nova Scotia provides funding for solar water and solar air systems that offset other fuels (oil, natural gas, propane, wood, etc.).

At the beginning of 2012, although no target was established for Solar, net energy savings of 0.099 GWh were expected for 2012.

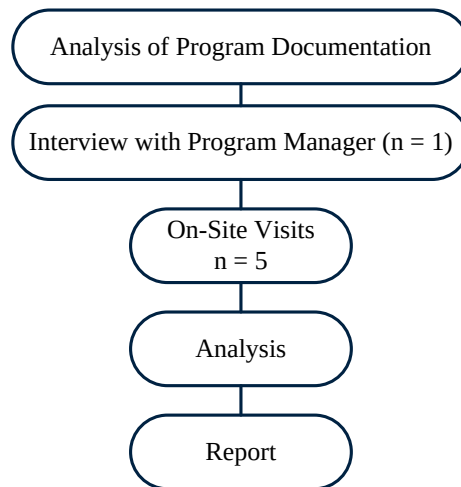
Electric savings generated by Residential Solar and Commercial Solar are accounted for under the Existing Houses and Prescriptive Rebate programs respectively as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the evaluation for Solar. At this stage, all of the available program information was reviewed.

The following sources were consulted:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interview with Program Manager

Econoler staff met the Program Manager (PM) in July 2012. The discussion helped the Evaluator understand all program elements, such as the program background, mechanisms and delivery.

2.2.3 On-Site Visits

In November 2012, five on-site visits were conducted in residential and commercial facilities where solar equipment had been installed. The visits were conducted by Econoler's subcontractor, Equilibrium Engineering. These on-site visits were used to ensure that the equipment had been installed correctly and was functioning properly.

Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix II.

3 TRACKING SHEET

Econoler reviewed the content of ENSC's tracking sheet for Solar. The tracking sheet is clear and useful. It provides a quick way to monitor the status and achieved savings of all the projects, and only minor additions for the evaluation are needed, as discussed below. There are three main tabs included in the tracking sheet:

- > the Pre-Approval tab, which provides a complete summary of each application submitted to the program;
- > the Rebates Approval tab, which provides information on the savings achieved for all the participants who applied for a rebate in 2012; and
- > the Financing Approval tab, which provides information on the savings achieved for all the participants who chose the financing option in 2012.

All fields necessary for program administration and program evaluation are present in these tabs. Each project has a unique identification number that allows navigation between the different tabs.

The information in the Pre-Approval tab includes information on all the customers (residential and commercial) who applied to participate in the program in 2012, even if the project was not approved or if the installation was not completed yet. As for the Rebates Approval and Financing Approval tabs, they contain technical details only available for those who have completed their installation.

The Rebates Approval tab lists both participant and project information. All participant information necessary to conduct field activities (survey and on-site visits) is available in this tab. All the fields were filled in properly without any details missing. Technical information, such as the existing energy source for heating and domestic hot water, the model type and number of units installed are also available in the tab. This tab also presents the related tracked savings. Gross savings are calculated using the unitary savings values defined for each type of equipment installed. These unitary savings values come from the Solar Thermal Performance Directory of Solar Domestic Hot Water Systems from Natural Resources Canada¹ (NRCan).

The Financing Approval tab contains similar information to the Rebates Approval tab. The only difference is that it contains only participants who received a zero-interest loan instead of the rebate offered through the program.

Furthermore, ENSC uses additional tabs to summarize the savings by electrical and non-electrical sources, by customer type (residential and commercial) and by rebate type (mail in or zero-interest

¹ Natural Resources Canada, Solar Thermal Performance Directory of Solar Domestic Hot Water Systems, April 2012, <http://canmetenergy.nrcan.gc.ca/renewables/solar-thermal/publications/1343>

financing). These savings presented for each month and net savings calculated using a line loss factor (specific to residential or commercial) and a NTGR.

In light of these observations, the Evaluator concludes that the tracking sheet for Solar is complete, consistent and easy to work with.

4 IMPACT EVALUATION

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation aims to determine the gross and net electric savings of the program for 2012. Energy and demand savings were considered in this evaluation. To do so, Econoler analyzed the unitary energy savings values for each type of equipment installed.

The impact evaluation was mainly based on a review of the parameters used for estimating the unitary savings values of each type of equipment installed, a review of the parameter used for the RETScreen analysis for commercial participants as well as five on-site visits.

First, most of the unitary savings values used by ENSC for each type of equipment installed are based on two sources: a publication from NRCan² and a solar verification project report from Equilibrium Engineering³. The first step of the impact evaluation was to review the parameters that apply to each unitary savings value and determine whether these values are appropriate. Next, Econoler reviewed the assumptions made by ENSC when attributing savings to residential projects with more collectors installed than identified in the equipment list. Finally, the evaluator reviewed a RETScreen analysis for commercial participants.

In addition, on-site visits were performed for each type of collector installed (flat plate or evacuated tubes) and category of participant. On-site visits were used to verify the new equipment installed as well as to collect information on the different energy sources used for space and water heating. The data collected during this activity were used to validate the information presented in the tracking sheet.

4.1.1 On-Site Visit Sampling and Protocol

Sampling Methodology

Five on-site visits were conducted under the 2012 evaluation of Solar. The sampling was based on program tracking sheets that contained the list of participants and information about the type of project implemented in 2012.

² Natural Resources Canada, Solar Thermal Performance Directory of Solar Domestic Hot Water Systems, April 2012, <http://canmetenergy.nrcan.gc.ca/renewables/solar-thermal/publications/1343>

³ Equilibrium Engineering, Solar Verification Project – 2010, Final report, August 2010

At the time of sampling, the tracking sheet contained 38 projects offsetting electricity (37 from the residential sector and 1 from the commercial sector), for which a total of 76 collectors were installed. An analysis revealed that flat plate collectors were installed in 30 projects while an evacuated tube system was installed in 8 projects. Most participants installed the solar system only for Domestic Hot Water (DHW) heating. The table below summarizes these findings.

Table 2: Total Number of Projects and Tracked Savings Used for On-Site Visit Sampling⁴

System Usage	Collector Type		
	Flat Plate	Evacuated Tubes	Total
DHW Only	28	7	35
Space Heating Only	0	0	0
Both	2	1	3
Total	30	8	38

Although most of the systems installed included one or two collectors, some projects (15%) did include a larger number of collectors (3 or more).

The Evaluator planned five on-site visits to ensure selecting sites that represented each sector, each system usage and each collector type, as well as small (1 or 2) and large (3 or more) numbers of collectors. A list of regions located within a 2-hour drive from larger regional centres (Halifax and Dartmouth) was established for site selection.

On-Site Visit Protocols

An on-site visit protocol listing the information to be collected for each site was developed for this program. For each site visited, the Evaluator ensured that the systems were installed correctly and functioning properly. The type and characteristics of the solar system as well as the heat source were also collected.

⁴ As of October 2012

4.2 GROSS SAVINGS

The gross energy was computed based on a review of the unitary savings values and the total number of each type of equipment installed presented in the program tracking sheet.

4.2.1 Unitary Savings Values

Tracked Savings

The tracking sheet provided for 2012 contained a total of 45 completed projects, with 44 for residential participants and 1 for commercial participants. These projects involved installations with electricity savings, and their participants did not receive solar rebates under EnerGuide for Houses (18 additional houses) or Performance Plus (16 additional houses).

ENSC calculates savings differently depending on whether the equipment is installed for residential or commercial participants. For each type of equipment installed for residential participants, a unitary savings value was defined by ENSC based on NRCan's Performance Directory of Solar Domestic Hot Water Systems⁵. In this directory, each equipment listed has completed certification to Solar Domestic Hot Water Systems (CSA Standard F379) and the savings have been determined using a hot water load of 300 litres/day (standard day). For systems that were not tested in NRCan's facilities, detailed computer models were developed, and the standard day test was simulated using TRNSYS software.

However, some participants installed solar equipment that was not included in the NRCan directory. For these categories of equipment, ENSC used a set of average savings for models with one collector and models with two collectors, based on the average performance of all equipment within each category. Table 3 summarizes all unitary energy savings values used by ENSC in the tracking sheet.

⁵ Natural Resources Canada, Solar Thermal Performance Directory of Solar Domestic Hot Water Systems, April 2012

Table 3: Unitary Savings Values for Solar Equipment

Make	Model	Collector Number and Size	Savings (kWh/year)
Apricus Inc.	DWBPHE_AP40	2 x 2.74 m ²	1,981
Atis Group Inc.	Solensis ST-0100 ⁶	1 x 2.874 m ²	1,464
	Solensis ST-0200	2 x 2.874 m ²	2,414
Copperhill Alternate Energy Inc.	CETT-32-08-CP-066	1 x 3.43 m ²	858
	CETT-32-08-CP-06	2 x 3.43 m ²	1,764
EnCom Alternative Energy Solutions	EnCom 300	1 x 4.69 m ²	1,903
Enerworks Inc.	EWRA 16	1 x 2.874 m ²	1,464
	EWRA 2	2 x 2.874 m ²	2,414
	EWRA2-DWHX6	2 x 2.874 m ²	2,314
Globe Solar Energy Inc.	IP-195	1 x 2.55 m ²	928
Heliodyne Inc.	501856	1 x 2.51 m ²	911
	50186	2 x 2.51 m ²	1,667
Solcan Ltd.	DBTT 64-40	2 x 2.89 m ²	2,106
Thermo Dynamics Ltd.	SB32-9PV ⁷	1 x 2.98 m ²	1,667
	SB64-9PV	2 x 2.98 m ²	2,761
Viessmann Manufacturing Company Inc.	1-200F-200V ⁷	1 x 2.53 m ²	1,408
	2-200F-300V	2 x 2.53 m ²	2,364
Other	-	1 collector	1,325
	-	2 collectors	2,198

For systems including both hot water heating and space heating, ENSC estimated that space heating would offset five percent of the annual energy consumption related to space heating. ENSC based its estimates on a report from Equilibrium Engineering⁸ in which several existing houses were modeled with solar space and water heating systems installed. The savings are based on an average Nova Scotia home with a 16,850 kWh heating load, for which five percent savings represents 842.5 kWh per year.

⁶ Simulated

⁷ Simulated

⁸ Equilibrium Engineering, Solar Verification Project – 2010, Final report, August 2010

For residential participants who installed three or more collectors, ENSC used the same savings values as the base case with one or two collectors, depending on the model. The lack of information on the exact impact of additional collectors led ENSC to take a conservative approach and only claim these unitary savings.

Moreover, ENSC determined whether Solar participants were also participants in the former EnerGuide for Existing Houses or Performance Plus programs. If they were, ENSC does not count their savings under Solar to avoid double counting, since these were already attributed to EnerGuide or Performance Plus.

Finally, since April 2012, all commercial participants have been required to provide a RETScreen or similar analysis of their project for ENSC to accept the proposed savings. However, the only commercial project for 2012 was already installing its solar system before the pre-approval and RETScreen requirement was implemented. Therefore, ENSC calculated the project savings based on the system unitary savings value and the number of collectors.

Revised Savings

Energy Savings for Residential Installations

Econoler evaluated the unitary savings values used for DHW in residential homes by performing RETScreen simulations using the same input data as in NRCan's tests. These simulations were completed for every solar model for which technical specifications were available in RETScreen's database. For all simulated models, the savings values simulated were very similar to the ones from the NRCan's directory. From these results, the Evaluator has concluded that all the savings values from the NRCan's directory are acceptable. For solar systems that could not be simulated with RETScreen, Econoler has compared their unitary savings values with the ones that were validated and has concluded that these savings are also appropriate. Therefore, all unitary savings values used by ENSC for DHW are appropriate.

To evaluate the space heating unitary savings values for residential participants, Econoler first reviewed the report by Equilibrium Engineering⁹, who inspected and modeled several existing houses that had installed solar space and water heating systems. Equilibrium's findings showed that a dedicated solar system with one or two panels could on average provide 6.5 percent of the space heating load. Econoler then performed RETScreen simulations and the same level of savings was observed. Therefore, the Evaluator has concluded that using savings equal to 6.5 percent of the space heating load for the average Nova Scotia home is appropriate. However, this percentage of savings should only be applied to systems dedicated to space heating.

⁹ Equilibrium Engineering, Solar Verification Project – 2010, Final report, August 2010

For combo systems (water and space heating), which require specific controllers to transfer the heat produced between the DHW and the heating system, the Evaluator has defined two possibilities. First, if the participant installed a system with more collectors than defined in the NRCAN model list, Econoler concluded that the additional collectors were used specifically for space heating. Therefore, space heating savings of 6.5 percent were attributed in addition to the DHW savings. Second, if the participant installed a system with the exact number of collectors as defined in the NRCAN model list (one or two collectors depending on the model), the Evaluator concluded that most savings occurred with the DHW and no savings were attributed to space heating.

Energy Savings for Commercial Installations

The only commercial participant had installed a combo system with many collectors before the RETScreen requirement was implemented. ENSC calculated its savings based on the model unitary savings, the number of collectors installed and a 25 percent reduction as a contingency. The space heating savings were also based on 6.5 percent of the heating load for the average Nova Scotia house, as in the case of all the residential participants. Since there was no additional information about the commercial participant, after evaluating the estimation used by ENSC, the Evaluator has concluded that ENSC's approach is conservative and therefore appropriate.

Demand Savings

No demand savings are calculated in the tracking sheet for this program. Based on the information received from ENSC, the peak period for electricity demand in Nova Scotia occurs in December, January and February between 7 a.m. and 12 p.m., as well as between 4 p.m. and 11 p.m. on a weekday that is not a holiday¹⁰. As in the 2011 evaluation, Econoler elected to use the 5 p.m. to 7 p.m. timeframe as the peak load period for this year's evaluation.

Solar systems increase the temperature of the water, which is then supplied to the hot water tank. Such systems could not have a direct impact on the peak load. Instead, they reduce the energy consumption and power demand of the hot water system. Since hot water systems only have a weak impact on the peak load because of their duty cycle, Econoler has considered the peak load demand savings to be minimal regarding the addition of a solar system. Therefore, the Evaluator has considered the demand savings to be null for this program.

4.2.2 On-Site Visit Results

The five on-site visits conducted at participating households and businesses during this evaluation revealed that all the equipment inspected was working properly and the installation seemed appropriate, except for one participant who was still waiting for the plumbing to add the space heating

¹⁰ Nova Scotia Power, Domestic Service Time-Of-Day Tariff,
"http://www.nspower.ca/en/home/aboutnspi/ratesandregulations/electricityrates/domesticservicetimeofdaytariffoptional.aspx"

loop to the DHW system. Also, all the equipment installed was consistent with the information found in the tracking sheet.

4.2.3 Revised Gross Savings

The annual gross savings for all sectors and categories of equipment installed through Solar are presented in Table 4. They were calculated using the unitary savings values reviewed in this report. Overall, total gross energy savings amount to 0.109 GWh at the meter.

Gross savings at the generator level are also estimated in Table 4, using a line loss factor provided by Nova Scotia Power between the meter and the generator of 1.064 for commercial dwellings and 1.100 for residential dwellings. Using these factors, total gross energy savings at the generator are estimated at 0.120 GWh.

Table 4: Evaluation Results – Revised Gross Savings

Category of Measure	Residential		Commercial		Total
	DHW	SH	DHW	SH	
Program Tracking Sheet					
Tracked energy savings (GWh)	0.095	0.003	0.011	0.001	0.110
Evaluated Energy Savings					
Adjustment	0	- 0.0003	0	+ 0.0003	
Total Gross Energy Savings – at Meter (GWh)	0.095	0.002	0.011	0.001	0.109
Line loss factor	1.100	1.100	1.064	1.064	
Total Gross Energy Savings – at Generator (GWh)	0.105	0.002	0.012	0.001	0.120

4.3 NET-TO-GROSS RATIO

To estimate the tracked net savings, ENSC used a Net to Gross Ratio (NTGR) of 0.7 (30% free-ridership), based on participants' responses to a single screening question asked in the pre-approval application process.

This single question provided a good insight of the program's influence on the participants' decision, but should not be considered appropriate in quantifying the free-ridership level. Considering the small number of participants and relatively low total energy savings, no survey was conducted. Therefore, the Evaluator has assumed that the free-ridership is null for the 2012 evaluation and that the NTGR for this program is 1.

4.4 NET SAVINGS

Since the NTGR for the program is 1, the net savings will be exactly the same as the gross savings.

$$\text{Net savings} = \text{Gross Evaluation Savings} \times \text{NTGR}$$

Overall, the total net energy savings amount to 0.109 GWh at the meter, and 0.120 GWh at the generator.

Table 5: Evaluation Results – Revised Net Savings

Category of Measure	Residential		Commercial		Total
	DHW	SH	DHW	SH	
Energy Savings					
Total gross energy savings – at meter (GWh)	0.095	0.002	0.011	0.001	0.109
NTGR	1	1	1	1	-
Total Net Energy Savings (GWh) – at Meter	0.095	0.002	0.011	0.001	0.109
Line loss factor	1.100	1.100	1.064	1.064	-
Total Net Energy Savings (GWh) – at Generator	0.105	0.002	0.012	0.001	0.120

The table below presents comparisons between the energy savings established by this evaluation and those calculated in the 2012 tracking sheet.

Table 6: Comparisons of Tracked and Evaluated Savings at the Generator

	Gross Savings	NTGR	Net Savings
Energy Savings			
Tracked Savings from ENSC	0.120 GWh	0.70	0.084 GWh
Evaluation Results	0.120 GWh	1.00	0.120 GWh
Demand Savings			
Tracked Savings from ENSC	0 GWh	0.70	0 GWh
Evaluation Results	0 GWh	1.00	0 GWh

The energy savings values calculated were compared to the program's tracked savings for 2012. The values calculated were 43 percent higher than those tracked. This can mainly be explained by the NTGR assumed by ENSC (0.7). Also, a small adjustment was made for space heating, but it was not significant compared to the gain in energy savings resulting from the change in NTGR.

CONCLUSION

The 2012 evaluation revealed that Solar had generated net energy savings of 0.120 GWh at the generator. To calculate the net savings of Solar in 2012, Econoler not only reviewed the parameters used for estimating the unitary savings values of each type of equipment installed, but also completed a number of RETScreen simulations to validate whether the savings were acceptable for residential and commercial participants. Furthermore, five on-site visits were completed to validate solar system installation and the consistency between the information presented in the tracking sheet and that found on site.

APPENDIX I - RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Complete a RETScreen simulation for all the projects to improve the accuracy of the deemed savings: The RETScreen simulation tool is very easy to use and understand. With adequate input data (such as the number of occupants, the collector slope, the collector azimuth, etc.), the PM could quickly simulate each project and produce a precise savings estimate for each participant.
	2. Consider requiring solar installers to complete a RETScreen simulation for all the projects: In relation with the preceding recommendation, participants might have difficulty finding all the required technical information about their solar system. Since solar installers have a better technical knowledge about their products and visit every house to install the equipment, they could collect all the necessary information to complete the RETScreen simulations. Therefore, they could be put in charge of providing the information to ENSC and even completing the RETScreen simulations themselves. Since the software is free and very simple to use, ENSC would only need to provide some simple instructions on information collection and inputting.
	3. Include a participant survey to estimate free-ridership (FR) if participation level is high enough to justify doing so: Participants' responses to ENSC's screening question revealed that a certain level of FR could be expected for Solar. Since the participation level was low this year, no survey was conducted to collect the information required to determine a statistically sound FR level. In the future, if a greater number of participants and a more significant energy savings impact are expected, the evaluation should include quantification of an accurate FR based on a participant survey.

APPENDIX II – ON-SITE VISIT PROTOCOL

1. General Information

Date of visit: _____

ENSC project #:: _____

Participant name: _____

Telephone: _____

Address: _____

Type of Residential building *(if applicable)*: _____

Type of Commercial building *(if applicable)*: _____

Number of occupants *(or # of units if applicable)*: _____

EnerGuide for Existing Houses/ Performance Plus Participant _____

2. System information

Appliance	Number of Flat Plate Collectors		Number of Evacuated Tubes Collectors	
	From Tracking Sheet	On-Site Validation	From Tracking Sheet	On-Site Validation
Domestic Hot Water heating (DHW):				
Space Heating (SH):				
DHW & SH:				
<u>Explanation if different:</u>				

3. Project information

Solar system		
	From tracking sheet	Contact declaration
Date of installation:	N/A	
Validate that the solar system is operational:	N/A	
Energy source for the existing DHW heating system (<i>electric, natural gas, etc.</i>):		
Energy source for the existing space heating system (<i>electric, natural gas, etc.</i>):		
Solar system type (<i>flat plate or evacuated tubes</i>):		
Solar system usage (<i>DHW, SH or both</i>):		
Tank size (<i>If DHW or both</i>):	N/A	
Tank location (<i>If DHW or both</i>):	N/A	
Dealer:		
Collector make :		
Collector model:		
Collector Size (<i>visual validation</i>):		
Validate if the solar system is operational (<i>Yes/No - If no, Why?</i>):	N/A	
Validate if the solar system is operational all year long (<i>Yes/No - If no, Why?</i>):	N/A	

Notes:



LED HOLIDAY LIGHT EXCHANGE IMPACT EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

February 19, 2013



ECONOLER

ACRONYMS

DSM	Demand-Side Management
ENSC	Efficiency Nova Scotia Corporation
IRP	Integrated Resource Plan
LED	Light-Emitting Diode
LHLE	LED Holiday Light Exchange
NTGR	Net-to-Gross Ratio
UARB	Utility and Review Board

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Diversity factor	The ratio of the sum of the individual maximum demands of the various subsystems to the maximum demand of the whole system.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.
Spillover (internal)	Percentage of savings attributable to participants who continue to implement the energy efficiency measures introduced by a program after participating in it once, without participating in the program a second time.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 impact evaluation of the LED Holiday Light Exchange (LHLE), which is a component of the Efficient Products program.

PROGRAM COMPONENT OVERVIEW

The LHLE provides individuals across Nova Scotia with the opportunity to receive a set of LED holiday lights in exchange for two sets of old traditional holiday lights in order to reduce electrical energy consumption and demand. The LHLE is mainly a community outreach and awareness activity. The exchanges are made through local tree-lighting events held all across the province. There is a limit of one set of LED holiday lights per person.

The LHLE has been running every fall since 2005. Efficiency Nova Scotia Corporation (ENSC) was the only entity responsible for delivering the LHLE in 2012 after Nova Scotia Power discontinued its involvement in the LHLE.

In 2011, the first LHLE evaluation was conducted. It revealed that, from the time of the 2007 Integrated Resource Plan (IRP) to the end of 2011, 46,399 LED holiday light sets had been distributed through the LED holiday light exchange events and generated net energy savings of 1.447 GWh.¹

In 2012, 9,661 LED holiday light sets have been distributed through the LHLE.

KEY FINDINGS

The 2012 impact evaluation of the LHLE computed the net energy savings resulting from the distribution of a total of 9,661 LED holiday light sets in 2012. In addition, 42 units distributed at the end of 2011 were added to this amount (for a total of 9,703 sets) since, at the time of completing the 2011 evaluation report, the final numbers provided to the Evaluator did not include these units.

To calculate the net savings of the LHLE, Econoler reviewed the parameters used by ENSC to estimate gross savings and took into consideration interactive effects for LED holiday lights. Due to the special nature of this program, the free-ridership and spillover effects were not measured during this evaluation and the net-to-gross ratio (NTGR) is assumed to be 1.

The evaluation revealed that the LHLE generated net energy savings of 0.349 GWh and demand savings of 0.753 MW at the generator in 2012.

¹ As indicated in the 2011 LHLE Evaluation Report. At the time of reporting the 2011 final results to the Evaluator, the final count was not yet available. The number provided to the Evaluator for 2011 was missing 42 units, which will be taken into account in this evaluation.

Table 1: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings				
Tracked savings from ENSC	0.374 GWh	0.374 GWh	1.00	0.374 GWh
Evaluation results	0.435 GWh	0.349 GWh	1.00	0.349 GWh
Demand Savings				
Tracked savings from ENSC	1.871 MW	1.871 MW	1.00	1.871 MW
Evaluation results	0.939 MW	0.753 MW	1.00	0.753 MW

Although the unitary savings value was revised to 40.8 kWh due to an increase in the average daily usage assumption for the LED holiday lights installed, the net evaluated energy savings fell short of the tracked savings by 7 percent. For demand savings, the difference is more significant (-60 percent). The addition of a diversity factor and interactive effects explain these drops in savings.

1 PROGRAM DESCRIPTION

The LHLE is aimed at promoting the use of energy-efficient LED lights for holiday lighting. The LHLE is mainly a community outreach and awareness activity. Through local tree-lighting events held annually in November and December across Nova Scotia, ENSC provides individuals with the opportunity to receive a set of LED lights in exchange for two sets of old traditional holiday lights. There is a limit of one set of LED holiday lights per person.

The LHLE has been running every fall since 2005. ENSC was the only entity responsible for delivering the LHLE in 2012 after Nova Scotia Power discontinued its involvement in the LHLE. Since the 2007 Integrated Resource Plan (IRP), 56,102 LED holiday light sets have been exchanged through the LHLE.

A first impact evaluation was conducted in 2011, covering the years 2007 to 2011. The evaluation demonstrated net energy savings of 1.447 GWh resulting from the distribution of 46,399 LED holiday light sets during this period.²

This report aims to evaluate the electricity savings generated by the LHLE in 2012. The impact evaluation is based on a review of the parameters used in ENSC unitary savings calculations. Because of the short period targeted by the LHLE and the relative level of savings it generated, ENSC has not planned any specific process evaluation activities for this evaluation.

² As indicated in the 2011 LHLE Evaluation Report. At the time of reporting the 2011 final results to the Evaluator, the final count was not yet available. The number provided to the Evaluator for 2011 was missing 42 units, which will be taken into account in this evaluation.

2 IMPACT EVALUATION

2.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The purpose of the impact evaluation is to determine the gross and net savings of the LHLE in 2012. To this end, Econoler reviewed ENSC unitary savings calculations by comparing them with those performed by other jurisdictions. Subsequently, the gross energy savings were calculated from this revised unitary savings value and the gross demand savings were calculated using a diversity factor. Finally, the net savings were evaluated by applying the interactive effects generated by the replacement of traditional incandescent lights with LED lights.

2.2 GROSS SAVINGS

The quantity of LED sets exchanged during the LHLE events was computed in a tracking sheet. Then, ENSC used an average unitary savings value to estimate the total energy and demand savings generated by the program.

2.2.1 Unitary Savings Value

The average unitary savings value estimated for each set of LED lights exchanged is 35.2 kWh and the unitary peak demand is estimated at 176 W. These values have been used since 2007 to estimate the gross energy and demand savings generated by the LHLE. They are based on the assumptions presented in the table below and were revised in the last evaluation.

Table 2: ENSC Unitary Savings Estimate for Each Set of LED Lights Exchanged

Parameters	Values
Proportion of old large incandescent sets returned (25 lamps per set)	40%
Proportion of old mini incandescent sets returned (100 lamps per set)	40%
Proportion of old mini incandescent sets returned (50 lamps per set)	20%
Wattage of old large incandescent sets (25 lamps per set)	$7 \text{ W/lamp} \times 25 \text{ lamps/set} = 175 \text{ W/set}$
Wattage of old mini incandescent sets (100 lamps per set)	$0.4 \text{ W/lamp} \times 100 \text{ lamps/set} = 40 \text{ W/set}$
Wattage of old mini incandescent sets (50 lamps per set)	$0.4 \text{ W/lamp} \times 50 \text{ lamps/set} = 20 \text{ W/set}$
Average old wattage (incandescent sets)	$(40\% \times 175 \text{ W}) + (40\% \times 40 \text{ W}) + (20\% \times 20 \text{ W}) = 90 \text{ W/set}$

Parameters	Values
Wattage of new LED sets (25 lamps per set)	$0.08 \text{ W/lamp} \times 25 \text{ lamps/set} = 2 \text{ W/set}$
Average displaced wattage (per exchange)	$(90 \text{ W} - 2 \text{ W}) = 88 \text{ W}$
Annual usage	$5 \text{ h/day} \times 40 \text{ days/yr} = 200 \text{ h/yr}$
Number of new LED sets used to replace the 2 old sets returned	2
Unitary Energy Savings Value (per exchange)	$2 \text{ sets} \times 88 \text{ W} \times 200 \text{ h/yr} = 35.2 \text{ kWh/yr}$
Unitary Peak Demand (per exchange)	$2 \text{ sets} \times 88 \text{ W} = 176 \text{ W}$

Through the LHLE, ENSC offers one set of LED lights in exchange for two sets of traditional incandescent lights; there is a limit of one set of LED holiday lights per person. Consequently, ENSC calculates the unitary savings value associated with each LED set exchanged based on the assumption that, ultimately, customers would probably replace both sets returned with new LED sets.

This assumption is conservative from two perspectives:

- > It assumes that only two sets of old incandescent lights are returned for every LED set exchanged. However, in practice, the in-field teams see many customers bringing in multiple sets of old incandescent lights for only one LED set.
- > It also assumes that each set of old incandescent lights returned will ultimately be replaced even if it is possible that the customer will rather elect to use only the new set provided by ENSC.

On the other hand, it is also possible that a customer buys additional sets of holiday lights. In some cases, the old incandescent sets returned were longer and contained more lights. However, Econoler considers that ENSC's assumption is still conservative.

Displaced Wattage

Based on in-field observation, ENSC established proportions of old sets returned for three different types of incandescent light sets. The wattages used for these different types of old sets returned (7 watts for large incandescent sets of 25 lamps and 0.4 watt for mini incandescent sets of 50 and 100 lamps) were validated by reviewing the different studies presented in the table below.

Table 3: Estimated Wattage Values for Old Incandescent Sets

Type of Lights	Estimated Wattage	Source
Large incandescent	7.00 W	Based on results from testing done by PG&E ³
Mini incandescent	0.45 W	
Large incandescent	7 and 5 W	BC Hydro, Impact Evaluation – Seasonal LEDs ⁴
Mini incandescent	0.40 W	
Large incandescent	4 W	Efficiency Maine Residential Technical Reference Manual ⁵
Mini incandescent	0.45 W	
Large incandescent	5 W	Ontario Power Authority Report ⁶
Mini incandescent	0.5 W	

These studies demonstrate that the wattage values used by ENSC for large and mini incandescent light sets are appropriate.

In addition, Econoler analyzed the results obtained at the beginning of January 2013 from a survey conducted by ENSC with 69 respondents who participated in the LHLE in December 2012. These results demonstrated that different types of incandescent sets are returned by the participants, i.e. indoor large, indoor mini and outdoor large sets with various quantities of lamps, but no participant declared having returned sets with 100 lamps. However, only the types of old sets returned were collected through the survey and not the number. Therefore, Econoler did not have enough reliable information to revise the three different types of incandescent light sets returned and their proportion used by ENSC in the savings calculations. Thus, no adjustment for the wattage values of the sets of lamps replaced can be calculated and ENSC displaced wattage will be used for this evaluation.

If the LHLE is conducted once again in 2013, Econoler recommends adding some questions in the survey to validate the type, the quantity and the number of lamps per set of each set returned. This would allow for a review of the average old wattage using the real types and proportions of old sets returned.

The wattage used for the replacement set of LED lights provided by ENSC corresponds to the real wattage value of the C-6 LED lights offered through the LHLE.

³ Pacific Gas and Electric Company (PG&E), A Better Way to Light Up the Holidays, <http://www.pge.com>, 2012.

⁴ Sampson Research, Market & Impact Evaluation of BC Hydro's Seasonal LED Initiative, Executive Summary prepared for BC Hydro, July 28, 2005.

⁵ Efficiency Maine, Residential Technical Reference Manual, No. 2009-1, February 5, 2009.

⁶ Ontario Power Authority (OPA), "2010 Prescriptive Measures and Assumptions" and "2011 Prescriptive Measures and Assumptions," www.powerauthority.on.ca/evaluation-measurement-and-verification/measures-assumptions-lists_

Annual Usage

For the hours of operation, as in the last evaluation report, Econoler considers the annual usage of 40 days used by ENSC to be acceptable. While BC Hydro⁷ and the OPA rather assume an annual usage of 31 days, corresponding to the entire month of December, other jurisdictions such as the U.S. Department of Energy⁸, PG&E⁹ and the University of Maine¹⁰ assume an annual usage of 40 to 45 days to estimate the savings associated with the usage of LED holiday lighting.

The daily usage of 5 hours per day was reviewed in this evaluation based on the ENSC January 2013 survey results. The average daily usage declared by the participants is 5.8 hours per day.

Therefore, Econoler decided to change the daily usage of 5 hours per day to 5.8 hours per day and base its calculations on ENSC's assumption for the annual usage of 40 days per year, which represents an average value of all the studies mentioned above.

Unitary Savings Value

The annual unitary savings value of 35.2 kWh per set of LED lights exchanged used by ENSC was revised to take into account the new daily usage of 5.8 hours per day. This revision resulted in an increased unitary savings value of 40.8 kWh. This value was used in the present evaluation to compute the gross energy savings achieved by the LHLE in 2012.

The unitary peak demand estimated at 176 W remained the same.

2.2.2 Diversity Factor

In the tracking sheet, ENSC estimated gross demand savings by using a diversity factor of 100 percent. As in the last evaluation, Econoler revised this assumption, considering that the probability that the LED holiday lights would be turned on during the peak electricity demand is not 100 percent. Indeed, the peak electricity demand for Nova Scotia Power is expected to occur between 5 p.m. and 7 p.m. on a weekday in December, January or February.

For this year's evaluation, Econoler used the same approach to evaluate the probability that the LED holiday lights would be turned on at the time of the peak electricity demand for Nova Scotia Power. Two elements were considered: the probability that the holiday lights would be turned on between 5 p.m. and 7 p.m. and the probability that they would be turned on the day of the peak load, which should occur on a weekday in December, January or February. Since the evaluation revealed that the

⁷ BC Hydro, Make Your Holiday Season Bright and Energy Efficient!, Power Smart program, <http://www.bchydro.com>, October 2010.

⁸ U.S. Department of Energy, LED Products, Energy Savers, www.energysavers.gov, Last Update: 2012-01-11.

⁹ PG&E, A Better Way to Light Up the Holidays, www.pge.com.

¹⁰ The University of Maine, LED Alternatives Offer Efficient Holiday Lighting, www.umaine.edu, November 29, 2010.

LED holiday lights would be on for about 5.8 hours a day, usually in the evening, there was a high probability that the lights would be turned on between 5 p.m. and 7 p.m. Thus, that probability was estimated at 100 percent. Furthermore, ENSC assumed that the LED holiday lights were used, on average, 40 days per year during the month of December and the beginning of January. Knowing this, Econoler evaluated the probability that the LED holiday lights would be turned on the day of the peak load. Based on Nova Scotia Power historical peak load data¹¹, it appears that, in 50 percent of cases, the peak load occurred during the month of December. Therefore, as in the 2011 LHLE evaluation, a diversity factor of 50 percent was used in the demand savings calculations.

2.2.3 Total Gross Savings

The gross savings of the LHLE for 2012 are presented in the table below. They were calculated using the unitary savings value validated during this evaluation and using the number of LED sets exchanged through the LHLE during the fall 2012. For this year's evaluation, the total gross energy and demand savings amount to 0.396 GWh and 0.854 MW at the meter.

Between the meter and the generator, the line loss factor for residential rate classes is estimated by Nova Scotia Power at 1.100. Using this value, total gross energy and demand savings are estimated at 0.435 GWh and 0.939 MW at the generator level.

Table 4: Evaluation Results – Total Gross Energy Savings

Number of Units	
Number of LED sets – from tracking sheet ¹²	9,703
Energy Savings	
Unitary energy savings value (kWh)	40.8
Total Gross Energy Savings – at Meter (GWh)	0.396
Line loss factor	1.100
Total Gross Energy Savings – at Generator (GWh)	0.435
Demand Savings	
Unitary peak demand (W)	176
Diversity factor	50%
Total Gross Demand Savings – at Meter (MW)	0.854
Line loss factor	1.100
Total Gross Demand Savings – at Generator (MW)	0.939

¹¹ Nova Scotia Power, Hourly Total Net Nova Scotia Load,

http://oasis.nspower.ca/en/home/default/monthlyreports/hourly_ns.aspx, visited on February 5, 2012.

¹² 9,661 sets were handed out in 2012. 42 units distributed at the end of 2011 were added to this amount (for a total of 9,703 sets) since, at the time of completing the 2011 Evaluation Report, the final numbers did not include these units.

2.3 INTERACTIVE EFFECTS

In a residence, interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as heating and cooling. In the case of the LHLE, replacement of old traditional holiday lights with LED holiday lights inside the house causes an increase in the heating load during their use. Indeed, LED lights release less heat than the old incandescent lights they traditionally replace.

The interactive effects on electric heating for LED holiday lights are estimated at -100 percent when they are installed inside the house. This assumption is based on the fact that holiday lighting is installed during winter (heating season), in common rooms, at medium height and when no air conditioning unit is used. Therefore, 100 percent of the energy released from the holiday lights is used for the heating load. Similar discussions were held a few years ago with Hydro-Québec for its holiday lighting program and it was agreed to remove any impact for electrically heated houses. Only external holiday lighting was promoted and considered for the energy savings.

The table below presents the calculation details for the interactive effects factor. It reflects the proportion of residences in Nova Scotia that use electricity as a main heating source and the percentage of residences where seasonal LED lights were installed inside the house. According to a survey conducted in 2011 by ENSC with 1,004 respondents, 33 percent of households in Nova Scotia use electricity as a main heating source for their home¹³. To determine the indoor/outdoor installation ratio, Econoler assumed that the sets of LED lights that replaced large incandescent lights had been installed outside. Those sets represented 40 percent of the sets exchanged. The remaining sets, replacing mini incandescent lights, were considered to be used for indoor holiday decoration.

Table 5: Interactive Effects Factor for the LHLE

Parameters	% of Residences	Interactive Effects
Using electric heating – indoor seasonal LED lights	$33\% \times 60\% = 19.8\%$	-100%
Using electric heating – outdoor seasonal LED lights	$33\% \times 40\% = 13.2\%$	0%
Not using electric heating – indoor seasonal LED lights	$67\% \times 60\% = 40.2\%$	0%
Not using electric heating – outdoor seasonal LED lights	$67\% \times 40\% = 26.8\%$	0%
Weighted Interactive Effects Factor	100%	-19.8%

The survey conducted with 2012 LHLE participants included a question to validate where the LED lights distributed through the program were installed, either inside or outside. However, it was not possible to draw any conclusions from the results obtained since half of the respondents selected both

¹³ ENSC from 2011 socket study.

choices, i.e. inside and outside, even if only one set of LED holiday lights was exchanged per individual. Therefore, Econoler recommends improving this question and the available answers if a similar survey is conducted next year.

2.4 NET-TO-GROSS RATIO

Due to the special nature of this program, the short target period and the fact that it requires special involvement from the participant, the distortion effects of the LHLE are assumed to be negligible. Consequently, the NTGR is assumed to be 1.

2.5 NET SAVINGS

Since the NTGR for the LHLE is assumed to be 1, the net savings were calculated using the interactive effects only.

$$\text{Net savings} = \text{Gross Evaluation Savings} \times (1 + \text{Interactive effects factor})$$

The net energy savings calculated for 2012 are shown in the table below. Overall, the total net energy and demand savings amount to 0.317 GWh and 0.685 MW at the meter, and 0.349 GWh and 0.753 MW at the generator.

Table 6: Evaluation Results – Total Net Savings

Energy Savings	
Total gross energy savings – at meter (GWh)	0.396
Interactive effects factor	-19.80%
NTGR	1.00
Total Net Energy Savings – at Meter (GWh)	0.317
Line loss factor	1.100
Total Net Energy Savings – at Generator (GWh)	0.349
Demand Savings	
Total gross demand savings – at meter (MW)	0.854
Interactive effects factor	-19.80%
NTGR	1
Total Net Demand Savings – at Meter (MW)	0.685
Line loss factor	1.100
Total Net Demand Savings – at Generator (MW)	0.753

As shown below, the gross and net savings resulting from this evaluation were compared to the gross and net savings estimates from the 2012 tracking sheet.

Table 7: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings				
Tracked savings from ENSC	0.374 GWh	0.374 GWh	1.00	0.374 GWh
Evaluation results	0.435 GWh	0.349 GWh	1.00	0.349 GWh
Demand Savings				
Tracked savings from ENSC	1.871 MW	1.871 MW	1.00	1.871 MW
Evaluation results	0.939 MW	0.753 MW	1.00	0.753 MW

To establish energy and demand savings, Econoler reviewed the unitary savings values computed by ENSC in the tracking sheet. The daily usage assumption was changed to be higher, resulting in a unitary savings value initially estimated at 35.2 kWh increased to 40.8 kWh. The peak demand savings of 176 W remained the same.

The fact that the evaluated results fall below the tracked savings can be explained by the adjustment of the following factors:

- > The diversity factor: ENSC used a diversity factor of 100 percent in the tracking sheet to estimate demand savings. This value was adjusted to 50 percent by Econoler given the probability that the LED holiday lights would be turned on during the peak electricity demand.
- > The interactive effects factor: Interactive effects were not taken into account in the tracking sheet. However, Econoler considers that the interactive effects on the heating load caused by the replacement of traditional holiday lights with LED holiday lights are not negligible. The interactive effects factor for the LHLE was estimated at -19.8 percent by the Evaluator and was used in the net savings calculations.



BUSINESS ENERGY REBATES
IMPACT AND PROCESS EVALUATION 2012
EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 7, 2013



ECONOLER

ACRONYMS

BER	Business Energy Rebates
BES	Business Energy Solutions
BNI	Business, Non-Profit and Institutional
CATI	Computer-Assisted Telephone Interviewing
CDI	Commercial Direct Install
CFL	Compact Fluorescent Lamp
CEE	Consortium for Energy Efficiency
CRA	Corporate Research Associates
DSM	Demand-Side Management
DSMDS	Demand-Side Management Data System
EC	Electronically Commutated
ENSC	Efficiency Nova Scotia Corporation
HP-T8	High Performance T8 lamps
HSPF	Heating Seasonal Performance Factor
IES	Illuminating Engineering Society
LED	Light Emitting Diode
NEMA	National Electrical Manufacturers Association
NTGR	Net-to-Gross Ratio
PM	Program Manager
RDI	Residential Direct Install
RW-T8	Reduced Wattage T8 lamps
SBES	Smart Business Energy Solutions
SLC	Smart Lighting Choices
TRM	Technical Reference Manual
VSD	Variable Speed Drive

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Diversity factor	The ratio of the sum of the individual maximum demands of the various subsystems to the maximum demand of the whole system.
Energy Efficiency Ratio	A ratio calculated by dividing the cooling capacity (in Btu/h) by the power input (in watts) at a given set of rating conditions.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.

Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Business Energy Rebates (BER), also known as the Prescriptive Rebate program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM) and 10 distributors, 50 on-site visits and one telephone survey of 56 mail-in rebate participants.

PROGRAM OVERVIEW

BER provides financial incentives in the form of prescriptive rebates to business, non-profit and institutional (BNI) clients to encourage reduction of electrical energy consumption and demand.

Since its start, BER has offered mail-in rebates on a range of energy-efficient measures. For 2012, BER has been expanded to include instant rebates through electrical distributors within the province of Nova Scotia.

The prescribed measures are divided into eight categories:

- > HVAC;
- > lighting;
- > refrigeration;
- > motors and drives;
- > compressed air;
- > agricultural equipment;
- > commercial kitchen equipment; and
- > commercial laundry equipment.

In 2012, program design and implementation was upgraded in several aspects. In particular, BER has made significant progress towards horizontal diversification by incorporating commercial kitchen equipment and agricultural equipment into the eligible measures. The Evaluator has noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Moreover, following the recommendations from the 2011 evaluation report, additional efforts were made in program promotion and communication, as well as in informing participants about expected savings.

BER aimed to achieve net electricity savings of 14.9 GWh and demand savings of 2.9 MW for 2012.

KEY FINDINGS

The evaluation of BER demonstrated that the mail-in rebate approach had a total of 175 participants in 2012, which is a considerable increase compared to the previous years (106 participants in 2011 and 13 participants in 2010).¹ In terms of net energy savings, the mail-in rebate approach generated 7.779 GWh for the year of 2012, which represents an increase in comparison with the figures for 2011 (7.002 GWh) and 2010 (0.503 GWh). For the instant rebate approach, the net energy savings are 14.079 GWh for 2012, in comparison with 7.954 GWh for 2011 and 6.245 GWh for 2010.

Awareness

Program awareness constitutes an important aspect of the program strategy in terms of keeping the number of participants on the rise and ensuring program continuity in the years to come. The evaluation has revealed that the main source of awareness for the BER mail-in rebate approach was communication from ENSC (41%), including contact with ENSC staff, the ENSC website, the newspapers, ENSC literature and ENSC presentations. ENSC's intensified efforts in program promotion in 2012 have yielded good results.

Contractors and vendors also contributed to program awareness, with 36 percent of the mail-in rebate participants reporting having learned about the program from them. Moreover, 25 percent of the participants stated that it was the contractor who presented and specified the measures to implement. These results highlight the importance of contractors in program promotion.

Word of mouth was also mentioned as an important source of awareness, which could be viewed as a strong indicator of program satisfaction.

Satisfaction and Motivations

Satisfaction with the program has been strong among mail-in rebate participants and distributors. Actually, most of them expressed their satisfaction with the program overall and its various aspects. Considering the mail-in rebate participants' high level of satisfaction with the program and its prescriptive nature, it was only natural that most of them did not face any barriers during their involvement in the program. The application process was considered easy by the vast majority of mail-in rebate participants.

Another initiative introduced to help improve satisfaction and participation was ENSC's new energy sheet, which informs mail-in rebate participants about the expected savings of the implemented measures. The information in this sheet would satisfy the ultimate motivation for participating in BER and for installing energy-efficient equipment, i.e. energy savings and cost reduction.

¹ The level of participation is unknown for the instant rebate approach.

Impact on the Market

With regard to the instant rebate approach, many distributors noticed, on one hand, that program advertising activities had a good impact on their sales of LED lighting systems. On the other hand, according to some distributors interviewed during the 2012 BER evaluation, most of their high-performance and reduced-wattage T8 lamps and high-performance ballasts were sold through other ENSC programs, namely Business Energy Solutions (BES) and Custom Retrofit. These distributors explained that other BNI programs offered higher lighting incentives than BER and that most projects undertaken by their customers were carried out through programs other than BER, although energy savings were counted only once. Therefore, they indicated that the influence of the BER instant rebate approach on their sales of T8 lamps and ballasts was weaker than that of other BNI programs. Actually, Econoler found that 37 percent of T8 lamps and 48 percent of ballasts eligible for an instant rebate were already funded by another BNI program.

Program Energy Savings

To calculate the net savings of the BER mail-in rebate approach in 2012, Econoler reviewed the ENSC-estimated gross savings by analysing the results of 50 on-site visits and measuring the distortion effects associated with this specific approach. A free-ridership level of 18 percent was determined through the participant survey, resulting in a net-to-gross ratio (NTGR) of 0.82.

As for the instant rebate approach, Econoler calculated the respective free-ridership levels of high-performance and reduced-wattage T8 lamps, high-performance electronic ballasts and LED lighting systems, based on the distributor interviews. The free-ridership level estimated for each of these categories of product is presented in the table below.

Table 1: Distortion Effects and Net-to-Gross Ratio

	2012 Mail-In Rebate	2012 Instant Rebate		
		T8 Lamps	Ballasts	LEDs
Free-Ridership Level	18%	27%	24%	11%
NTGR	0.82	0.73	0.76	0.89

Overall, the evaluation revealed that BER generated net energy savings of 21.858 GWh and demand savings of 6.285 MW at the generator in 2012.

Table 2: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Adjusted Gross Savings	Adjusted Gross Savings with Interactive Effects	NTGR*	Net Savings
Energy Savings					
Tracked Savings from ENSC	26.680 GWh	26.680 GWh	26.680 GWh	0.78	20.819 GWh
Evaluation Results	26.804 GWh	27.295 GWh	25.191 GWh	0.86	21.858 GWh
Demand Savings					
Tracked Savings from ENSC	7.838 MW	7.838 MW	7.838 MW	0.78	6.133 MW
Evaluation Results	7.873 MW	7.912 MW	7.315 MW	0.86	6.285 MW

*NTGRs were different for each rebate approach. The NTGRs presented in this table correspond to the rounded averages obtained by dividing the net savings by the installed gross savings (with interactive effects).

For the mail-in rebate approach, the net energy and demand savings evaluated for 2012 were slightly lower than those tracked by ENSC, respectively by 7 percent and 3 percent. This could mainly be explained by the adjustments calculated from on-site visits and applied to the tracked gross savings. For the HVAC measures, overall adjustment ratios of 0.863 and 1.037 were applied respectively on the energy and demand savings of all the projects implemented in this category. Additionally, diversity factors were taken into account to establish the peak demand savings. These revisions made to the tracked savings allowed for a more precise estimation of energy and demand savings.

For the instant rebate approach, the net energy and demand savings calculated for this evaluation were higher than the tracked savings, respectively by 13 percent and 6 percent. This result could be explained by the fact that ENSC applied an NTGR of 0.75 on all the products purchased through the program. For this evaluation, NTGRs were calculated for the products contributing the most savings. The NTGR for the other products was assumed to be 1. Interactive effects of -15.5 percent were also applied to the gross savings calculated for indoor lighting products, but the conservative NTGR value used for tracked savings was sufficient to offset the reduction of savings caused by this interactive effects factor.

RECOMMENDATIONS

Econoler has found that the program has desirable strengths and is working with satisfactory results. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations aimed at optimizing the program at various places in the present report. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- BER-R1. Analyze product offering to reduce duplicate rebates and program overlapping in the market:** Some eligible measures covered by the BER instant rebate approach are also covered by other BNI programs (BES and Custom Retrofit). When analyzing the savings associated with the instant rebate, Econoler found that 37 percent of the T8 lamps and 48 percent of the ballasts eligible for an instant rebate were already funded by another BNI program. This information was confirmed by some of the distributors interviewed during this evaluation. They indicated that most of their high-performance and reduced-wattage T8 lamps and high-performance ballasts were sold through other ENSC programs, mostly BES. These distributors explained that for these products, a large part of their sales volume came from a small number of contractors who worked on projects under other BNI programs. Although some products were double-funded, it is important to note that ENSC did not claim savings within the BER program for these items. The Evaluator was advised that ENSC already planned to remove the lamp and ballast rebates from the range of rebates accessible to the BES DAs and Custom project contractors. Still, the Evaluator considers that the products rebated through BER Instant Rebate should be limited to specific products with low market penetration since T8 lamps and HP ballasts are largely covered by the other two BNI programs offered by ENSC. Thus, Econoler recommends reviewing product offering of the BNI programs and limiting instant rebates to specific products with low market penetration, such as LED technologies. This would avoid double funding, dissatisfaction by stakeholders and program-overlapping in the market (i.e. offering different rebates under different forms for the same market).
- BER-R2. Improve the tracking sheet to facilitate effective validation of savings:** Improvements to both mail-in and instant rebate tracking sheets could be made to facilitate analyzing energy and demand savings calculated for the program. Currently, all the values used in savings calculations are contained in one cell. Breaking down these values in different cells would allow the Evaluator to easily validate the savings calculations for each category of product and apply adjustments when necessary. Furthermore, both tracking sheets contain information presented in separate tabs. Consolidating all the information in one main database is another change that would facilitate the evaluation process.

- BER-R3. Define different full load hours values according to building characteristics:** Currently, for HVAC measures, ENSC uses two typical full load hours values to estimate energy savings in heating, depending on the heat pump capacity. Thus, these same values are applied on all types of building. However, the on-site visits demonstrated 1) that very few participants were able to enter a reliable value in the “Full load hours” field of the HVAC worksheet; and 2) that full load hours could vary significantly depending on the building’s characteristics, such as the building type and the temperature set point. Therefore, Econoler recommends developing a reference table with full load hours values defined according to different factors that might affect them like the building type (office building, retail stores, etc.) and the heating temperature set point of the building. This kind of information can be more easily and reliably collected using the worksheet than the full load hours themselves. A similar approach to recording the full load hours could be followed for cooling measures.
- BER-R4. Introduce tighter control on some product requirements:** For lighting measures, one of the elements having a significant impact on the savings review is replacing non-eligible old lamps. To mitigate this issue in the future, the Evaluator recommends that participants be required to provide photographs of the lamps and/or fixtures they intend to replace, regarding lighting products with an eligibility criterion requiring the new product to replace a specific type of lamp or a minimum level of wattage. This recommendation is not intended to estimate savings based on the real wattage values of the replaced old lamps, but to ensure that this specific eligibility criterion is met and savings calculations are in compliance with the baseline.
- BER-R5. Move products from the instant rebate to the mail-in rebate:** In relation to the preceding recommendation on validating the eligibility of old lamps, there could also be a similar issue with LED chandelier lamps and LED high bay fixtures. Therefore, Econoler recommends that these products be included in the mail-in rebate portion of the BER program so that ENSC has tighter control on eligibility criteria by requiring the photographs of the lamps and/or fixtures that the participant intends to replace. This recommendation also resonates with some distributors, who mentioned during the in-depth interviews that eligibility criteria on the products to be replaced were really difficult to validate in stores unless they collected the replaced old lamps, which would have required much time, space and organization.
- BER-R6. Standardize savings calculations for lighting products with typical baseline values:** A statistical analysis of the adjustment ratios calculated for each of the 14 lighting projects visited for this evaluation demonstrated that the error margin was too high, making it impossible to apply a common adjustment ratio on all the projects implemented in the category. This large error margin was due to the large variations between the adjustment ratios obtained from the on-site visits. Even if the sample size had been ten times bigger, the error margin would have remained very high because of the huge variations in the adjustments. These large variations between the adjustment ratios calculated for each

project raised a question on the methodology used to estimate savings. A major source of errors certainly resided in the fact that savings were based on the real wattage values of the replaced old lamps declared by participants. Therefore, Econoler recommends standardizing the savings calculations for lighting products with typical baselines for every type of product installed. Such an approach to all eligible products would greatly simplify the savings calculations. And then, ENSC would only need to monitor the market trends and the new regulations introduced to adjust the baseline table, when necessary.

- BER-R7. Ensure that the participant provides the motor specifications sheet:** For motor measures, the adjustments made to the savings calculations were generally a consequence of wrongly identified efficiency values on the worksheet. Therefore, the Evaluator recommends ensuring that the participant provides the motor specifications sheet (or a picture of the motor nameplate) to make it easier for ENSC to validate efficiency results at the savings calculation stage.
- BER-R8. Develop a reference table with baseline and new wattage values for T5 and T8 high bay fixtures, LED technologies and induction technologies:** The review of the displaced wattage values used for T5 and T8 high bay fixtures, LED technologies and induction technologies showed that the savings used in the tracking sheet might have been underestimated in some cases because of the relatively low ballast wattage values used for baseline fixtures. Moreover, for the new fixtures installed, ENSC often only uses the wattage of the lamp since most product specifications sheets do not list the wattage values of the whole fixture. For the 2012 evaluation, no adjustment was made since specific savings values were calculated for each product sold through the program and that savings values were calculated in one cell, making it impossible to apply any adjustment factor. To make savings evaluations more precise in the future, Econoler recommends developing a reference table with baseline lamp and ballast wattage values associated to each type of T5 and T8 high bay fixture, LED technologies and induction technologies sold through the instant rebate approach. These values would be based on typical replacement scenarios found in literature or established by well-informed market experts. For the wattage values of the new fixtures installed, Econoler recommends using typical ballast factor values instead of the information on each product specifications sheet, which is often unavailable.
- BER-R9. Include interactive effects in calculating the tracked savings of all the indoor lighting products sold through the instant rebate approach:** For the lighting measures implemented through the mail-in rebate approach, interactive effects were already included in ENSC's gross savings calculations. For the instant rebate approach, interactive effects are only considered for LED strip lighting used in refrigeration applications. Therefore, the Evaluator had to adjust the tracked savings to take into account an interactive effects factor of -15.5 percent for all indoor lighting products. To make savings calculations more precise in the future, interactive effects should be systematically integrated into the savings calculations of all the indoor lighting products sold through the BER instant rebate.

1 PROGRAM DESCRIPTION

Business Energy Rebates (BER) provides financial incentives in the form of prescriptive rebates to business, non-profit and institutional (BNI) clients to encourage the reduction of electrical energy consumption and demand. All BNI customers in Nova Scotia are eligible. Launched on June 28, 2010, BER was closely modeled after successful prescriptive programs offered by other Demand-side Management (DSM) administrators, in particular Efficiency Vermont.

The term 'prescriptive rebate' refers to a particular rebate value that has been calculated prior to a customer submitting a proposal. If a given product or technology shows energy savings potential, then the product or technology along with its suggested rebate value can be 'prescribed' universally for any incoming client.

Since its start, BER has offered mail-in rebates on a range of energy-efficient measures. For 2012, BER has been expanded to include instant rebates through electrical distributors within the province of Nova Scotia.

The electrical distributors involved in BER are part of a network of preferred vendors and play a key part in promoting instant rebates. These distributors also provide end-users with customer service in the form of product expertise, as well as assistance in completing mail-in applications.

The prescribed measures offered under BER are divided into eight categories as indicated below. These categories include measures eligible for either an instant in-store rebate or a mail-in rebate.

- > HVAC;
- > lighting;
- > refrigeration;
- > motors and drives;
- > compressed air;
- > agricultural equipment;
- > commercial kitchen equipment; and
- > commercial laundry equipment.

For 2012, BER has made significant progress towards horizontal diversification by including new eligible categories of measure into the program, namely commercial kitchen equipment and agricultural equipment.

Eligible measures have been established for each measure category by applying specific criteria based on industry standards such as ENERGY STAR® and the National Electrical Manufacturers Association (NEMA), and on minimum efficiency/efficacy values.

To facilitate customer participation, a list of already approved measures is available. It is to be noted that the eligible measures are not limited to this list, which ensures that measures designed by any

manufacturer can be implemented through the program, provided they meet the specified criteria for that measure category.

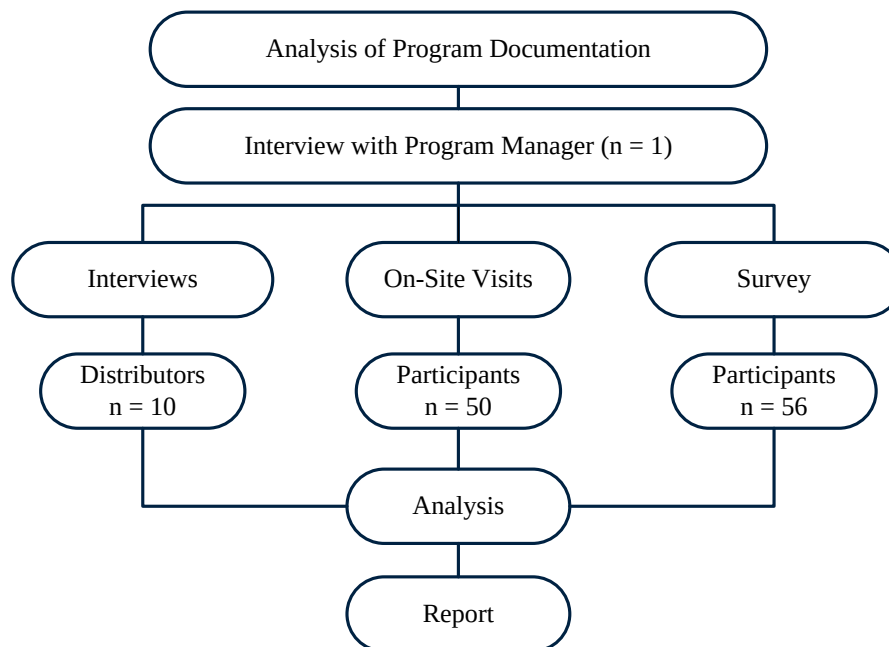
BER aimed to achieve net electricity savings of 14.9 GWh and demand savings of 2.9 MW for 2012. Savings generated by BER are accounted for under the Prescriptive Rebate program as outlined in the 2012 Demand-Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for BER. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was obtained primarily from the following sources:

- > ENSC website;
- > Program Manual;
- > Evaluation Plan – Schedule A – CIRx Screening Tool; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews with the Program Manager (PM) respectively in July and August 2012. Among other things, these interviews were intended to follow up on the 2011 evaluation recommendations regarding process issues, as well as to understand the main changes that occurred in program delivery in 2012. Based on the information obtained from these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 Interviews with Distributors

In October 2012, 10 interviews were conducted with the participating distributors. These interviews were mainly used to establish the free-ridership. The questions were meant to estimate how the market would have reacted without the program.

The guide used for the interviews with the distributors is presented in Appendix II for reference.

2.2.4 On-Site Visits

In the fall 2012, 50 on-site visits were conducted at the facilities of some participants who applied for a mail-in rebate under BER. These visits were conducted by Econoler's subcontractor, Equilibrium Engineering. Their purpose was to validate whether the measures were properly implemented according to the information contained in the tracking sheet. Additionally, hours of operation, various conditions of operation and, whenever possible, old and new equipment characteristics (wattage, HP, efficiency, etc.) were validated during the on-site visits.

Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix III.

2.2.5 Participant Survey

A telephone survey with a total of 56 mail-in rebate participants was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in October and November 2012 utilizing computer-assisted telephone interviewing (CATI) technology. The average length of the survey was 13 minutes.

The participant survey was meant to generate feedback on the following aspects of the mail-in rebate approach of BER:

- > free-ridership;
- > previous program participation;
- > program awareness;
- > participant motivations, concerns and barriers;
- > energy attitudes;

- > satisfaction with the program; and
- > recommendations for improvements.

The profile of the organizations interviewed through the survey and the survey questionnaire are shown in Appendices IV and V respectively. The table below shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2011 and 2012 telephone surveys.

Table 3: Sample Size and Sampling Error

Mail-in Rebate Survey	Mail-in Rebate Population	Sample Size (n)	Sampling Error at 90% Confidence Interval
2011 Participants	106 ²	43	±9.7%
2012 Participants	175 ³	56	±9.9%

² The population of BER participants for the 2011 survey was 52 at the time the survey was being conducted.

³ The population consisted of all the participants who were each individually identified by a unique code number in their project name as registered in the tracking sheet.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

In 2011, Econoler performed a comprehensive process evaluation of the BER program. The 2010 evaluation report and recommendations, the program manual and website, the application forms, the logic model and program theory were among the program elements examined in the process evaluation. The PM was interviewed along with program partners and participants. The 2011 approach generated a series of recommendations to improve the program performance and management.

The 2012 process evaluation is a continuation of the 2011 evaluation and covers the following aspects:

- > follow-up on the 2011 evaluation recommendations regarding process issues;
- > new and/or updated program documentation including program modifications since the last evaluation;
- > program tracking sheet;
- > program partners' perspectives on process issues; and
- > program participants' perspectives on process issues.

Recommendations and follow-ups regarding impact evaluation (energy or demand) will be discussed in the Impact Evaluation section of this report.

3.2 PROGRAM DOCUMENT ANALYSIS AND INTERVIEWS WITH THE PROGRAM MANAGER

The following section describes the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interviews with the PM. It also covers the follow-up on recommendations from last year in each applicable section.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory, in which all the information about the program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program, based on a template provided by the Evaluator.

In 2012, the Evaluator has noted that the program memory has been included in the program manual along with its various Appendices. The Evaluator is also pleased to report that BER has now an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff, as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The program manual is intended to provide fundamental information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The BER program manual is now presented in a standardized template which applies to all ENSC programs and includes the same table of contents with 10 sections. This is a considerable improvement on the 2011 format and has followed one of the Evaluator's major recommendations.

With this new format, most recommendations regarding the program manual, such as documenting important assumptions or practices, explaining the criteria for selecting the projects to be visited and providing the parameters used to estimate program objectives, are now covered in the program manual, as well as its attached files and Appendices.

The following table compares the program manual content of 2011 to the new 2012 version. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 4: Program Manual Content - BER

Program Manual Content	2011	2012
Document revisions	✓	✓
Program description (including nature or type of program)	✓	✓
Program justification	⚠	✓
Program objectives	✓	✓
Incentives	✓	✓
Eligibility criteria	✓	✓
Program partners and their roles	Not Applicable	✓
Program barriers	✓	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	✓	✓
Details about the savings calculations and types of measure	✓	✓
Annual budget	✓	✓
Cost-effectiveness test results	✓	✓
Market study or technical study supporting program elements or assumptions	⊘	✓
Marketing plan	⊘	✓
Evaluation plan	⊘	✓
Program theory	✓	✓
Logic model	✓	✓
Program process flow chart	✓	✓
Partner or participant process flow chart	✓	✓
Program forms	✓	✓
 Information included in the program manual  Information partially included in the program manual  No information		

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program's logic model. Econoler is currently working with ENSC to make sure that each program's updated logic model reflects the current program strategy, and the performance indicators established based on the program theory. The programs' logic models will all be finalized and included in the programs' manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the Evaluator's recommended template for an evaluation plan, which is included as an Appendix of the BER program manual. The PM provided positive feedback on this important tool that complements the program manual and makes it possible to evaluate the program. The addition of the evaluation plan to the program documentation is a great improvement from previous years.

3.2.4 Program Charts

The program now has three process charts: one for instant rebate partners, one for mail-in rebate participants and one for the PM. These charts were recommended in the 2011 evaluation and are very informative for any new staff responsible for the program, as well as for program partners and participants.

Econoler has the following recommendation on the program charts:

- **Provide partners and participants with simplified process charts:** The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well designed. Moreover, the partners should be given copies of their process chart. After all, since these charts are intended for the distributors and the mail-in participants, they must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version number and revision date should be indicated in each chart.

3.2.5 Marketing and Outreach Activities

ENSC is moving away from program-specific marketing to a more all-inclusive approach with increased focus on offering a full suite of energy-saving services and rebates for businesses. There has been a focus on building tools and strengthening relationships with partners to promote co-marketing of ENSC's offerings. Market segment specific materials have been developed for key verticals and are being delivered in partnership with related industry associations.

Besides the master marketing plan for the business sector, which is not specific to any particular program, the Evaluator found additional information in the evaluation plan regarding the marketing strategy for this program. It includes the following activities:

- > marketing materials placed in distributor branches;
- > attendance at trade shows;
- > inclusion of articles in trade association newsletters; and
- > province-wide mail-outs to businesses.

Furthermore, all recommendations from the 2011 evaluation regarding 1) increasing promotion activities, 2) providing information about the program portfolio and 3) informing participants about expected savings have been followed. The first recommendation was followed by increasing the marketing budget for this program, which presently features a multitude of promotional and informational activities. The second recommendation was followed by implementing an initiative in June 2012 to provide participants with energy sheets indicating the expected savings of the implemented measures.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator has noticed that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

The Evaluator has the following recommendation on the marketing plan:

- > **Make the performance indicators more quantitative:** To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

3.3 TRACKING SHEET

Mail-In Rebate

As part of the 2012 BER evaluation, Econoler reviewed the content of the tracking sheet for the mail-in rebate approach. This tracking sheet is an extract from the online Demand-Side Management Data System (DSMDS). The Evaluator did not review the complete content of the DSMDS, but, for certain projects, online documents were consulted to obtain and validate details on the measures.

Two main tabs were included in the mail-in rebate tracking sheet provided by ENSC:

- > the Project Summary tab, which provides a quick summary of each application submitted for a mail-in rebate; and
- > the Energy Savings tab, which provides information on the savings achieved for all the completed projects.

In general, the tracking sheet contains the minimum information to allow the PM to monitor program participation and the related savings. Much additional information is available in the DSMDS about each individual project, but because of some system limitations, this information could not be easily included in the tracking sheet. Consequently, many fields necessary for evaluation purposes were missing from the tracking sheet. This is one of the reasons why some recommendations made in the last evaluation have not been applied in the 2012 tracking sheet. ENSC is currently working on this issue by making necessary adaptations to the DSMDS so that it will be possible to include in one report all the essential information needed for administration and evaluation purposes.

The information in the Project Summary tab includes the project name (i.e. the string of letters and numbers identifying each project of this program), the company name and the measure category. The measure category field can be filled out using a standardized scroll-down menu, which prevents making spelling mistakes when filling out this field and permits easy evaluation of program costs and savings for each type of measure. Also, the Project Summary tab presents all the project database numbers. These numbers allow for quick locating of each project in the DSMDS along with the details of the measures implemented in the Energy Savings tab.

Upon the request of the Evaluator, the PM added the participants' responses to the free-ridership pre-screening questions included in the application form. This approach to monitoring the free-ridership pre-screening process is considered a good practice and is useful for the assessment of free-ridership within the impact evaluation.

The other tab called "Energy Savings" lists the general category of the measures installed, the savings calculation methodologies, as well as the demand and energy savings values estimated by the PM. The number of units, their characteristics (wattage, horsepower, efficiency ratio, etc.) and the hours of operation for the old and new equipment are entered in this tab by the PM based on the information provided by program participants in the application forms. In some cases, default values are used by the PM when the details for the old equipment are not available or when the savings calculation methodology requires their use (as in the case of some refrigeration measures). Currently, all these values are entered in one cell and, to repeat what was recommended in the 2011 evaluation report, it would facilitate savings analyses if each of these values was recorded in a separate column.

The energy and demand savings presented in the Energy Savings tab differ slightly from the energy and demand savings recorded in the Project Summary tab, which are used as the official tracked savings values. In the Project Summary tab, savings at the generator are also calculated for each project, using the specific line loss factor associated with each participant's rate code.

Participant information necessary to conduct the field activities (surveys and on-site visits) was not available in the tracking sheet. Such information was provided in a separate database by the PM, coming from another extract of the online DSMDS. Although the participant information could easily be linked to the projects, using the unique identification numbers, it should be noted that having it incorporated directly in the tracking sheet would have been more convenient for the Evaluator.

In conclusion, several adjustments should be made to facilitate the validation of the savings calculations and to improve tracking sheet consistency. Knowing that ENSC is currently working on such improvements on the DSMDS, the Evaluator makes the following recommendations that should be taken into account when developing the reporting option for the DSMDS in 2013.

- > **Merge all the information on the projects implemented and the energy savings into a single database:** As mentioned earlier in this section, the tracking sheet submitted by ENSC for the mail-in rebate approach consisted of two key tabs containing calculated savings figures, namely the “Project Summary” and the “Energy Savings” sheets. When reviewing the tracking sheet, the Evaluator did not find any added value of using two distinctive tabs and therefore recommends that ENSC ensure that the DSMDS allows merging all the information into a single database. This would help reduce the risk of calculation errors, facilitate the validation process and prevent duplicates (e.g. the demand and energy savings of each project were included in both tabs, with no link between the related cells of either tab).
- > **Break down the values used for savings calculations in different cells:** As it was the case in 2011, all the values used for savings calculations are contained in one cell. This approach to tracking data does not allow for a systematic validation of the savings for each measure. A simple reorganization of the database would make this validation possible while reducing the likelihood of data entry errors. The number of units as well as their key characteristics, such as wattage, horsepower, efficiency ratio and hours of operation, should each be contained in a separate cell. Most of this information can be collected directly from the application forms. Considering the multitude of approaches used to calculate the energy savings for this program, it would be useful to keep the detailed equation in the database, as the savings calculation parameters can vary from one project to another.
- > **Record all the information on each participant:** For this year’s evaluation, participant information required for conducting the field activities (surveys and on-site visits) was provided separately to the Evaluator. Therefore, Econoler recommends that the following items be always included in the reporting sheet that would be generated by the DSMDS:
 - contact name, phone number and email address;
 - facility name, address, city, postal code and general phone number.

Moreover, participants’ answers to the free-ridership pre-screening questions were added by the PM upon the request of the Evaluator. In the future, this information should be recorded in the DSMDS as soon as a new project is entered and included in the reporting sheet.

- **Ensure that complete contact information is always provided:** It is recommended that the PM ensure that all the contact information fields are systematically filled out. The analysis of the 2012 tracking sheet showed that the contact name, facility phone number and email address were missing for many projects. A protocol could be implemented to ensure that all the contact information is collected.

Instant Rebate

Econoler also reviewed the content of ENSC's tracking sheet for the instant rebate approach of BER. This tracking sheet contains a summary of the monthly savings achieved for each distributor. Econoler also reviewed the monthly reporting sheets that contain information on the number of products sold and the energy and demand savings calculations.

Reporting sheets are produced on a monthly basis. These sheets show the product codes and quantities sold, as indicated in the distributor invoices and allow the PM to monitor the sales of each distributor and to calculate their related savings. Energy and demand savings are calculated for every product sold, using a formula referring to a table which lists all the unitary savings values for each product code. Subsequently, these energy and demand savings are entered in the tracking sheet, but only the total savings are recorded on a monthly basis for each distributor.

The same template is used to produce all the monthly reporting sheets and this ensures that the information is always presented in the same way. As a further improvement, some of the information included in the monthly reporting sheets should be absorbed into the database. Currently, the name of each distributor is registered once in the column where their product codes are listed. This way of inputting data makes it difficult to calculate sales and savings for each distributor.

Technical data on products are sometimes included in the product code. This means that the available information is provided in a string of numbers and characters, which does not allow for conducting any analysis on the parameters used in the unitary savings calculations. It was only with a master list of products provided by the PM that Econoler was able to associate each product with its appropriate broader category (e.g. electronic ballasts, T8 lamps, LED downlights) using the product code. Although this list is available, the association is not being done systematically in the monthly reporting sheets.

In conclusion, the monthly reporting sheets already present all the necessary fields for administration purposes and savings calculations. However, several adjustments could be made in the future to improve the content of these sheets and to include all the information provided by the distributors in the official tracking sheet. Therefore, the Evaluator recommends that ENSC:

- **Consolidate all the information collected from the monthly reporting sheets:** The official tracking sheet for the instant rebate approach only provides overall figures, i.e. the monthly savings for each distributor. No detailed information on the products sold by each distributor or the savings calculations for each product code is included. So the Evaluator recommends

consolidating all the information contained in the individual monthly reporting sheets and the master list of products into one comprehensive tracking sheet, which would facilitate monitoring the products sold yearly through the instant rebate approach and thereby make it easier to calculate program savings. For instance, the information provided in the master list of products would allow associating each product sold through the program with the right category of product, thus facilitating the application of different NTGRs and interactive effects factors according to the category of product.

- > **Improve the template for the monthly reporting sheets:** A template indicating the information required in the monthly reporting sheets is used by the PM. This template could be improved to facilitate the analysis of each distributor or product category (electronic ballasts, T8 lamps, etc.), as well as the consolidation of all monthly reporting sheets into one tracking sheet. At least three columns should be added to the template to respectively identify the distributor, the tracking month, and the broader category of product. The revised template would provide the PM and the Evaluator with a way to better monitor the program results by including both the savings and product sales.
- > **Facilitate the savings validation by providing technical information in separate fields:** Currently, the only information associated with the product codes is the category of product and their respective savings calculations. Technical information, such as the wattage and the number of lamps per fixture, is included in the product code name. This way of presenting information, i.e. in one long string of numbers and characters, prevents any analysis or validation of the savings calculations. Therefore, Econoler recommends presenting the technical information provided in the product code name in separate fields.

3.4 RELATIONSHIP WITH PARTNERS

As part of the process evaluation, 10 distributors involved in the instant rebate component were interviewed about their satisfaction with the program. As shown in the table below, overall program satisfaction received a score of 8.3 on a scale of 1 to 10, which means the distributors were in general very satisfied with the program. Those who gave a lower satisfaction score were mainly dissatisfied with the complicated procedures, frequent changes made to the program and delays in providing product specifications.

Table 5: Distributors' Satisfaction with Program

Aspect of Program	Mean (/10)
<i>Sample Size</i>	<i>10</i>
Mean (1="Not at all Satisfied", 10="Very Satisfied")	
Program overall	8.3
Program support and communications	8.9
Rebate processing, tracking and reporting	7.5

Program support and communications received a score of 8.9 on the same scale of satisfaction. On one hand, many distributors stated that the advertising activities had a good impact on end-user customers and on their businesses; they noticed that their sales of lighting measures became much easier, especially those related to LED lighting. On the other hand, some distributors interviewed about the instant rebate approach indicated that most of the T8 lamps and high performance ballasts sold in 2012 were through other ENSC programs, mostly Business Energy Solutions (BES). These distributors explained that a large part of their sales volume came from a small number of contractors buying or promoting a complete package to their customers, usually including new ballasts, lamps and fixtures for the whole building. This kind of package is being offered under other BNI programs. Moreover, according to one distributor, other BNI programs took away part of their BER business because most of the ballasts and lamps were being sold through these other programs or were being bought from larger distributors, thus eliminating the market for replacements.

Finally, distributors were a little less satisfied with rebate processing, tracking and reporting. For this particular aspect of the program, they gave a score of 7.5 on the 10-point scale of satisfaction. Their main concern was related to the wait times for ENSC to reimburse the rebates claimed at the end of every month. Some distributors also mentioned that the EXCEL spreadsheet in which they had to report the rebate manually was not compatible with their own systems and that the password protection caused some difficulties. If it was not password-protected, they could at least copy and paste data from one system to another.

When asked to give suggestions on program improvements, apart from the wait times to reimburse the rebates and the template for reporting, some distributors said they hoped ENSC would continue good advertising and keep working hard on other measures than lighting.

3.5 PARTICIPANT PERSPECTIVES

3.5.1 Previous Program Participation

Before participating in BER, three in ten participants had previously taken part in an ENSC program (30%). Among those who had previously participated in the programs, Smart Lighting Choices and Custom Retrofit were most frequently mentioned, while those participating in Small Business Energy Solutions, Commercial Direct Install, Solar, and Residential Direct Install were fewer.

Table 6: Previous Program Participation

Other Program Participation	2011 (%)	2012 (%)
<i>Sample Size</i>	43	56
Yes	21%	30%
No	65%	66%
Don't know	14%	4%
Program Participation*	2011 (#)	2012 (#)
<i>Sample Size**</i>	9	17
Smart Lighting Choices (SLC)	--	7
Custom Retrofit	3	5
Small Business Energy Solutions (SBES)	3	2
Commercial Direct Install (CDI)	--	2
Solar	--	2
Residential Direct Install (RDI)	--	1
Others	3	3
*Base: Respondents who previously participated in programs		
**Multiple responses		

3.5.2 Program Awareness

Participants found out about BER in a number of different ways. However, communication from ENSC was the primary source (41%), including contact with ENSC staff (20%), the ENSC website (14%), the newspapers (5%), ENSC literature (4%) and ENSC presentations (2%). Contact with contractors or vendors (36%) and word of mouth (25%) were also common ways in which participants heard about the program.

The results indicate that ENSC's actions have contributed to program knowledge. Moreover, the high level of word of mouth is a good indicator of program satisfaction.

Table 7: Sources of Awareness

Sources of Awareness	2011 (%)	2012 (%)
<i>Sample Size</i>	43*	56*
TOTAL ENSC SOURCES	--	41%
ENSC staff	14%	20%
ENSC website	26%	14%
Newspaper	--	5%
ENSC literature	26%	4%
ENSC presentation	7%	2%
Contractor or vendor	60%	36%
Business associate/friend/word of mouth	53%	25%
Internet	--	9%
Department of Agriculture	--	9%
Agricultural newsletter/bulletin	--	4%
Previous participant	30%	2%
Others	--	7%
*Multiple responses		

3.5.3 Motivations and Barriers to Participation

The most important motivation for over one-half of those participating in BER was to save on energy costs (55%), while for two in ten the most important motivation was to take advantage of the incentives and rebates (20%). These two motivations also topped the list of the second most important motivations for participating.

Table 8: Motivations for Participating

Motivations for Participating	2011 (%)		2012 (%)	
	Most Important Motivation	Second Most Important Motivation	Most Important Motivation	Second Most Important Motivation
<i>Sample Size</i>	43	43	56	56
Save on energy costs/bills	44%	21%	55%	32%
Take advantage of program incentives/ rebates	33%	26%	20%	30%
Update equipment	--	7%	7%	4%
Replace non-working equipment	--	--	4%	--
Improve existing lighting conditions	7%	7%	2%	9%
Reduce maintenance costs	2%	7%	2%	2%
Already planning project	--	--	2%	--
Quality of efficiency measures	5%	2%	--	--
Environment	2%	9%	--	7%
Recommended by contractor	2%	--	--	2%
Find ways to reduce carbon footprint	--	5%	--	--
Others	5%	5%	9%	9%
None/No other reason	--	--	--	4%
Don't know	--	12%	--	2%

The respondents were asked about their motivations for installing energy-efficient equipment. Across most of the measures implemented, the most important motivation was to save on energy costs (66% overall). This was generally consistent across the six measures under consideration.

Table 9: Motivations for Product Installation

Motivations for Product Installation	2012													
	Lighting		New Motors or VSDs		HVAC Equipment/ Upgrades		Compressed Air		Kitchen		Agriculture		All Measures	
	Most Imp. %	2nd Most Imp. %	Most Imp. #	2nd Most Imp. #	Most Imp. #	2nd Most Imp. #	Most Imp. #	2nd Most Imp. #	Most Imp. #	2nd Most Imp. #	Most Imp. #	2nd Most Imp. #	Most Imp. %	2nd Most Imp. %
<i>Sample Size</i>	25	25	6	6	14	14	2	2	6	6	3	3	56	56
Save on energy costs/bills	60%	28%	5	3	11	5	--	--	3	2	3	--	66%	30%
Take advantage of program incentives/ rebates	8%	8%	--	1	1	2	1	1	--	1	--	--	7%	13%
Improve existing lighting conditions	12%	28%	--	--	--	--	--	--	--	--	--	--	5%	13%
Old equipment, replace prior to failure	--	4%	1	--	--	4	1	--	1	--	--	1	5%	11%
Part of building renovation or addition	4%	--	--	--	--	1	--	--	1	--	--	--	4%	2%
Reduce carbon footprint	--	12%	--	--	--	--	--	--	1	--	--	--	2%	5%
Reduce maintenance costs	--	4%	--	--	--	--	--	--	--	--	--	--	--	2%
Others	16%	4%	--	1	2	2	--	1	--	--	--	1	11%	11%
None/No other factors	--	4%	--	--	--	--	--	--	--	2	--	1	--	7%
Don't know/ Refused	--	8%	--	1	--	--	--	--	--	1	--	--	--	7%

To satisfy the most important motivational elements for participating in BER and for installing energy-efficient equipment, program activities, promotional literature and advertising materials should continue to focus on energy savings and cost reductions.

The individuals responsible for specifying the measures to be implemented through the program were quite often someone within the company or organization (27%) or a contractor (25%). To a lesser degree, outside design professionals (14%) and manufacturer representatives (9%) were also responsible for specifying the measures.

These results, combined with the fact that contractors or vendors were an important source of program awareness, highlight the importance of contractors in program promotion.

Table 10: Individual Responsible for Specifying Measures to Be Implemented

Main Responsible	2011 (%)	2012 (%)
<i>Sample Size</i>	43	56
Someone within company/organization	35%	27%
Contractor	28%	25%
Outside design professional (architect, engineer)	2%	14%
Manufacturer representative	30%	9%
Utility account manager	2%	2%
Others	2%	11%
No one specific group or person	--	5%
Don't know	--	7%

Most participants did not face any barriers during program participation (89%), although one in ten did face barriers (11%). Of the few participants who faced barriers during the program, they felt that the lack of information did not allow them to make an informed decision, that the paperwork/process required too much work, or that approval took too long.

Table 11: Barriers Faced During Program Participation

Faced Barrier(s)	2011 (%)	2012 (%)
<i>Sample Size</i>	43	56
No	88%	89%
Yes	9%	11%
Don't know	2%	--

3.5.4 Energy Attitudes

Virtually all the participants indicated that both reducing energy usage (100%) and managing energy costs (96%) is important for their organization, giving a rating of '5' or '4' (with '5' being "very important").

Table 12: Importance of Energy Management

Importance of...*	2011 (%)	2012 (%)
<i>Sample Size</i>	43	56
Reducing energy usage	98%	100%
Managing energy costs	93%	96%
*Those giving a rating of 5 or 4 on a scale where 5= "Very important" and 1= "Not at all important"		

Nearly all the participants indicated they would purchase energy-efficient measures or products in the future with 96% giving a likelihood rating of '5' or '4' (with '5' indicating "very likely").

Table 13: Likelihood of Purchasing Energy-Efficient Measures or Products in the Future

Likelihood of Energy-Efficient Upgrades when Installing/Replacing Equipment in the Future	Sample Size	Rating: 5= "Very likely" and 1 = "Not at all likely"				
		5	4	3	2	1
2011 (%)	43	74%	26%	--	--	--
2012 (%)	55	78%	18%	2%	2%	--
*Don't know/Refused excluded from calculations						

These results show a very positive attitude and a high level of motivation towards energy efficiency among the participants. Moreover, survey results indicate that a significant proportion of the participants had participated in another program prior to BER. These findings indicate a favorable trend towards energy management.

3.5.5 Program Influence

Participants were asked to rate the importance of various factors in influencing their decision to implement energy-efficient measures. The ENSC rebates were the most important influence on their decision to implement these measures (with a mean of 8.1 on an importance scale of 0 to 10), followed by the information received during the initial contact (with a mean of 7.5). Of slightly less importance were the information provided through program outreach and marketing activities, the organization's corporate policy or guidelines regarding equipment purchase, or the standard practice in the industry (with a mean ranging from 6.4 to 6.6 respectively).

Table 14: Importance of Factors in Influencing Decision

Importance of Factors in Influencing Decision to Implement Energy-Efficient Measures	2011		2012	
	<i>Sample Size*</i>	Mean	<i>Sample Size*</i>	Mean
Mean (0="Not at all important", 10="Extremely important")				
ENSC rebates	41	7.3	56	8.1
Information received during initial contact	42	6.4	55	7.5
Information provided through program outreach and marketing activities	42	5.1	55	6.6
Organization's corporate policy or guidelines regarding the purchase of equipment	39	5.4	55	6.4
Standard practice in industry	37	5.4	49	6.4
Previous experience with program or similar program	41	4.3	52	4.7
*Don't know/Refused removed from calculations				

3.5.6 Satisfaction with the Program

In terms of satisfaction with the program, all the aspects received satisfaction from over 80 percent of the participants. The program overall received the highest level of satisfaction (95%), followed closely by interactions and communication with ENSC staff (91%). The program application/forms/paperwork, the initial confirmation of eligibility, and the time required to receive the rebate or incentive each received a satisfaction rating of 89 percent. The aspect receiving the lowest satisfaction rating was the rebate or incentive amount (82%), and the rating was nonetheless positive.

Table 15: Satisfaction with Program

Aspect of Program*	2011		2012	
	Sample Size**	% Satisfied	Sample Size**	% Satisfied
Program overall	42	91%	56	95%
Interactions and communication with ENSC staff	38	87%	56	91%
Program application, forms and paperwork	40	85%	56	89%
Initial confirmation of eligibility	42	86%	55	89%
Time required to receive rebate or incentive	41	83%	55	89%
Rebate or incentive amounts	43	79%	56	82%
*Those giving a rating of 5 or 4 on a scale where 5= "Very satisfied" and 1= "Not at all satisfied"				
**Don't know/Refused removed from calculations				

Of the three participants who were dissatisfied with the program overall, two were dissatisfied because they did not feel ENSC was helpful, while one thought it was difficult to sign up for the program. However, as shown in the following table, the process for participating in the program was considered easy by the large majority of participants, with nearly nine in ten participants (87%) giving the process a rating of '5' or '4' (with '5' representing "very easy").

Table 16: Ease of Application Process

Ease of Application Process	2012
Sample Size*	55
5 - Very easy	51%
4	36%
3	7%
2	2%
1 - Very difficult	4%
*Don't know/Refused removed from calculations	

The few participants who found the participation process difficult indicated that it required too much paperwork, that there was not enough information on the process, or that the process itself took too long.

Table 17: Causes for Program Application Difficulty

Causes for Program Application Difficulty *	2012
<i>Sample Size**</i>	7
Too much paperwork	4
Not enough information on process	3
Timely process/Took too long	2
*Base: Respondents who found process difficult, '1', '2', or '3' rating, where '5'= "Very easy" and 1= "Very difficult"	
**Multiple responses	

BER participants were asked if they had recommended the program to another potential participant. Eight in ten participants had done so, which is a strong indicator of satisfaction and continued momentum for further program promotion.

Table 18: Recommended Program to Others

Recommended Program	2012
<i>Sample Size</i>	56
Yes	80%
No	20%

3.5.7 Participant Recommendations for Improvements

In terms of suggestions for improving BER, one in ten participants recommended that more information be provided (11%) or that there be better program marketing or awareness (11%). Other recommendations made by just fewer than one in ten included making the forms more user-friendly (9%) or rebating more measures (7%).

Table 19: Recommendations to Improve Program

Suggestions	2011 (%)	2012 (%)
<i>Sample Size</i>	<i>43*</i>	<i>56*</i>
Provide more information/information sessions	14%	11%
Better marketing/awareness	12%	11%
Make forms more user-friendly	2%	9%
Offer more measures rebated	--	7%
More direct contact between customer and program staff/more contact people/better communication	9%	5%
Increase/better rebates	7%	5%
ENSC staff should be more knowledgeable	--	4%
Good program/Continue good work	--	4%
Instant rebate at point of purchase	--	2%
Others	14%	5%
None/No recommendations/Don't know	51%	54%
*Multiple responses		

4 IMPACT EVALUATION FOR MAIL-IN REBATE

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation for mail-in rebate is aimed at determining the gross and net savings of this component of BER for 2012. Both energy and demand savings were considered in the evaluation. To do so, the following parameters were analyzed by Econoler:

- > savings calculation methodology for each category of measure;
- > installation and characteristics of the new equipment;
- > characteristics of the old equipment, when possible;
- > hours of operation;
- > load factor;
- > diversity factor;
- > interactive effects; and
- > free-ridership.

The impact evaluation of the mail-in rebate approach was based on a review of the tracking sheet, 50 on-site visits and the participant survey.

The review of the tracking sheet included a validation of the measures implemented and their corresponding savings, as well as an analysis of the methodologies used in *The BER – Measure Equations Tool* to calculate savings for each type of measure.

As recommended in the 2011 evaluation report of BER, the number of on-site visits for the mail-in rebate approach was increased for 2012 in order to allow covering all categories of measure with sufficient on-site visits and, when needed, establishing adjustment ratios to revise savings calculations. Therefore, 50 on-site visits were performed during this evaluation, including at least one on-site visit for each category of measure except commercial laundry equipment since no project was implemented in this category in 2012. On-site visits were mainly used to verify the equipment installed at participant facilities and their characteristics, as well as to collect information on hours of operation and other conditions of operation from the site contact.

In the end, the tracking sheet review and on-site visits were used to establish:

- > adjustment ratios for the gross energy savings calculated in the tracking sheet;
- > diversity factor to evaluate the peak demand for demand savings; and
- > interactive effects to apply on the gross demand and energy savings.

The participant survey provided information to calculate the net-to-gross ratio (NTGR) for this program. The NTGR established was used to calculate the program net savings.

4.1.1 On-Site Visit Sampling and Protocol

Sampling Methodology

A total of 50 on-site visits were conducted for the impact evaluation of the mail-in rebate approach. The sampling was established in September 2012 from the tracking sheet of participants who went through this type of rebate at that time.

As of September 2012, the tracking sheet contained 171 projects implemented by 159 participants, and these projects covered all the different categories of measure offered through the mail-in rebate approach. The table below presents the weight in terms of the number of projects and tracked savings for each category of measure.

Table 20: Total Number of Projects and Tracked Savings Used for On-Site Visit Sampling⁴

Category of Measure	Number of Projects		Tracked Savings		Sample
	Qty	%	kWh	%	n
HVAC	40	23%	2,487,334	44%	22
Lighting	85	50%	1,696,755	30%	15
Motors and Drives	15	9%	758,621	13%	7
Refrigeration	4	2%	349,951	6%	3
Compressed Air	8	5%	296,173	5%	1
Agricultural Equipment	5	3%	61,876	1%	1
Commercial Kitchen Equipment	13	8%	24,490	1%	1
Commercial Laundry Equipment ⁵	1	0%	0	0%	0
Total	171	100%	5,675,200	100%	50

In order to ensure that the on-site visits covered all the significant categories of measure present in the tracking sheet, the sample selection was made in accordance with the percentage of tracked savings for each of them.

Sampling was conducted using data on completed projects as of September 2012. At the time of the sampling, the HVAC and lighting categories featured the largest savings with 74 percent of the total savings. Thus, the number of on-site visits planned for these categories was significant. For the other categories that represented fewer savings, smaller samples were established since their impact on total savings was expected to be minimal. Therefore, no adjustment ratio was calculated for these categories

⁴ As of September 2012.

⁵ At the time of doing the on-site visit sampling, there was only one project in the commercial laundry equipment category. No electric savings were associated with this project since the water heating source was oil. The mail-in rebate was provided by the PNS.

apart from the ones for which an on-site visit was conducted. Moreover, at the time of the sampling, no site with electricity as their main water heating energy source had implemented commercial laundry equipment measures and so no on-site visit was planned for this category.

Due to the large number of visits to conduct in relation to the number of projects completed at the time of doing the sample selection, no limit on regions was applied.

On-Site Visit Protocol

On-site visits were used to establish an adjustment ratio for each category of measure, except when savings in a category were too low to visit a sufficient number of sites.

An on-site visit protocol listing the information to be collected was developed. For each site, the information on the type and number of measures implemented, the wattage or the capacity, as well as the characteristics of old and new equipment installed was collected. In addition, the hours of operation were collected for each facility visited based on the contact declaration. Information on the facility's heating and cooling equipment and usage was also collected.

4.2 GROSS SAVINGS

For the year of 2012, the tracking sheet provided for the mail-in rebate contains a total of 295 projects completed by 175 participants and covering 7 different categories of measures. The gross savings estimations presented in the tracking sheet were reviewed by Econoler through an analysis of *The BER – Measure Equations Tool* and 50 on-site visits.

The BER – Measure Equations Tool contains all the calculation methodologies for establishing the energy and demand savings achieved by each measure promoted by the program. These calculation methodologies come from credible organizations such as the Illuminating Engineering Society (IES), ENERGY STAR, the Consortium for Energy Efficiency (CEE), and most of the time, Efficiency Vermont. The parameters of the old and new equipment used in the calculations (e.g. hours of operation, power, capacity, efficiency, load factor, etc.) were provided by the participant in the application form. When those parameters are not provided in the application form, they are estimated by the PM based on the typical baseline and high efficiency values often sourced from Efficiency Vermont TRM.

Generally speaking, the methodologies used in *The BER – Measure Equations Tool* were found to be accurate by the Evaluator. Some of them were analyzed in greater detail with the on-site visits results as presented in the following sections.

The results of the 50 on-site visits conducted for this impact evaluation were analyzed in detail and were used to adjust gross energy savings values where inconsistencies were found. To establish these adjustments, Econoler used the data collected onsite to recalculate energy and demand savings

with the equations found in *The BER – Measure Equations Tool*. When savings values were found to be different from those recorded in the tracking sheet, an adjustment ratio was calculated.

The adjustments were mainly based on the hours of operation declared by the participant during on-site visits. For most of the measures, the hours of operation need to be indicated by participants in their application forms. However, for certain measures, the hours of operation used in the savings calculations are fixed values mainly sourced from Efficiency Vermont Technical Reference Manual (TRM)⁶. Moreover, fixed hours of operation are used when the hours of operation declared by the participant in the application form are absent or unacceptable by the PM. Thus, when the hours of operation calculated based on information collected on-site were different from the data used in *The BER – Measure Equations Tool*, an adjustment ratio on the energy savings was calculated. Other adjustments were mainly related to projects that did not meet program requirements (e.g. LEDs that were used to replace existing Compact Fluorescent Lamps (CFLs)) and equipment specifications that were incorrectly identified by participants in their project submissions.

Each project visited was analyzed and reviewed to establish the ratio between the savings found in the tracking sheet and the savings calculated by the Evaluator based on the on-site visit results. On the basis of these ratios, Econoler established an overall adjustment ratio to be applied to all the savings in the categories with an error margin acceptable. For the other categories, the adjustment, when necessary, was only made on the gross energy savings values of the projects for which the on-site visit was conducted.

The following sections present the adjustments that were calculated for every category of measures, except commercial laundry measures, of which no project displacing electrical energy was implemented in 2012. So this impact evaluation does not cover the review of this measure category.

4.2.1 HVAC Measures

A total of 22 visits were conducted at the sites where HVAC measures, mainly air and ground source heat pumps, were implemented. The on-site visits conducted for this category of measures allowed validating the number of units installed, their capacity, Heating Seasonal Performance Factor (HSPF) and efficiency ratios (EER or SEER), as well as the proper installation of equipment for each project. Following on-site validation of equipment usage and specifications, tracked savings calculations were verified.

For many projects visited, a correction (an increase or a decrease) had to be applied on the energy savings and/or demand savings calculated in the tracking sheet. These corrections were mainly due to the fact that the heating or cooling capacity, the HSPF or the efficiency ratios (EER or SEER) were incorrectly identified on the participant worksheet. In fact, in many cases, the participant worksheet

⁶ Efficiency Vermont, Technical Reference User Manual (TRM) – Measure Savings Algorithms and Cost Assumptions, September 20, 2011.

was not filled out and the information had to be collected with the specifications sheets of the new heat pumps installed.

One kind of recurrent adjustment made was the correction of HSPF values. For half of the verified projects, the HSPF for region IV (as indicated in the heat pump specifications sheet) was directly applied to the saving equations, whereas this value had to be divided by 1.15, to account for the colder climate encountered in Region V, of which Nova-Scotia is a part. The value of 1.15 is what is generally used by other organizations, including Natural Resources Canada⁷. For 3 of the 22 projects sampled, mistakes were made in formulae or wrong values were used (for example, using the EER value instead of HSPF to calculate savings in heating), sometimes leading to significant over-prediction of savings.

For some projects, the full load hours were estimated by the participant. In these cases, Econoler chose to use the typical values from Efficiency Vermont as more appropriate ones. Since full load hours depend on the heating and cooling demand of the building as well as on the capacity of the HVAC system, their estimation requires a thorough understanding of building mechanics as well as detailed information on the building construction, which is generally beyond the participant's expertise.

Furthermore, on two visits, the Evaluator found that the heat pumps were not used to heat the building at a normal temperature of 20°C, but rather to maintain the air at a lower temperature suitable for industrial operations. To reflect the fact that less heating was required in those buildings, the Evaluator reduced their full load hours. It was considered that demand savings would remain the same because those heat pumps operated at a single speed. This showed that applying typical values for variables such as full load hours to all the cases could increase the risk of overestimating savings if the usage projected by the participant differs greatly from standard usage.

These findings have prompted a recommendation on how to improve the assessment of full load hours. Currently, ENSC uses two typical values in heating, one for heat pumps below 65,000 Btu and the other for heat pumps above 65,000 Btu. They are the same average values for all types of building. In the future, these full load hours should be reviewed by considering other factors that might affect them such as the building type (office building, retail stores, etc.), among other things. These kinds of information are often easy to collect in the worksheet. Moreover, simple questions such as the heating temperature set point of the building would allow for applying an adjustment factor to the typical full load hours when the building is kept at a temperature considerably lower than 20°C. A similar approach could be used for the full load hours in cooling. Since HVAC projects represent the biggest source of energy savings among all the measure categories in the mail-in rebate approach, it is believed that those improvements on savings calculations would be of great importance. In the opinion of the Evaluator, this would also simplify the process for the participant, as it seemed that very

⁷ Natural Resources Canada, Air Conditioners and Heat Pumps under 19kW (65,000 Btu/h) - March 2005, <<http://oee.nrcan.gc.ca/regulations/2166>>

few participants were able to enter a reasonable or appropriate value in the “Full load hour” field of the HVAC worksheet.

Among the 22 projects reviewed, 21 were used to establish the adjustment ratios that would be applied to all energy and demand savings in the HVAC category. Although the remaining project represented small savings, it required a major adjustment because of serious mistakes in the savings calculations. Since its variation between the tracked and the evaluated savings was much higher than for the rest of the projects reviewed, Econoler decided to leave it out of the general adjustment ratio calculation. Thus, the adjustment ratios were calculated on 21 projects with a reasonable standard deviation.

For energy savings, the adjustment ratio has been set at 0.863 with an error margin of 12.3 percent at a confidence interval of 90 percent, which has justified applying this correction factor to all the energy savings of this category. For demand savings, the adjustment ratio has been set at 1.037 with an error margin of 8.9 percent.

4.2.2 Lighting Measures

A total of 15 on-site visits were conducted to validate the parameters used in the savings calculations. One of those 15 projects had to be removed from the sample because the project had not been completed for special reasons beyond ENSC’s and the participant’s control. Therefore, Econoler did not consider this project in the analysis. For each of the remaining 14 sites visited, the energy and demand savings were calculated using the wattage information and hours of operation obtained during the visits. The Evaluator also took into account the number of units observed on site. Thus, the installation rate has also been included in the adjustment ratio. Heating and cooling systems were validated as well during the visit to calculate accurate interactive effects where applicable.

As for the HVAC measures, the results of this analysis revealed that the tracked savings of many projects visited had to be adjusted, upward or downward.

In most cases, the number of installed units declared in the worksheet corresponded to the number installed on site. Only in two cases, a few units were kept as spares and this slight adjustment was made to the savings calculations.

In terms of hours of operation, some adjustments were made to the energy savings calculations, but the values used in the equations were often close to what the Evaluator validated on site. In fact, many lighting projects included exterior lighting, which made it easier for participants to estimate hours of operation.

The validation of the wattage values had a bigger impact on the savings revision. On one hand, in some of the cases studied by the Evaluator, participants overestimated the wattage of the old lamps replaced, resulting in higher tracked savings than what it should have been estimated. On the other hand, some participants underestimated the wattage values of their old lamps because they did not

consider the ballast factor. Actually, a detailed examination of the calculation methods for the wattage values showed that the ballast factor of fixtures was generally neglected. As old magnetic ballasts consume more power than new electronic ones, this could have resulted in underestimated wattage values of the old lamps replaced and thus an underestimation of savings.

Another variable that had an impact on the savings review was the replacement of non-eligible old lamps. In fact, one large project saw its savings reduced by 85 percent because most of the lamps replaced were already energy-efficient. In this particular case, the project should have been considered ineligible because LEDs were installed to replace CFLs instead of incandescent lamps. However, since Econoler considers that the project involved an energy efficiency upgrade, the savings were only adjusted to account for the real baseline wattage (14-watt CFLs) instead of 60-watt incandescent lamps. Another project in a similar case used LEDs to replace burned-out identical ones. To mitigate this issue concerning lighting products with an eligibility criterion requiring that the new product replaces a specific type of lamp or a minimum level of wattage, the Evaluator recommends that participants be required to provide a photograph of the lamps and/or fixtures they intend to replace before uninstalling them.

In addition, the projects in which the lamps replaced did not meet the product requirement were those that should have been funded through the BER instant rebate. ENSC explained that such situations arose when customers did not purchase their lighting products at a participating store (e.g. a large business with multiple facilities across Canada which purchased their lighting products in another province). This was not viewed as a major problem by the Evaluator except that it revealed an issue with respecting the requirement stipulating that CFL replacements are not eligible for LED screw-in lamps. The Evaluator also believes that the same problem could have occurred with LED chandelier lamps and LED high bay fixtures. Therefore, Econoler recommends that those products be included in the mail-in rebate portion of the BER program, where ENSC can have tighter control on eligibility criteria by requiring the photographs of the lamps and/or fixtures that the participant intend to replace. This recommendation was also confirmed by some comments received during the in-depth interviews with distributors. They mentioned that eligibility criteria on the products to be replaced were really difficult to validate in stores unless they collected the old lamps replaced, which would require a lot of space, time and organization.

Overall, the analysis of the 14 lighting projects revealed that, of the 336,893 kWh reviewed, 115,783 kWh should be subtracted from the tracked energy savings. This has represented an adjustment ratio of 0.656. However, a statistical analysis of the adjustment ratios calculated for each project in the sample demonstrated that the error margin on the average adjustment ratio was too high (305%) to be applied on all the projects implemented in this category. This huge error was due to the large variations among the adjustment ratios. Even if the sample size had been ten times bigger, the error margin would still have remained very high because of the big variations in the adjustments. Consequently, it was not justifiable to apply this adjustment ratio to all the projects in the lighting category and the savings were therefore only corrected for the sampled projects. As a result, the total energy savings of the lighting category have been slightly lower than those tracked by ENSC by

4.08 percent. Demand savings were also revised. A total of 15.55 kW had to be subtracted from the total demand savings of this category, resulting in a reduction of 1.50 percent.

These large variations among the adjustment ratios calculated for each project raised a question about the methodology used to estimate savings. The fact that savings were based on the real wattage values of the replaced old lamp declared by the participant was certainly a major source of errors. Therefore, Econoler recommends standardizing the savings calculations for lighting products by defining typical baselines to be used for each type of product installed. For instance, based on the type of fixture and the lumen output, a LED PAR lamp of 16 - 25 watts would typically replace an old 75-watt incandescent or halogen PAR lamps⁸. Using such approach for all eligible products would largely simplify the savings calculations. Then, ENSC will only need to monitor market trends and the new regulations introduced to adjust the baseline table when necessary.

4.2.3 Refrigeration Measures

Based on the three on-site visits conducted for this category of measures, Econoler validated the proper installation and the characteristics of the equipment stated in the projects' documentation. It was found that in all three cases the measures had been properly implemented. However, in one case, the equation used did not match the calculation procedure in the *BER Measure Equations Tool*, so the proper equation was used to adjust savings.

Since the sample size was too limited to justify applying these findings to all the refrigeration projects, savings were corrected only for the visited projects. Tracked energy savings of 348,199 kWh were reduced by 3,649 kWh (1%), while demand savings were reduced from 71.37 to 71.21 kW, a decrease of 0.2%. These corrections had an overall impact of -0.19 percent on the energy savings of this category and -0.05 percent on the demand savings side.

4.2.4 Motors and Drives Measures

Seven on-site visits were conducted for motors and drives measures. These visits allowed validating the technical data used by ENSC in the energy and demand savings calculations, namely the efficiency of the new motors installed, the hours of operation and how Variable Speed Drives (VSD) impacted the operation of the system or process.

Generally, for motor measures, adjustments had to be made to revise wrongly identified efficiency data in the worksheet. The nominal efficiencies of the new motors installed were collected during on-site visits and revised in the savings calculations where necessary. The adjustments resulted in higher or lower savings depending on the projects. The Evaluator believes that ensuring that the participant

⁸ Ontario Power Authority (OPA), "2011 Quasi-Prescriptive Measures and Assumptions," Release Version 1, December 2010.

provides the motor specifications sheet (or a picture of the motor nameplate) would help ENSC validate efficiency data at the savings calculation stage. Adjustments to the annual operation hours were also made in a few cases when reliable data were available on-site.

For drive measures, demand and energy savings were calculated using one of the two following approaches. In some cases, energy and demand saving factors determined for specific applications (e.g. supply fan, boiler feedwater pump) were used. These factors were provided in *The BER – Measure Equations Tool* and come from the Efficiency Vermont TRM. For projects that did not correspond to any of the typical applications available, hours of operation for existing components and speed reduction expected for the VSD were used to revise the estimated savings. Most adjustments for VSD savings had to be done to correct a misunderstanding of the impact of the VSD on the process. So it is suggested that for projects that do not correspond to any of the five applications covered in *The BER – Measure Equations Tool*, the PM should contact the participant to validate the reason for which a VSD is installed and include this explanation in the worksheet.

Because the number of visits was insufficient to obtain an appropriate adjustment ratio applicable to all the projects of this category, savings were adjusted for the visited projects only. The tracked energy savings of these specific projects totalled 280,518 kWh and were increased to 307,622 kWh, resulting in an adjustment of 1.097.

Overall, this correction has increased the energy savings of the Motors and Drives category by 3.34 percent. The tracked demand savings of this category have been reduced by 2.87 percent; the analysis revealed that the demand savings estimated by ENSC for the 7 projects visited should be reduced by 3.88 kW.

4.2.5 Compressed Air Measures

For compressed air measures, only one on-site visit was conducted. This visit revealed that the operation hours reported by the participant were much longer than those validated on site, with the information recorded for 9 months on the interface of the compressor. Therefore, the energy savings for this project were reduced by 29,437 kWh, i.e. 32.1 percent of the tracked energy savings. The demand savings remained the same.

Because the sample size was too small to allow drawing generalized conclusions about this category of measure, the reduction was only applied to the sampled project and represented a decrease of 9.83 percent of the overall energy savings.

4.2.6 Agricultural Measures

One on-site visit was conducted in a facility where agricultural measures were implemented. This visit revealed that the energy savings had been underestimated as the default value used by ENSC for the operation hours was lower than the actual usage made by the participant. Accordingly, the energy

savings were increased by 4,204 kWh (33.8 percent) and demand savings remained the same as found in the tracking sheet.

This increase in the overall energy savings of this category of measure is equivalent to an adjustment of 1.037.

4.2.7 Commercial Kitchen Measures

For commercial kitchen measures, only one on-site visit was conducted. This visit revealed that the operation hours and the number of racks washed per day entered in the worksheet differed from what was observed on site. The hours of operation were revised upward, while the number of racks washed per day was reduced by 50 percent. These changes resulted in a reduction of 10.7 kWh in the energy savings tracked for this project, which represents decrease of 21.8 percent. In terms of demand savings, these changes resulted in an increase of 0.29 W.

Overall, the total energy savings for this category were reduced by only 0.02 percent and demand savings increased by 0.36 percent.

4.2.8 Commercial Laundry Measures

No commercial laundry projects were implemented under the mail-in rebate approach in 2012. However, the methodology used to calculate energy and demand savings for these measures was reviewed during this evaluation. It has been found that this methodology comes from a reliable source, namely the CEE, and that the assumptions made are reasonable.

4.2.9 Diversity Factor

Based on the information received from ENSC, the peak period for electricity demand in Nova Scotia occurs in December, January and February between 7 a.m. and 12 p.m. as well as between 4 p.m. and 11 p.m. on a weekday that is not a holiday⁹. As with the 2011 evaluation, Econoler elected to use the 5 p.m. to 7 p.m. timeframe as the peak load period for this year's evaluation.

In order to evaluate the peak demand for demand savings, hours of operation were investigated for all the sites visited during on-site visits. For each category of measure, the percentage of total demand savings occurring during the peak demand period was established. These percentages were used to determine the specific diversity factor associated with each category. However, Econoler used a different approach for the commercial kitchen category. A diversity factor of 0 was measured for the only site visited in this category, but Econoler considers that this site did not represent the current practice in the majority of facilities participating in the commercial kitchen category, i.e. restaurants.

⁹ Nova Scotia Power, Domestic Service Time-Of-Day Tariff, [www.nspower.ca](http://www.nspower.ca/en/home/aboutnspi/ratesandregulations/electricityrates/domesticservicetimeofdaytarrifoptional.aspx).
<http://www.nspower.ca/en/home/aboutnspi/ratesandregulations/electricityrates/domesticservicetimeofdaytarrifoptional.aspx>.

Therefore, for this category, Econoler has decided to use the weighted average of all the diversity factors obtained for all the categories of product.

The diversity factors obtained for each category are presented in Table 21.

Table 21: Diversity Factors for Mail-In Rebate

Category of Measure	2012 Diversity Factor
HVAC	100%
Lighting	97%
Refrigeration	100%
Motors and Drives	93%
Compressed Air	65%
Agricultural Equipment	85%
Commercial Kitchen Equipment	97%*
*Corresponds to the weighted average of all diversity factors calculated for each project visited.	

4.2.10 Revised Gross Savings

Energy and demand savings for the program were revised to include the adjustments presented in the sections above. Using the diversity factors calculated for each category, the peak demand was established.

Savings at the generator level were calculated using a line loss factor of 1.076 between the meter and the generator. This value was calculated using the weighted average of the line loss factor values for all the participants (obtained with their rate code in the 2012 BER Mail-In Rebate tracking sheet) and the energy savings generated by the projects they implemented. The line loss factors were provided by Nova Scotia Power for every rate code.

The savings obtained for each category of measure are presented in Table 22.

The total gross energy savings for the BER program have been estimated at 8.817 GWh at the meter and at 9.487 GWh at the generator. The total gross demand savings have been estimated at 2.915 MW at the meter and at 3.137 MW at the generator.

Table 22: Evaluation Results – Revised Gross Savings – Mail-In Rebate

Category of Measure	HVAC	Lighting	Refrigeration	Motors and Drives	Compressed Air	Agricultural	Kitchen	Laundry	Total
Program Tracking Sheet									
Tracked Energy Savings (GWh)	3.388	2.836	1.883	0.811	0.300	0.113	0.069	0	9.400
Tracked Demand Savings (MW)	1.283	1.036	0.326	0.135	0.052	0.038	0.082	0	2.953
Evaluated Energy Savings									
Adjustment ratio on energy savings	0.863	0.959	0.998	1.033	0.902	1.037	1.000	-	0.938
Total Gross Energy Savings – at Meter (GWh)	2.923	2.720	1.880	0.838	0.270	0.117	0.069	-	8.817
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-	-
Total Gross Energy Savings – at Generator (GWh)	3.145	2.927	2.022	0.902	0.291	0.126	0.074	-	9.487
Evaluated Demand Savings									
Adjustment ratio on Demand Savings	1.037	0.985	1.000	0.971	1.000	1.000	1.004	-	1.010
Total Gross Demand Savings – at Meter (MW)	1.331	1.020	0.326	0.131	0.052	0.038	0.082	-	2.981
Diversity Factor	100%	97%	100%	93%	65%	85%	97%	-	-
Total Gross Peak Demand Savings – at Meter (MW)	1.331	0.990	0.326	0.122	0.034	0.032	0.080	-	2.915
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-	-
Total Gross Demand Savings – at Generator (MW)	1.432	1.098	0.351	0.141	0.056	0.041	0.089	-	3.208
Total Gross Peak Demand Savings – at Generator (MW)	1.432	1.065	0.351	0.132	0.037	0.035	0.086	-	3.137

4.3 INTERACTIVE EFFECTS

Interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as heating and cooling systems. For instance, replacement of old lighting products with new efficient lighting products inside a heated and/or cooled space causes an increase in the heating load during winter and a decrease in the cooling load during summer.

For the mail-in rebate approach, interactive effects factors were already applied to gross savings generated by lighting measures on a per project basis. These factors come from the Efficiency Vermont TRM and have taken into account whether the products were installed in a heated or cooled space as well as the source of energy used for heating. The Evaluator reviewed these factors and has considered them to be appropriate. In fact, the interactive effects factors from Efficiency Vermont are very similar to those usually used by Econoler, which come from a study conducted for Hydro-Québec¹⁰ based on different building simulations. For the other measures, no interactive effects factors were applied.

4.4 NET-TO-GROSS RATIO

The NTGR evaluation for the mail-in rebate is based on a self-report approach which relies on a series of questions designed to measure the influence of the program on participants' decision to implement program-eligible energy efficiency measures. These questions were included in the participant survey.

This section presents the methodology used to transform responses to NTGR survey questions into an NTGR. For the program, the NTGR includes the assessment of free-ridership. Once this effect has been quantified, the NTGR is calculated based on the following equation:

$$NTGR = (1 - \% \text{ free-ridership}).$$

4.4.1 Free-Ridership

For the mail-in rebate approach, free-ridership can occur when participants declare they would still have implemented the energy efficiency measures in the absence of the program.

¹⁰ ADS ASSOCIÉS, "Évaluations des effets énergétiques combinés des mesures d'économies d'énergie – secteur commercial," report presented to Hydro-Québec, 1992.

The telephone survey included various free-ridership questions that attempted to measure the following variables:

- > the probability that the participant would have installed the same energy-efficient equipment in the absence of the program;
- > the probability that the participant would have installed standard equipment instead of energy-efficient equipment in the absence of the program;
- > if the participant had decided to implement the energy efficiency measures before participating in the program;
- > the probability that the participant would have paid for the full cost of the energy-efficient measures in the absence of the program;
- > the level of influence of various factors on the customer's decision to participate in the program; and
- > the temporal sequence of the program and the participant's decision.

Each group of questions is transposed into a level of program attribution used to calculate the global free-ridership level for each participant.

Since 2011, ENSC has included three pre-screening questions in the mail-in rebate application form to prevent free-ridership. These three questions are yes-or-no questions. A participant who declares being a free-rider as shown by their responses to the three questions and whose project involves an incentive of more than \$2,000 is not eligible to the program. For the other participants, their answers to the pre-screening questions were taken into account in conjunction with telephone survey answers.

The algorithm behind the free-ridership calculation, including the relation with the three pre-screening questions, is presented in Appendix VI.

Using this approach, survey and pre-screening question results revealed a free-ridership level of 18 percent. Using a similar approach, the 2011 evaluation presented a 17.6 percent free-ridership level, which demonstrates that the free-ridership level remained stable since the previous evaluation even though the proportions of projects among the different categories of measure changed. In 2011, lighting measures generated the highest savings followed by refrigeration systems. This year, lighting measures again brought important savings to the program, but it was the HVAC systems that contributed the biggest savings. However, the fact that the mail-in rebate approach remained similar to 2011 edition could explain the stability in the free-ridership level.

4.4.2 NTGR Calculation

Using the free-ridership level established, the NTGR value for the mail-in rebate approach has been estimated at 0.82. This value was applied to the gross savings calculation.

4.5 NET SAVINGS

The net savings for the mail-in rebate approach were estimated using the NTGR. Since interactive effects were already included in the gross savings calculations of the lighting projects, no other factor had to be applied. The following equation was used to calculate the program net savings.

$$\text{Net Savings} = \text{Revised Gross Savings} \times \text{NTGR}$$

This equation was used for both demand and energy savings. The results obtained for each category of measure are presented in Table 23. For 2012, the total net energy and demand savings have amounted to 7.230 GWh and 2.390 MW at the meter, and 7.779 GWh and 2.572 MW at the generator.

Table 23: Evaluation Results – Revised Net Savings – Mail-In Rebate

Category of Measure	HVAC	Lighting	Refrigeration	Motors and Drives	Compressed Air	Agricultural	Kitchen	Laundry	Total
Energy Savings									
Total Gross Energy Savings – at Meter (GWh)	2.923	2.720	1.880	0.838	0.270	0.117	0.069	-	8.817
NTGR	0.82	0.82	0.82	0.82	0.82	0.82	0.82	-	0.82
Total Net Energy Savings – at Meter (GWh)	2.397	2.231	1.541	0.687	0.222	0.096	0.057	-	7.230
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-	-
Total Net Energy Savings – at Generator (GWh)	2.579	2.400	1.658	0.740	0.238	0.103	0.061	-	7.779
Demand Savings									
Total Gross Peak Demand Savings – at Meter (MW)	1.331	0.990	0.326	0.122	0.034	0.032	0.080	-	2.915
NTGR	0.82	0.82	0.82	0.82	0.82	0.82	0.82	-	0.82
Total Net Peak Demand Savings – at Meter (MW)	1.091	0.812	0.267	0.100	0.028	0.027	0.066	-	2.390
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-	-
Total Net Peak Demand Savings – at Generator (MW)	1.174	0.873	0.287	0.108	0.030	0.029	0.071	-	2.572

The table below presents comparisons between the energy and demand savings established by this evaluation for the mail-in rebate approach and those calculated in the 2012 tracking sheet.

Table 24: Comparison of Tracked and Evaluated Savings at the Generator for Mail-In Rebate

	Initial Gross Savings	Adjusted Gross Savings	Adjusted Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	10.114 GWh	10.114 GWh	10.114 GWh	0.83	8.395 GWh
Evaluation Results	10.114 GWh	9.487 GWh	9.487 GWh	0.82	7.779 GWh
Demand Savings					
Tracked Savings from ENSC	3.179 MW	3.179 MW	3.179 MW	0.83	2.638 MW
Evaluation Results	3.179 MW	3.137 MW	3.137 MW	0.82	2.572 MW

The energy and demand savings fell short of those tracked by ENSC by 7 percent and 3 percent, respectively. This result could be explained by the following factors:

- > Revision of the savings calculations: Energy and demand savings calculated for 50 projects were reviewed based on the data collected during on-site visits and the validation of the savings calculations. For all the projects in the HVAC category, an adjustment ratio of 0.863 was applied on energy savings and that of 1.037 on demand savings. For the other categories of measures, adjustments were only applied on the savings calculated for the visited projects.
- > Diversity factor: Diversity factors were not taken into account in the tracking sheet. Econoler used the data collected during on-site visits to establish the percentage of total demand savings occurring during the peak demand period. The addition of diversity factors in the demand savings calculations resulted in a small decrease of the tracked demand savings calculated by ENSC.
- > NTGR: Based on the 2011 evaluation, ENSC used an NTGR of 0.83 to calculate the tracked net savings. For 2012, a new free-ridership level of 18 percent was measured through the participant survey, resulting in an NTGR of 0.82. Even though statistically this result indicates that the free-ridership level remained stable since the last evaluation, it had a slight effect on the net savings calculated for the program.

These revisions to the tracked savings allowed for a more precise estimation of energy and demand savings. Despite these adjustments, the mail-in rebate approach has been shown to continue contributing important savings.

5 IMPACT EVALUATION FOR INSTANT REBATE

5.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation for instant rebate is aimed at determining the gross and net savings of this component of BER for 2012. Both energy and demand savings were considered in this evaluation. To do so, the following parameters were analyzed by Econoler:

- > savings calculation methodology for each type of product;
- > diversity factor;
- > interactive effects; and
- > free-ridership.

The impact evaluation of the instant rebate was based on a review of the monthly reporting sheets and 10 distributor interviews.

The monthly reporting sheets contain the quantity of products sold for each product code provided by each distributor. Energy and demand savings are automatically computed in the monthly reporting sheets using the product codes, which are all associated with a unitary savings value. These unitary savings values were reviewed during this evaluation.

The interviews with distributors provided information to calculate the NTGR for this program based solely on free-ridership. The NTGR established was used to calculate the program net savings.

5.2 GROSS SAVINGS

Gross savings for the instant rebate approach were reviewed by the Evaluator based on the total number of products sold and their associated savings.

The different categories of products eligible for an instant rebate were defined as followed:

- > High-performance T8 (HP-T8) and reduced-wattage T8 (RW-T8) lamps;
- > High-performance ballasts;
- > occupancy sensors for lighting and HVAC applications;
- > electric motors for refrigeration applications;
- > T5 and T8 high bay fixtures;
- > LED technologies;
- > induction technologies; and
- > Integrated dual enthalpy economizer controls¹¹.

¹¹ Since no integrated dual enthalpy economizer control was sold under the instant rebate approach in 2012, no review of unitary savings values was conducted for this product.

For each category of product, unitary savings values were estimated by the PM to calculate the program gross savings in the tracking sheet. Econoler reviewed the parameters used to establish these unitary savings values.

Products eligible for the BER instant rebate approach were also eligible for incentives through BES and Custom Retrofit. To avoid double counting, the instant rebate savings calculations took into account the portion of products rebated through the instant rebate approach and one of these two programs. To do so, the PM collected information from distributors on products rebated through BES and Custom Retrofit. This information indicated that 80 percent of the HP-T8 lamp, RW-T8 lamp and high performance ballast products purchased through BES and Custom Retrofit were products rebated through the instant rebate approach. Hence, the total number of products considered for savings calculations under the instant rebate component took into account these deductions. The PM used the value of 80 percent to calculate the total numbers of T8 lamps and HP ballasts that had to be deducted and divided this number equally among the sub categories of T8 lamps and HP ballasts. However, this approach did not take into consideration the actual proportion of products in each sub-category. In fact, an analysis of the sales of T8 lamps and HP ballasts through Instant Rebate in 2012 demonstrated that a more realistic distribution of these products would be:

- > 63 percent of HP-T8-32 W versus 37 percent of RW-T8-28 W;
- > for HP ballasts, 62 percent of the sales were in 2-lamp ballasts, followed by 4-lamps ballasts with 27 percent of the sales, 9 percent for 3-lamp ballasts and 2 percent for 1-lamp ballasts .

For this evaluation, Econoler elected to use these percentages to calculate the proportions of the deduction of T8 lamps and HP ballasts in each sub-category of product.

For higher value rebates such as LED wall packs, BER instant rebates are excluded from BES and Custom Retrofit. Within BES, delivery agents (DAs) are not offered BER instant rebates for their purchases. This is stipulated contractually and has been formally communicated to all the DAs, as well as the distributors. For Custom Retrofit, this exclusion is enforced by the Custom team. They ensure that quotes exclude all instant rebates before providing a Custom incentive estimate or signing a project development agreement. Consequently, prior to initiating the implementation incentive, the Custom team reviews distributor quotes and makes the necessary deductions from savings and incentives, wherever applicable.

5.2.1 T8 Lamps (HP-T8 and RW-T8)

Tracked Savings

The displaced wattage of HP-T8 and RW-T8 lamps has been established by ENSC using a 34-watt T12 lamp as the baseline and the real wattage value of the T8 lamps purchased. For the hours of operation, ENSC uses a value of 3,400 hours per year, corresponding to the weighted average of the hours of operation used for BES and Custom Retrofit in 2010.

Table 25: Tracked Unitary Savings for T8 Lamps

Type of T8 Lamps	Displaced Wattage	Hours of operation	Unitary Savings
HP-T8-32 W	34 W – 32 W = 2 W	3,400 h/year	6.8 kWh
RW-T8-28 W	34 W – 28 W = 6 W		20.4 kWh
RW-T8-25 W	34 W – 25 W = 9 W		30.6 kWh

Revised Savings

Econoler reviewed these two key parameters used in the unitary savings calculation for T8 lamps.

For the displaced wattage values, Econoler considered the approach appropriate. Therefore, the respective displaced wattages for all lamps have remained unchanged for this evaluation.

The hours of operation were reviewed according to the results of the metering activity conducted under BES. A total of 260 loggers were installed in 46 participating facilities in the commercial sector. The hours of operation of 1,914 lamps, including a large proportion of T8 lamps, were metered for two weeks. The data were used to estimate the average annual usage of each lamp. Overall, the annual usage of the 1,914 lamps metered during the study amounted to 3,399.4 hours per year, which matches the value of 3,400 hours per year used by ENSC for HP-T8 and RW-T8 lamps. Therefore, Econoler decided that this value was appropriate and should be kept in the energy savings calculations.

5.2.2 High Performance Ballasts

Tracked Savings

For high-performance ballasts, the unitary savings values used in the tracking sheet were based on the 2011 SLC evaluation results. These unitary savings values were established based on the different ballast displaced wattage values and the proportion of each new ballast and lamp systems sold in 2011.

The displaced ballast wattage values were obtained by calculating the difference between the wattage of a magnetic ballast with 34-watt T12 lamps and the wattage of a high-performance ballast for different types of T8 lamps, excluding the savings associated with the lamp replacement. The following equation summarizes this calculation:

$$\begin{aligned}
 &\text{Unitary Ballast Wattage Savings (W)} = \\
 &(\text{Baseline ballast and lamp W} - \text{New ballast and lamp W}) - \\
 &(\text{Unitary W Savings for the Lamp} \times \text{Number of lamps per ballast})
 \end{aligned}$$

Table 26 details the unitary savings values calculated for each type of ballast (1-lamp, 2-lamp, 3-lamp and 4-lamp ballasts).

Table 26: Displaced Wattages for Each Type of Ballast Used in the Tracking Sheet

New Ballast and Lamp Systems	Baseline Wattage	New Wattage	Lamp ΔW	Ballast ΔW	Proportion of T8 Lamps*	Average Ballast ΔW
1-lamp ballast with HP-T8-32 W lamp	43.0	27.0	2.0	14.0	52.05%	13.52
1-lamp ballast with RW-T8-28 W lamp	43.0	24.0	6.0	13.0	47.54%	
1-lamp ballast with RW-T8-25 W lamp	43.0	21.0	9.0	13.0	0.41%	
2-lamp ballasts with HP-T8-32 W lamps	72.0	54.0	4.0	14.0	52.05%	13.52
2-lamp ballasts with RW-T8-28 W lamps	72.0	47.0	12.0	13.0	47.54%	
2-lamp ballasts with RW-T8-25 W lamps	72.0	42.0	18.0	12.0	0.41%	
3-lamp ballasts with HP-T8-32 W lamps	112.0	80.0	6.0	26.0	52.05%	24.56
3-lamp ballasts with RW-T8-28 W lamps	112.0	71.0	18.0	23.0	47.54%	
3-lamp ballasts with RW-T8-25 W lamps	112.0	63.0	27.0	22.0	0.41%	
4-lamp ballasts with HP-T8-32 W lamps	144.0	107.0	8.0	29.0	52.05%	27.55
4-lamp ballasts with RW-T8-28 W lamps	144.0	94.0	24.0	26.0	47.54%	
4-lamp ballasts with RW-T8-25 W lamps	144.0	84.0	36.0	24.0	0.41%	
*These percentages correspond to the proportion of each type of T8 lamp sold through the SLC program in 2011 (source: 2011 SLC evaluation report).						

By analyzing these calculations, the ballast factors used for the baseline and the new systems could be determined. For old magnetic ballasts, ballast factors ranging from 1.26 to 1.06 were used depending on the number of lamps, while a value of 0.84 was used for new high-performance ballasts.

Using these displaced wattages and hours of operation of 3,400 hours per year, the unitary savings values for each type of ballast were established.

Table 27: Tracked Unitary Savings Values for High-Performance Ballasts

Type of Ballast	Demand Savings (W)	Hours of Operation (h/year)	Energy Savings (kWh/year)
1-lamp ballast	13.52	3,400	45.968
2-lamp ballast	13.52	3,400	45.968
3-lamp ballast	24.56	3,400	83.504
4-lamp ballast	27.55	3,400	93.670

Revised Savings

For this year's evaluation, Econoler revised these unitary savings values according to the proportion of each type of T8 lamp sold in 2012 through the BER Instant Rebate approach and the hours of operation used for T8 lamps.

Table 28: Revised Displaced Wattages for Each Type of Ballast

New Ballast and Lamp Systems	Baseline Wattage	New Wattage	Lamp ΔW	Ballast ΔW	Proportion of T8 Lamps*	Average Ballast ΔW
1-lamp ballast with HP-T8-32 W lamp	43.0	27.0	2.0	14.0	39.7%	13.40
1-lamp ballast with RW-T8-28 W lamp	43.0	24.0	6.0	13.0	57.0%	
1-lamp ballast with RW-T8-25 W lamp	43.0	21.0	9.0	13.0	3.3%	
2-lamp ballasts with HP-T8-32 W lamps	72.0	54.0	4.0	14.0	39.7%	13.36
2-lamp ballasts with RW-T8-28 W lamps	72.0	47.0	12.0	13.0	57.0%	
2-lamp ballasts with RW-T8-25 W lamps	72.0	42.0	18.0	12.0	3.3%	

New Ballast and Lamp Systems	Baseline Wattage	New Wattage	Lamp ΔW	Ballast ΔW	Proportion of T8 Lamps*	Average Ballast ΔW
3-lamp ballasts with HP-T8-32 W lamps	112.0	80.0	6.0	26.0	39.7%	24.16
3-lamp ballasts with RW-T8-28 W lamps	112.0	71.0	18.0	23.0	57.0%	
3-lamp ballasts with RW-T8-25 W lamps	112.0	63.0	27.0	22.0	3.3%	
4-lamp ballasts with HP-T8-32 W lamps	144.0	107.0	8.0	29.0	39.7%	27.13
4-lamp ballasts with RW-T8-28 W lamps	144.0	94.0	24.0	26.0	57.0%	
4-lamp ballasts with RW-T8-25 W lamps	144.0	84.0	36.0	24.0	3.3%	

As for T8 lamps, Econoler kept the value of 3,400 hours per year used for calculating energy savings of high-performance ballasts. Using the displaced wattages presented in the table above and these annual hours of operation, Econoler revised the unitary savings values for each type of ballast.

Table 29: Revised Unitary Savings Values for High-Performance Ballasts

Type of Ballast	Demand Savings (W)	Hours of operation (h/year)	Energy Savings (kWh/year)
1-lamp ballast	13.40	3,400	45.56
2-lamp ballast	13.36	3,400	45.42
3-lamp ballast	24.16	3,400	82.14
4-lamp ballast	27.13	3,400	92.24

5.2.3 Occupancy Sensors for Lighting Applications

Tracked Savings

Occupancy sensors were incorporated into the Upstream BER component at the end of 2011. The unitary savings values used to estimate the energy and demand savings from this product category have been fixed at 172 kWh and 49.0 W, based on an analysis of occupancy sensors for commercial lighting systems¹² for the IES.

Revised Savings

Econoler reviewed the parameters used in the unitary savings of the IES. The IES provides different occupancy factors depending on the zone controlled by the occupancy sensor:

Table 30: Occupancy Factor Provided by the IES

Zone	Occupancy Factor
Break Room	0.16
Class Room	0.42
Private Office	0.28
Washroom	0.34
Laundry Room	0.34
Warehouse	0.55
Conference Room	0.38
Average	0.35

ENSC has used an occupancy factor of 0.33 to estimate the savings in the tracking sheet. This value is just below the average value calculated for all the typical zones. Since no detailed information was available about the different zones controlled by the occupancy sensors purchased through the BER instant rebate, Econoler has considered the average value of 0.33 used by ENSC to be conservative and therefore appropriate.

As for the hours of operation (before the installation of the occupancy sensor), ENSC has used a value of 3,500 hours per year. To be consistent with the other lighting products, Econoler has considered it to be more appropriate to use hours of operation of 3,400 hours per year.

Therefore, the unitary energy and demand savings values have been revised to 167 kWh and 47.6 W respectively.

¹² VonNeida et al., 2000, IES Paper #43.

5.2.4 Occupancy Sensors for HVAC Applications

Tracked Savings

Occupancy sensors for HVAC applications rebated through the program are specifically designed to control the HVAC of hotel rooms. For this specific product category, ENSC uses unitary savings values of 438 kWh for energy savings and 90 W for demand savings. These two values come from the Massachusetts TRM¹³.

Revised Savings

Econoler reviewed the parameters used in the Massachusetts TRM for estimating the energy savings values of an occupancy sensor used to control hotel rooms HVAC equipment. The baseline considered in the assumptions is a HVAC system without occupancy-based control. The high-efficiency case corresponds to the installation of controls that include:

- > occupancy sensors;
- > window/door switches for rooms that have operable window or patio doors; and
- > set back to 65 °F in the heating mode and set forward to 78 °F in the cooling mode when the occupancy detector is in the unoccupied mode.

Sensors controlled by a front desk system were not taken into account in the calculation.

The energy and demand savings estimated with these assumptions are based on an energy analysis conducted in 2010 by National Grid and NSTAR. Therefore, Econoler considers the energy and demand savings used in the tracking sheet to be appropriate and reliable since they were based on a study conducted by a credible organization. Both the States of Massachusetts and the Rhode Island¹⁴ use these savings values. Therefore, no adjustment was applied to these values.

5.2.5 Electric Motors for Refrigeration Applications

Tracked Savings

Electric motors for refrigeration applications are eligible for an instant rebate. In 2012, only electronically commutated (EC) motors for walk-in cooler evaporator fans (with a minimum nameplate power of 1/20 hp) were rebated through the instant rebate. To estimate the savings of these products, ENSC uses the nameplate power of the evaporator fan, a load reduction factor of 0.65 and hours of

¹³ Mass Save, Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures, 2012 Program Year – Plan Version, October 2011, pages 196-197.

¹⁴ National Grid, Rhode Island Technical Reference Manual for Estimating Savings from Energy Efficiency Measures, 2012 Program Year, November 2011.

operation totalling 8,760 hours per year. This calculation is based on the Massachusetts TRM¹⁵ and resulted in a unitary savings value of 233.454 kWh and demand savings of 26.65 W.

Revised Savings

After reviewing the engineering calculations used to estimate these unitary savings values based on the data found in the literature, Econoler concluded that the values used by ENSC should be revised. The value calculated by ENSC did not take into account either the motor efficiency or the energy savings gained from reduced heat on the evaporator fans. Therefore, Econoler looked for other references with specific findings on savings made through the installation of high efficiency motors for walk-in cooler evaporator fans. The Pennsylvania Public Utility Commission technical reference manual¹⁶ provided the most detailed information on this particular measure.

According to this document, the equation that should be used to estimate the savings from EC motors is as follows:

$$\text{Unitary Savings} = (kW_{Base} - kW_{EE}) \times L.F. \times DC \times (1 + \frac{1}{(DG \times COP)}) \times Hr$$

After examining the characteristics of the products sold through the program and used by ENSC in the tracked savings calculations, Econoler assumed that the nameplate power of the motor corresponded to 1/20 hp. The efficiency of the old motor was estimated at 26 percent (shaded-pole motor) while the efficiency for an EC motor was estimated at 66 percent.

The input assumptions to be used in the unitary savings calculation are presented in the table below.

Table 31: Input Assumptions Used for EC Motors for Walk-In Cooler Evaporator Fans

Parameter	Value
Standard Motor Power (1/20 hp * 0.746 kW/hp / 26%)	0.142 kW
EC Motor Power (1/20 hp * 0.746 kW/hp / 66%)	0.056 kW
Load Factor (L.F.)	0.9
Duty cycle of evaporator fan motor for cooler (DC)	100%
Degradation factor of compressor COP (DG)	0.98
Coefficient of performance of compressor in the cooler (COP)	2.5
Operating hours per year (Hr)	8,273

¹⁵ Mass Save, Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures, 2012 Program Year – Plan Version, October 2011, pages 196-197.

¹⁶ Pennsylvania Public Utility Commission, "Technical Reference Manual," Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards, June 2011.

Using these parameters, the unitary savings value for EC motors for walk-in cooler evaporator fans has been revised to 902 kWh and demand savings to 109 W. Econoler used these values for the impact evaluation.

5.2.6 T5 and T8 High Bay Fixtures

Tracked Savings

T5 and T8 high bay fixtures were incorporated into the Upstream BER component at the end of 2011. In 2012, the energy and demand savings calculated for these products were based on the differences between the real wattages of the new fixtures installed and typical baseline wattage, as well as on hours of operation of 3,400 hours per year.

Revised Savings

For this year's evaluation, Econoler reviewed the parameters used in the savings calculations based on what was found in the literature and the hours of operation revised for T8 lamps.

For the old system baseline wattage, ENSC uses the whole system wattage, which includes the ballast factor, while for the new fixture installed, ENSC generally uses the wattage of the lamp only since most product specifications sheets do not list the wattage values of the whole high-bay fixtures rebated through the program. In the case of high bay fixtures, the ballast factor is, in most cases, above 1. The fact that ENSC only uses the wattage of the lamp for new fixture in some savings calculations may suggest that the savings have been overestimated. However, Econoler's analysis of the whole system wattage used as the baseline has also revealed that the values used by ENSC is often below what is used by other jurisdictions, which would result in lower savings. For instance, for a 54W – 4 lamps T5 high bay fixture, ENSC uses a displaced wattage of 59 watts, while other jurisdictions, like the Ontario Power Authority, use a displaced wattage as high as 71 watts.

Table 32: Displaced Wattage Calculated for a Typical 54W – 4 Lamps T5 High Bay Fixture

	Baseline (Metal Halide Fixture)		New Fixture (T5 high bay fixture)		Displaced Wattage
	Lamp Wattage	Ballast Wattage	Lamp Wattage	Ballast Wattage	
From ENSC's tracking sheet	250 W	25 W	4*54W = 216 W	-	59
From OPA Report ¹⁷	250 W	45 W	4*54W = 216 W	8 W	71

¹⁷ Ontario Power Authority (OPA), "2011 Quasi-Prescriptive Measures and Assumptions," Release Version 1, December 2010.

The findings presented in the table above demonstrate that, although ENSC does not always include the wattage of the whole high bay fixture installed, the savings used in the tracking sheet remain conservative because of the relatively low ballast wattage values used for the baseline.

However, for this year's evaluation, no adjustment was made since specific savings values were calculated for each model of high bay fixtures sold through the program. Also, these savings values were calculated in one cell, which prevented any correction or calculation of an adjustment factor. Therefore, since the savings calculations of ENSC have been conservative, Econoler has decided to keep the savings values for T5 and T8 high bay fixtures as they were in the tracking sheet.

To allow for a more precise estimate of savings in the future, Econoler recommends comparing the baseline wattage values currently used to those used by other jurisdictions like the OPA and adjusting their values accordingly. For the wattage values of the new high bay fixtures, Econoler recommends using typical ballast factor values instead of the information on each product's specifications sheet, which is often unavailable.

5.2.7 LED Technologies

Tracked Savings

LED technologies have been eligible for an instant rebate since the end of 2011. Until then, only LED downlights and outdoor wall packs were offered through the program. In 2012, more LED technologies were added to the program such as LED garage lighting, LED high bay fixtures and LED strip lighting.

For each LED product category, ENSC calculates savings based on the difference between the new wattage of the product installed and a baseline wattage set according to the type of application and an equivalent light output level.

The hours of operation vary depending on the technologies and their typical application. For instance, 5,720 hours of operation per year are considered for LED strip lighting and 4,000 hours per year for LED outdoor wall packs and garage lighting. Otherwise, 3,500 hours of operation per year are used in the energy savings calculations.

Revised Savings

For this year's evaluation, Econoler reviewed the methodology used to calculate the energy and demand savings of all the LED technologies sold through the program.

As for the T5 and T8 high bay fixtures, Econoler has considered the approach used to calculate the displaced wattage between the old and new fixtures to be conservative, but the wattage values, particularly the ones used for the baseline, should be revised in 2013.

For the hours of operation, Econoler proposes the following adjustments:

- > For LED indoor fixtures, adjusting the hours of operation from 3,500 hours per day to the value obtained in the metering study, i.e. 3,400 hours per year. This would result in an overall adjustment of 0.971 on the energy savings calculations.
- > For LED outdoor wall packs and garage lighting, increasing the hours of operation currently estimated at 4,000 hours per year to 4,380 hours per year, based on the fact that outdoor lighting is typically turned on when it gets dark and that the average time of illumination in Halifax is 12 hours per day¹⁸. Therefore, Econoler considers it more accurate to use annual operating hours based on a daily usage of 12 hours per day. This revision would result in an upward adjustment of 1.095 for the energy savings calculations.

5.2.8 Induction Technologies

Tracked Savings

Induction technologies, more specifically induction wall packs and induction high bay fixtures, were newly added to the instant rebate approach in 2012. As with LED technologies, ENSC calculates savings for each induction lighting product category based on its real wattage and a baseline wattage set according to the type of application and an equivalent light output level. For induction wall packs, hours of operation are estimated at 4,000 hours per year. For induction high bay fixtures, ENSC uses hours of operation of 3,500 hours per year.

Revised Savings

Econoler reviewed the parameters used in the savings estimates used in ENSC's tracking sheet. As with the T5 and T8 high bay fixtures and LED technologies, Econoler believes that the approach used to calculate the displaced wattage between the old and new fixtures is conservative, but the wattage values, particularly the ones used for the baseline, should be revised in 2013.

For the hours of operation, Econoler proposes similar adjustments:

- > For induction high bay fixtures, adjusting the hours of operation from 3,500 hours per day to the value obtained in the metering study, i.e. 3,400 hours per year. This would result in an overall adjustment of 0.971.
- > For induction wall packs, increasing the hours of operation from 4,000 hours per year to 4,380 hours per year. This would result in an adjustment of 1.095.

¹⁸ National Research Council Canada, Sunrise/Sunset Calculator, Standard times of solar rise/set for Halifax NS 2012, Date modified: 2012-08-07, www.nrc-cnrc.gc.ca.

5.2.9 Diversity Factor

The diversity factors obtained for the different measure categories of the mail-in rebate approach were also used for instant rebates. No on-site visit was conducted this year for the instant rebate approach. Therefore, it was not possible to investigate demand savings that coincide with the NSPI system peak for the specific products sold through this approach. But since the products promoted by both mail-in and instant rebate approaches are used for the same types of application, the Evaluator decided to use the diversity factors established upon the 50 on-site visits conducted at participants' facilities which applied for a mail-in approach.

Table 33: Diversity Factors for Instant Rebate

Category of Measure	2012 Diversity Factor
HVAC	100%
Lighting	97%
Motors and Drives	93%

5.2.10 Revised Gross Savings

Energy and demand savings for the instant rebate approach were calculated using the unitary savings values revised under this evaluation. Savings at the generator level were also calculated using a line loss factor of 1.076 between the meter and the generator. This value corresponds to the line loss factor used for the mail-in rebate approach.

The total savings obtained for each product are presented in Table 34. For the instant rebate approach, gross energy savings have amounted to 16.551 GWh at the meter and 17.808 GWh at the generator. The total gross demand savings have been estimated at 4.438 MW at the meter and at 4.775 MW at the generator.

Table 34: Evaluation Results – Gross Energy and Demand Savings for Products with Unitary Savings Values – Instant Rebate

Product Category	HP-T8-32W	RW-T8-28W	RW-T8-25W	1-Lamp HP Ballasts*	2-Lamp HP Ballasts	3-Lamp HP Ballasts*	4-Lamp HP Ballasts	Lighting Occ. Sensors	HVAC Occ. Sensors	Motors
Tracking Sheet										
Number of Units	40,145	144,198	6,293	713	24,192	3,756	10,399	7,340	98	449
Evaluated Energy Savings										
Unitary Savings (kWh)	6.8	20.4	30.6	45.56	45.42	82.14	92.24	167	438	902
Total Gross Energy Savings – at Meter (GWh)	0.273	2.94	0.193	0.032	1.099	0.309	0.959	1.226	0.043	0.405
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076
Total Gross Energy Savings – at Generator (GWh)	0.294	3.165	0.207	0.035	1.182	0.332	1.032	1.319	0.046	0.436
Evaluated Demand Savings										
Unitary Savings (W)	2.0	6.0	9.0	13.40	13.36	24.16	27.13	47.7	90	109.00
Total Gross Demand Savings – at Meter (MW)	0.080	0.865	0.057	0.010	0.323	0.091	0.282	0.350	0.009	0.049
Diversity Factor	97%	97%	97%	97%	97%	97%	97%	97%	100%	93%
Total Gross Peak Demand Savings – at Meter (MW)	0.078	0.839	0.055	0.009	0.314	0.088	0.274	0.340	0.009	0.046
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076
Total Gross Demand Savings – at Generator (MW)	0.086	0.931	0.061	0.010	0.348	0.098	0.304	0.377	0.009	0.053
Total Gross Peak Demand Savings – at Generator (MW)	0.084	0.903	0.059	0.010	0.337	0.095	0.294	0.365	0.009	0.049

*BES and Custom Retrofit deductions were distributed among the sub-categories based on the proportions of sales of T8 lamps (HP-T8-32 W and RW-T8-28 W) and HP ballasts (1-lamp, 2-lamp, 3-lamp and 4-lamp) through Instant Rebate in 2012.

Table 35: Evaluation Results – Gross Energy and Demand Savings for All Other Products – Instant Rebate

Product Category	T5 and T8 High Bay	LED Lighting Systems	LED Wall Pack and Garage	LED Ref. Strip Lighting	Other LEDs	Induction High Bay	Induction Wall Pack	Total of All Categories
Tracking Sheet								
Number of Units	2,913	34,459	7,408	48	265	17	188	-
Tracked Energy Savings (GWh)	1.855	4.094	2.692	0.013	0.184	0.010	0.084	-
Tracked Demand Savings (MW)	0.548	1.166	0.675	0.002	0.046	0.003	0.021	-
Evaluated Energy Savings								
Adjustment Ratio	1.000	0.971	1.095	1.000	0.971	0.971	1.095	-
Total Gross Energy Savings - at Meter (GWh)	1.855	3.975	2.947	0.013	0.178	0.010	0.092	16.551
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-
Total Gross Energy Savings - at Generator (GWh)	1.996	4.278	3.171	0.014	0.192	0.011	0.099	17.808
Evaluated Demand Savings								
Adjustment Ratio	1.000	1.000	1.000	1.000	1.000	1.000	1.000	-
Total Gross Demand Savings - at Meter (MW)	0.548	1.166	0.675	0.002	0.046	0.003	0.021	4.577
Diversity Factor	97%	97%	97%	97%	97%	97%	97%	-
Total Gross Peak Demand Savings - at Meter (MW)	0.532	1.131	0.654	0.002	0.045	0.003	0.020	4.438
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-
Total Gross Demand Savings - at Generator (MW)	0.590	1.255	0.726	0.002	0.050	0.003	0.023	4.925
Total Gross Peak Demand Savings - at Generator (MW)	0.572	1.217	0.704	0.002	0.048	0.003	0.022	4.775

5.3 INTERACTIVE EFFECTS

Interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as heating and cooling systems. In the case of the instant rebate, replacement of standard lighting products with energy-efficient ones causes an increase in the heating load during winter and a decrease in the cooling load during summer.

An interactive effects factor of -15.5 percent is used for the lighting products sold through the instant rebate approach that are typically used for indoor lighting.

This factor is based on a study conducted by ADS in 1992 for Hydro-Québec and takes into account the proportion of commercial buildings electrically heated and the proportion air-conditioned. Since this information was not collected in the instant rebate tracking sheet and that no on-site visit was conducted for the instant rebate approach, Econoler used the proportions obtained from the 80 on-site visits conducted for BES. This program also covers a lot of products promoted through the instant rebate approach, including an important proportion of RW-T8 and HP-T8 lamps. Therefore, Econoler considers this source of data largely appropriate for calculating the interactive effects factor for the lighting products sold through the instant rebate approach.

Table 36: Interactive Effects Factor for Lighting Products

Parameters	Proportion of Buildings	Interactive Effects ¹⁹
Electric heating with air conditioning	17%	-43.4%
Electric heating without air conditioning	20%	-49.0%
No electric heating with air conditioning	29%	5.7%
No electric heating without air conditioning	34%	0.0%
Weighted Interactive Effects Factor	100%	-15.5%

For the outdoor lighting products, namely LED wall pack, LED garage and induction wall pack fixtures, no interactive effects have been considered.

For LED strip lighting used in refrigeration applications, an interactive effects factor of +17 percent has already been considered in the gross savings calculations. This value comes from Efficiency Vermont.

¹⁹ ADS ASSOCIÉS, "Évaluations des effets énergétiques combinés des mesures d'économies d'énergie – secteur commercial," report presented to Hydro-Québec, 1992.

5.4 NET-TO-GROSS RATIO

For the instant rebate approach, the NTGR evaluation includes the assessment of only one distortion effect: the free-ridership. Since the instant rebates are offered all year long through the program and so spillover or market effects are expected to be null, they were not included in this year's evaluation.

This section details the methodology used to evaluate free-ridership. Once this distortion effect has been quantified, the NTGR is calculated based on the following equation:

$$NTGR = (1 - \% \text{ free-ridership}).$$

5.4.1 Free-Ridership

For the instant rebate, free-ridership corresponds to the natural market trend. Thus, the free-ridership assessment aims at estimating what would have been the sales of energy-efficient products in a market that evolves naturally, i.e. without the program intervention.

For this year's evaluation, the free-ridership was measured through in-depth interviews with distributors using an approach similar to that used for the 2011 evaluation of SLC. Three specific products were targeted by this evaluation:

- > T8 lamps (HP-T8 and RW-T8);
- > high-performance electronic ballasts;
- > LED lighting systems, including LED screw-in bulbs, pin-based bulbs and downlights.

These products represent 59 percent of all the gross energy savings generated by the instant rebate approach.

The free-ridership assessment was made using a series of questions aimed at identifying the influences that the program had had on the market as well as other factors that might have influenced it. The in-depth interviews with the distributors included questions to estimate:

- > the percentage of their energy-efficient products that would not have been sold in the absence of the program;
- > the percentage of customers who would still have bought the products in the absence of the program; and
- > the program influence (on a scale of 0 to 10) on customers' decision to purchase the targeted energy-efficient lighting products.

The results of the in-depth interviews were then transposed into a level of free-ridership for each product. Using this approach, in-depth interview results have revealed the following levels of free-ridership:

Table 37: Free-Ridership for Instant Rebate

Product	Free-Ridership Level
High performance and low wattage T8	27%
High performance electronic ballasts;	24%
LED lighting systems	11%

A level of free-ridership of 27 percent was calculated for HP-T8 and RW-T8 lamps (an increase of 4 percent from last year), 24 percent for HP ballasts (an increase of 8 percent from last year) and 11 percent for the LED lighting systems. Free-ridership for LED lighting systems was evaluated for the first time in 2012.

These three free-ridership results show that the ENSC program influenced, respectively, 73 percent of the sales of T8 lamps, 76 percent of the HP ballasts and 89 percent of the LED lighting systems in 2012, while the remaining sales were attributed to the market's natural trend. Actually, there exist other sources of influence than ENSC's programs, such as the natural evolution of the technology, product cost reduction and the green building trend in the market. The relatively high percentage of free-ridership for both T8 lamps and HP ballasts could also be explained by the fact that BES and Custom Retrofit programs offer higher incentives and that BES reaches a large portion of the BNI customers, thus reducing the impact of the BER instant rebate on the market. In other words, distributors declared that the biggest influence on their T8 lamp and HP ballast offering and their clients' decision to purchase these two categories of energy-efficient product came from the incentives offered through BES and Custom Retrofit, indicating a smaller influence from the incentives offered through BER Instant Rebate.

However, the interviews generally showed that BER still had an influence on the distributors' product stock. For example, one distributor said they had just started having LED products in stock as a result of the rebate provided by the program which helps lower the high price of these products. This is an indication that the BER instant rebate had an important impact on the amount of LED lighting products distributed across the province for 2012.

5.4.2 NTGR Calculation

The NTGRs were calculated using the free-ridership levels established for each product included in the analysis:

Table 38: NTGRs for Instant Rebate

Product	NTGR
HP-T8 and RW-T8 lamps	0.73
High performance electronic ballasts	0.76
LED lighting systems	0.89

For the other products sold through the instant rebate approach, an NTGR of 1 has been used. These products were not introduced in the program until the end of 2011. Their sales were low in comparison with the sales of T8 lamps, HP ballasts and LED lighting systems. Moreover, they were often concentrated in a single distributor. Due to all these reasons, Econoler did not include these specific products in the free-ridership assessment.

5.5 NET SAVINGS

Net energy savings are estimated by adding the interactive effects and the NTGR to the gross energy savings using the following equation.

$$\text{Net Energy Savings} = \text{Gross Energy Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

The net energy savings were first calculated separately for each product because the interactive effects factor and NTGR differed from one product to another. Table 39 presents the details of the calculation.

Overall, the total net energy and demand savings have amounted to 13.084 GWh and 3.450 MW at the meter and 14.079 GWh and 3.713 MW at the generator.

Table 39: Evaluation Results – Net Energy and Demand Savings for Products with Unitary Savings Values – Instant Rebate

Product	HP-T8-32W	RW-T8-28W	RW-T8-25W	1-Lamp HP Ballasts	2-Lamp HP Ballasts	3-Lamp HP Ballasts	4-Lamp HP Ballasts	Lighting Occ. Sensors	HVAC Occ. Sensors	Motors
Energy Savings										
Total Gross Energy Savings – at Meter (GWh)	0.273	2.942	0.193	0.032	1.099	0.309	0.959	1.226	0.043	0.405
Interactive Effects Factor	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-	-	
NTGR	0.73	0.73	0.73	0.76	0.76	0.76	0.76	1.00	1.00	1.00
Total Net Energy Savings – at Meter (GWh)	0.168	1.815	0.119	0.021	0.706	0.198	0.616	1.226	0.043	0.405
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076
Total Net Energy Savings – at Generator (GWh)	0.181	1.952	0.128	0.022	0.759	0.213	0.663	1.319	0.046	0.436
Demand Savings										
Total Gross Peak Demand Savings– at Meter (MW)	0.078	0.839	0.055	0.009	0.314	0.088	0.274	0.340	0.009	0.046
Interactive Effects Factor	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-	-	
NTGR	0.73	0.73	0.73	0.76	0.76	0.76	0.76	1.00	1.00	1.00
Total Net Peak Demand Savings – at Meter (MW)	0.048	0.518	0.034	0.006	0.201	0.057	0.176	0.340	0.009	0.046
Line loss factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076
Total Net Peak Demand Savings – at Generator (MW)	0.052	0.557	0.036	0.006	0.217	0.061	0.189	0.365	0.009	0.049

Table 40: Evaluation Results – Net Energy and Demand Savings for All Other Products – Instant Rebate

Product	T5 and T8 High Bay	LED Lighting Systems	LED Wall Pack and Garage	LED Ref. Strip Lighting	Other LEDs	Induction High Bay	Induction Wall Pack	Total of All Categories
Energy Savings								
Total Gross Energy Savings – at Meter (GWh)	1.855	3.975	2.947	0.013	0.178	0.010	0.092	16.551
Interactive Effects Factor	-15.5%	-15.5%	0%	-	-15.5%	-15.5%	0%	-
NTGR	1.00	0.89	1.00	1.00	1.00	1.00	1.00	-
Total Net Energy Savings – at Meter (GWh)	1.567	2.990	2.947	0.013	0.151	0.008	0.092	13.084
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-
Total Net Energy Savings – at Generator (GWh)	1.686	3.217	3.171	0.014	0.162	0.009	0.099	14.079
Demand Savings								
Total Gross Peak Demand Savings – at Meter (MW)	0.532	1.131	0.654	0.002	0.045	0.003	0.020	4.438
Interactive Effects Factor	-15.5%	-15.5%	0%	-	-15.5%	-15.5%	0%	-
NTGR	1.00	0.89	1.00	1.00	1.00	1.00	1.00	-
Total Net Peak Demand Savings – at Meter (MW)	0.449	0.851	0.654	0.002	0.038	0.002	0.020	3.450
Line loss factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-
Total Net Peak Demand Savings – at Generator (MW)	0.484	0.915	0.704	0.002	0.041	0.003	0.022	3.713

The table below presents comparisons between the energy and demand savings established by this evaluation and those calculated in the 2012 tracking sheet.

Table 41: Comparison of Tracked and Evaluated Savings at the Generator for Instant Rebate

	Initial Gross Savings	Adjusted Gross Savings	Adjusted Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	16.566 GWh	16.566 GWh	16.566 GWh	0.75	12.424 GWh
Evaluation Results	16.690 GWh*	17.808 GWh	15.704 GWh	0.89**	14.079 GWh
Demand Savings					
Tracked Savings from ENSC	4.660 MW	4.660 MW	4.660 MW	0.75	3.495 MW
Evaluation Results	4.694 MW*	4.775 MW	4.179 MW	0.89**	3.713 MW

*Initial gross savings used for the evaluation results are different from the tracked savings because of the line loss factor. ENSC used a line loss factor of 1.067, based on past evaluations, and Econoler used a line loss factor of 1.076 for this year's evaluation.

**NTGRs were different for each category of product. The NTGRs presented in this table correspond to the rounded averages obtained by dividing the net savings by the installed gross savings (with interactive effects).

The net savings calculated by ENSC were compared with the tracked savings for 2011. On one hand, the energy and demand savings calculated for this evaluation are higher than the tracked savings by 13 percent and 6 percent respectively. This result could be explained by the fact that ENSC applied an NTGR of 0.75 on all the products purchased through the program. For this evaluation, NTGRs were calculated for the products generating the most savings, i.e. HP-T8 and RW-T8 lamps, HP ballasts and LED lighting systems. The NTGR for the other products has been assumed to be 1. In addition, the Evaluator has revised the deductions of T8 lamps and HP ballasts by taking into account the proportions of products sold in each sub-category and this revision has therefore slightly increased the savings. On the other hand, an interactive effects factor of -15.5 percent was also applied to the gross savings calculated for indoor lighting products, but the conservative NTGR value used for tracked savings was sufficient to offset the reduction of savings caused by this interactive effects factor.

For future evaluations, Econoler recommends including interactive effects into the savings calculations to allow for a more precise calculation of savings. In the 2012 tracking sheet, ENSC only included interactive effects for LED strip lighting used in refrigeration applications.

6 OVERALL BER RESULTS

This section summarizes the overall results of the impact evaluation for BER. With combined net savings generated from both mail-in rebate and instant rebate approaches, the total energy and demand savings have amounted to 21.858 GWh and 6.285 MW respectively. The table below presents the total gross and net savings established by the impact evaluation for BER.

Table 42: Overall Comparison of Tracked and Evaluated Savings at the Generator for BER

	Initial Gross Savings	Adjusted Gross Savings	Adjusted Gross Savings with Interactive Effects	NTGR*	Net Savings
Energy Savings					
Tracked Savings from ENSC	26.680 GWh	26.680 GWh	26.680 GWh	0.78	20.819 GWh
Evaluation Results	26.804 GWh-	27.295 GWh	25.191 GWh	0.86	21.858 GWh
Demand Savings					
Tracked Savings from ENSC	7.838 MW	7.838 MW	7.838 MW	0.78	6.133 MW
Evaluation Results	7.873 MW-	7.912 MW	7.315 MW	0.86	6.285 MW

*NTGRs were different for each rebate approach. The NTGRs presented in this table correspond to the rounded averages obtained by dividing the net savings by the installed gross savings (with interactive effects).

CONCLUSION

The 2012 evaluation of BER demonstrated that the program had undergone a series of changes, creating an intensified impact on the market. In fact, BER has grown in both range and scale, expanding from offering only mail-in rebates on a range of energy-efficient measures to instant rebates through electrical distributors within the province of Nova Scotia (formerly known as the Smart Lighting Choices program). It has also made significant progress towards horizontal diversification by incorporating commercial kitchen equipment and agricultural equipment into the eligible measures.

Furthermore, the Evaluator has observed major improvements to the program since the 2011 evaluation. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving not much time for ENSC to follow up on all the process and impact recommendations prior to the onset of the 2012 evaluation period which started in July 2012. Nevertheless, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Additional efforts were also made in program promotion and communication, as well as in informing participants about expected savings.

ENSC's actions in increasing program promotion and communication contributed significantly to program awareness in 2012, making it the principal means by which participants learned about the program. Contact with contractors or distributors was also an important source of program awareness, highlighting the key role played by these actors in program promotion. Moreover, word of mouth was an important source of program awareness, as well as a good indicator of program satisfaction.

Many distributors noticed that program advertising activities had a good impact on end-user customers and on their business. For instance, they stated that their sales of lighting measures became much easier, especially those related to LED lighting. Apparently, BER achieved success in promoting LED lighting measures in the BNI sector, and the majority of participants and distributors expressed strong satisfaction with the overall program, as well as with its various aspects. Despite this success, some distributors noted that for T8 and ballast products, other BNI programs (namely BES and Custom Retrofit) offered higher lighting incentives than BER and reached a large portion of the BNI customers, which eroded the impact of the BER instant rebate on these products.

The evaluation revealed that BER generated net energy savings of 21.858 GWh and demand savings of 6.285 MW at the generator in 2012, compared to 14.956 GWh and 3.469 MW respectively in 2011, and to 6.748 GWh and 1.267 MW respectively in 2010²⁰. To calculate the net savings of BER in 2012, Econoler reviewed the gross savings estimated by ENSC, based on 50 on-site visits and a literature review, and took into consideration the free-ridership level for each rebate approach.

²⁰ The 2010 and 2011 net energy savings include Business Energy Rebate (BER) and Smart Lighting Choices (SLC) results.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Analyze product offering to reduce duplicate rebates and program overlapping in the market: Some eligible measures covered by the BER instant rebate approach are also covered by other BNI programs (BES and Custom Retrofit). When analyzing the savings associated with the instant rebate, Econoler found that 37 percent of the T8 lamps and 48 percent of the ballasts eligible for an instant rebate were already funded by another BNI program. This information was confirmed by some of the distributors interviewed during this evaluation. They indicated that most of their high-performance and reduced-wattage T8 lamps and high-performance ballasts were sold through other ENSC programs, mostly BES. These distributors explained that for these products, a large part of their sales volume came from a small number of contractors who worked on projects under other BNI programs. Although some products were double-funded, it is important to note that ENSC did not claim savings within the BER program for these items. The Evaluator was advised that ENSC already planned to remove the lamp and ballast rebates from the range of rebates accessible to the BES DAs and Custom project contractors. Still, the Evaluator considers that the products rebated through BER Instant Rebate should be limited to specific products with low market penetration since T8 lamps and HP ballasts are largely covered by the other two BNI programs offered by ENSC. Thus, Econoler recommends reviewing product offering of the BNI programs and limiting instant rebates to specific products with low market penetration, such as LED technologies. This would avoid double funding, dissatisfaction by stakeholders and program-overlapping in the market (i.e. offering different rebates under different forms for the same market).

Executive Summary	2. Improve the tracking sheet to facilitate effective validation of savings*: Improvements to both mail-in and instant rebate tracking sheets could be made to facilitate analyzing energy and demand savings calculated for the program. Currently, all the values used in savings calculations are contained in one cell. Breaking down these values in different cells would allow the Evaluator to easily validate the savings calculations for each category of product and apply adjustments when necessary. Furthermore, both tracking sheets contain information presented in separate tabs. Consolidating all the information in one main database is another change that would facilitate the evaluation process. *See section 3.3 Tracking Sheet for more details
	3. Define different full load hours values according to building characteristics*: Currently, for HVAC measures, ENSC uses two typical full load hours values to estimate energy savings in heating, depending on the heat pump capacity. Thus, these same values are applied on all types of building. However, the on-site visits demonstrated 1) that very few participants were able to enter a reliable value in the “Full load hours” field of the HVAC worksheet; and 2) that full load hours could vary significantly depending on the building’s characteristics, such as the building type and the temperature set point. Therefore, Econoler recommends developing a reference table with full load hours values defined according to different factors that might affect them like the building type (office building, retail stores, etc.) and the heating temperature set point of the building. This kind of information can be more easily and reliably collected using the worksheet than the full load hours themselves. A similar approach to recording the full load hours could be followed for cooling measures. *See Section 4.2.1 HVAC Measures for more details.
	4. Introduce tighter control on some product requirements*: For lighting measures, one of the elements having a significant impact on the savings review is replacing non-eligible old lamps. To mitigate this issue in the future, the Evaluator recommends that participants be required to provide photographs of the lamps and/or fixtures they intend to replace, regarding lighting products with an eligibility criterion requiring the new product to replace a specific type of lamp or a minimum level of wattage. This recommendation is not intended to estimate savings based on the real wattage values of the replaced old lamps, but to ensure that this specific eligibility criterion is met and savings calculations are in compliance with the baseline. *See Section 4.2.2 Lighting Measures for more details.

Executive Summary	5. Move products from the instant rebate to the mail-in rebate*: In relation to the preceding recommendation on validating the eligibility of old lamps, there could also be a similar issue with LED chandelier lamps and LED high bay fixtures. Therefore, Econoler recommends that these products be included in the mail-in rebate portion of the BER program so that ENSC has tighter control on eligibility criteria by requiring the photographs of the lamps and/or fixtures that the participant intends to replace. This recommendation also resonates with some distributors, who mentioned during the in-depth interviews that eligibility criteria on the products to be replaced were really difficult to validate in stores unless they collected the replaced old lamps, which would have required much time, space and organization. *See Section 4.2.2 Lighting Measures for more details.
	6. Standardize savings calculations for lighting products with typical baseline values*: A statistical analysis of the adjustment ratios calculated for each of the 14 lighting projects visited for this evaluation demonstrated that the error margin was too high, making it impossible to apply a common adjustment ratio on all the projects implemented in the category. This large error margin was due to the large variations between the adjustment ratios obtained from the on-site visits. Even if the sample size had been ten times bigger, the error margin would have remained very high because of the huge variations in the adjustments. These large variations between the adjustment ratios calculated for each project raised a question on the methodology used to estimate savings. A major source of errors certainly resided in the fact that savings were based on the real wattage values of the replaced old lamps declared by participants. Therefore, Econoler recommends standardizing the savings calculations for lighting products with typical baselines for every type of product installed. Such an approach to all eligible products would greatly simplify the savings calculations. And then, ENSC would only need to monitor the market trends and the new regulations introduced to adjust the baseline table, when necessary. *See Section 4.2.2 Lighting Measures for more details.
	7. Ensure that the participant provides the motor specifications sheet*: For motor measures, the adjustments made to the savings calculations were generally a consequence of wrongly identified efficiency values on the worksheet. Therefore, the Evaluator recommends ensuring that the participant provides the motor specifications sheet (or a picture of the motor nameplate) to make it easier for ENSC to validate efficiency results at the savings calculation stage. *See Section 4.2.4 Motors and Drives Measures for more details.

Executive Summary	8. Develop a reference table with baseline and new wattage values for T5 and T8 high bay fixtures, LED technologies and induction technologies*: The review of the displaced wattage values used for T5 and T8 high bay fixtures, LED technologies and induction technologies showed that the savings used in the tracking sheet might have been underestimated in some cases because of the relatively low ballast wattage values used for baseline fixtures. Moreover, for the new fixtures installed, ENSC often only uses the wattage of the lamp since most product specifications sheets do not list the wattage values of the whole fixture. For the 2012 evaluation, no adjustment was made since specific savings values were calculated for each product sold through the program and that savings values were calculated in one cell, making it impossible to apply any adjustment factor. To make savings evaluations more precise in the future, Econoler recommends developing a reference table with baseline lamp and ballast wattage values associated to each type of T5 and T8 high bay fixture, LED technologies and induction technologies sold through the instant rebate approach. These values would be based on typical replacement scenarios found in literature or established by well-informed market experts. For the wattage values of the new fixtures installed, Econoler recommends using typical ballast factor values instead of the information on each product specifications sheet, which is often unavailable. *See Section 5.2.6 T5 and T8 High Bay Fixtures for more details. 9. Include interactive effects in calculating the tracked savings of all the indoor lighting products sold through the instant rebate approach*: For the lighting measures implemented through the mail-in rebate approach, interactive effects were already included in ENSC's gross savings calculations. For the instant rebate approach, interactive effects are only considered for LED strip lighting used in refrigeration applications. Therefore, the Evaluator had to adjust the tracked savings to take into account an interactive effects factor of -15.5 percent for all indoor lighting products. To make savings calculations more precise in the future, interactive effects should be systematically integrated into the savings calculations of all the indoor lighting products sold through the BER instant rebate. *See Section 5.5 Net Savings for more details.

Program Charts	10. Provide partners and participants with simplified process charts: The Evaluator recommends developing a simplified participant process chart and posting it on the program website, which is comprehensive, clear and well designed. Moreover, the partners should be given copies of their process chart. After all, these charts are intended for the distributors and the mail-in participants. Hence, they must describe the participation process in a simple way and be distributed as widely as possible to gain maximum exposure. The version number and revision date should be indicated in each chart.
Marketing and Outreach Activities	11. Make the performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the program. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.
Tracking Sheet	12. Merge all the information on the projects implemented and the energy savings into a single database: As mentioned earlier in this section, the tracking sheet submitted by ENSC for the mail-in rebate approach consisted of two key tabs containing calculated savings figures, namely the “Project Summary” and the “Energy Savings” sheets. When reviewing the tracking sheet, the Evaluator did not find any added value of using two distinctive tabs and therefore recommends that ENSC ensure that the DWMDS allows merging all the information into a single database. This would help reduce the risk of calculation errors, facilitate the validation process and prevent duplicates (e.g. the demand and energy savings of each project were included in both tabs, with no link between the related cells of either tab).

Tracking Sheet	13. Break down the values used for savings calculations in different cells: As it was the case in 2011, all the values used for savings calculations are contained in one cell. This approach to tracking data does not allow for a systematic validation of the savings for each measure. A simple reorganization of the database would make this validation possible while reducing the likelihood of data entry errors. The number of units as well as their key characteristics, such as wattage, horsepower, efficiency ratio and hours of operation, should each be contained in a separate cell. Most of this information can be collected directly from the application forms. Considering the multitude of approaches used to calculate the energy savings for this program, it would be useful to keep the detailed equation in the database, as the savings calculation parameters can vary from one project to another. 14. Record all the information on each participant: For this year's evaluation, participant information required for conducting the field activities (surveys and on-site visits) was provided separately to the Evaluator. Therefore, Econoler recommends that the following items be always included in the reporting sheet that would be generated by the DSMDS: - contact name, phone number and email address; - facility name, address, city, postal code and general phone number. Moreover, participants' answers to the free-ridership pre-screening questions were added by the PM upon the request of the Evaluator. In the future, this information should be recorded in the DSMDS as soon as a new project is entered and included in the reporting sheet. 15. Ensure that complete contact information is always provided: It is recommended that the PM ensure that all the contact information fields are systematically filled out. The analysis of the 2012 tracking sheet showed that the contact name, facility phone number and email address were missing for many projects. A protocol could be implemented to ensure that all the contact information is collected.

Tracking Sheet	16. Consolidate all the information collected from the monthly reporting sheets: The official tracking sheet for the instant rebate approach only provides overall figures, i.e. the monthly savings for each distributor. No detailed information on the products sold by each distributor or the savings calculations for each product code is included. So the Evaluator recommends consolidating all the information contained in the individual monthly reporting sheets and the master list of products into one comprehensive tracking sheet, which would facilitate monitoring the products sold yearly through the instant rebate approach and thereby make it easier to calculate program savings. For instance, the information provided in the master list of products would allow associating each product sold through the program with the right category of product, thus facilitating the application of different NTGRs and interactive effects factors according to the category of product. 17. Improve the template for the monthly reporting sheets: A template indicating the information required in the monthly reporting sheets is used by the PM. This template could be improved to facilitate the analysis of each distributor or product category (electronic ballasts, T8 lamps, etc.), as well as the consolidation of all monthly reporting sheets into one tracking sheet. At least three columns should be added to the template to respectively identify the distributor, the tracking month, and the broader category of product. The revised template would provide the PM and the Evaluator with a way to better monitor the program results by including both the savings and product sales. 18. Facilitate the savings validation by providing technical information in separate fields: Currently, the only information associated with the product codes is the category of product and their respective savings calculations. Technical information, such as the wattage and the number of lamps per fixture, is included in the product code name. This way of presenting information, i.e. in one long string of numbers and characters, prevents any analysis or validation of the savings calculations. Therefore, Econoler recommends presenting the technical information provided in the product code name in separate fields.

APPENDIX II – INTERVIEW GUIDE WITH DISTRIBUTORS

DISTRIBUTOR INTERVIEW GUIDE ENSC BUSINESS ENERGY REBATES PROGRAM

October 29, 2012

Hello, may I please speak with _____?

1. Yes [GO TO INTRODUCTION]
2. No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

INTRODUCTION

Hello, my name is _____, from Econoler, an engineering firm specializing in Energy Efficiency. I am calling on behalf of Efficiency Nova Scotia Corporation to gather your opinion about the impact of the Business Energy Rebates Program.

IDENTIFICATION AND SCREENING OF RESPONDENT

I1. According to our records, your company/store has participated in the Business Energy Rebates Program from Efficiency Nova Scotia. Econoler has been mandated by Efficiency Nova Scotia to conduct an evaluation of this program. We have a few questions about your company/store's participation in this program. I'd like to speak with someone in your company/store who is knowledgeable about the stocking and supplying of products that were rebated by the program. These products are high-performance and low (reduced) wattage T8 lamps, high-performance electronic ballasts and LED lighting systems, including LED screw-in bulbs and LED recessed downlights. Would that person be you?

- ☐ Person responsible available [CONTINUE]
- ☐ Person responsible currently unavailable [ARRANGE CALL BACK WITH THE RIGHT PERSON]
- ☐ No person responsible for stocking or management of products [CONTINUE INTERVIEW WITH STORE MANAGER/HEAD OFFICE CONTACT - CONTINUE]
- ☐ Don't know [CONTINUE INTERVIEW WITH STORE MANAGER/HEAD OFFICE CONTACT - CONTINUE]
- ☐ Refused [THANK AND TERMINATE]

Confidentiality

Please note that your responses will be kept strictly confidential and that we will not share the information you provide with any other party in a way that could identify your individual or corporate responses.

Recording of the Interview

Please note that the interview will be recorded. The recording will remain strictly confidential. It is simply a tool for me because I cannot write all the information that you will give me.

ASK IF HIGH-PERFORMANCE OR LOW WATTAGE T8 LAMPS WERE REBATED THROUGH THE PROGRAM

High-performance or low wattage T8 lamps

I have a few questions about your sales of **high-performance and low (reduced) wattage** T8 lamps that are promoted by the Business Energy Rebates Program.

Our records indicate that your total sales of high performance and low wattage T8 lamps up to August 2012 amounted to _____ products. Furthermore, your sales for 2011 amounted to _____ products.

Ask if there is a significant difference (plus or minus 25%) between sales in 2012 (expected) and 2011.

T1. If the current trend is maintained, your total sales for high-performance and low wattage T8 lamps in 2012 will be significantly lower/higher (*select the appropriate term*) than for the previous year. Is there any reason for this change?

[PROBE: market trend, more competitors offering these products, etc.]

T2. In 2012, the Business Energy Rebates Program provided an incentive of \$2 for each high-performance as well as for each low wattage T8 lamp sold in your store(s). If this incentive had not been available, do you think that your 2012 sales of **high-performance and low wattage** T8 lamps would have been about the same or lower?

1.	Same	[GO TO T4]
2.	Lower	[GO TO T2a]
98.	(Don't know)	[GO TO T4]
99.	(Refused)	[GO TO T4]

[IF ANSWERED SAME] I just want to make sure I understand well. Without the program and its incentive, you would have sold the same number of **high-performance and low wattage** T8 lamps?

T2a. In terms of percentage, how lower do you estimate that your store's sales of **high-performance and low wattage** T8 lamps would have been, in 2012, if the Business Energy Rebates Program incentive had not been available?

RECORD PERCENTAGE ____%

T4. In 2012, how important would you say the incentive from the Business Energy Rebates Program was in customers' decision to purchase high-performance or low wattage T8 lamps instead of standard T8 or T12 lamps? Please give your response on a scale from 0 to 10, where 0 is "not at all important" and 10 is "extremely important."

T5. If the program stopped this year, what percentage of customers do you think would still buy high-performance or low wattage T8 lamps, meaning that lamps would be about 45% more expensive?

*(If percentage is too different from percentage given at T2, validate both, and if they remain the same, try to get an explanation)

T6. Do you think that the \$2 incentive provided to clients for each high-performance or low wattage T8 lamp purchased is sufficient? Is it too low? Is it too high? What would be the appropriate amount?

ASK IF HP ELECTRONIC BALLASTS WERE REBATED THROUGH THE PROGRAM

High-performance electronic ballasts

I have a few questions about your sales of **high-performance** electronic ballasts for T8 lamps that are promoted by the Business Energy Rebates Program.

Our records indicate that your total sales of high-performance ballasts up to August 2012 amounted to _____ products. Furthermore, your sales for 2011 amounted to _____ products.

Ask if there is a significant difference (plus or minus 25%) between sales in 2012 (expected) and 2011.

E1. If the current trend is maintained, your total sales for high-performance ballasts in 2012 will be significantly lower/higher (*select the appropriate term*) than for the previous year. Is there any reason for this change?

[PROBE: market trend, more competitors offering these products, etc.]

E2. In 2012, the Business Energy Rebates Program provided an incentive of \$1 for each high-performance ballast sold in your store(s). If this incentive had not been available, do you think that your sales of **high-performance** ballasts in 2012 would have been about the same or lower?

1.	Same	[GO TO E4]
2.	Lower	[GO TO E2a]
98.	(Don't know)	[GO TO E4]
99.	(Refused)	[GO TO E4]

[IF ANSWERED SAME] I just want to make sure I understand well. Without the program and its incentive, you would have sold the same number of **high-performance ballasts**?

E2a. In terms of percentage, how lower do you estimate that your store's sales of high-performance ballasts would have been in 2012, if the Business Energy Rebates Program incentive had not been available?

RECORD PERCENTAGE ____%

E4. In 2012, how important would you say the incentive from the Business Energy Rebates Program was in customers' decision to purchase high-performance ballasts instead of standard electronic ballasts? Please give your response on a scale from 0 to 10, where 0 is "not at all important" and 10 is "extremely important."

E5. If the program stopped this year, what percentage of customers do you think would still buy high-performance ballasts, meaning that ballasts would be about 10% more expensive?

*(If percentage is too different from percentage given at E2, validate both, and if they remain the same, try to get an explanation)

E6. Do you think that the \$1 incentive provided to the client per high-performance ballast purchased is sufficient? Is it too low? Is it too high? What would be the appropriate amount?

ASK IF LED LIGHTING SYSTEMS WERE REBATED THROUGH THE PROGRAM

LED lighting systems

I have a few questions about your sales of LED lighting systems that are promoted by the Business Energy Rebates Program. By LED lighting systems, we mean LED screw-in bulbs and LED recessed downlights.

L2. In 2012, the Business Energy Rebates Program provided an incentive between \$10 and \$15 for each LED lighting system sold in your store(s). If this incentive had not been available, do you think that your 2012 sales of LED lighting systems would have been about the same or lower?

1.	Same	[GO TO L4]
2.	Lower	[GO TO L2a]
98.	(Don't know)	[GO TO L4]
99.	(Refused)	[GO TO L4]

[IF ANSWERED SAME] I just want to make sure I understand well. Without the program and its incentive, you would have sold the same number of LED lighting systems compared to standard lighting systems?

L2a. In terms of percentage, how lower do you estimate that your store's sales of LED lighting systems would have been in 2012, if the Business Energy Rebates Program incentive had not been available?

RECORD PERCENTAGE ____%

L4. In 2012, how important would you say the incentive from the Business Energy Rebates Program was in customers' decision to purchase LED lighting systems instead of CFLs? Please give your response on a scale from 0 to 10, where 0 is "not at all important" and 10 is "extremely important."

L5. If the program stopped this year, what percentage of customers do you think would still buy LED lighting systems, meaning that lamps would be 30% to 40% more expensive?

*(If percentage is too different from percentage given at L2, validate both, and if they remain the same, try to get an explanation)

L6. Do you think that the \$10-\$15 incentive provided to clients for each LED lighting system purchased is sufficient? Is it too low? Is it too high? What would be the appropriate amount?

L7. According to the program's rule, LED lighting systems sold are eligible to the rebate only if they are replacing incandescent or halogen lamp. How do you know which lamp is replaced with the LED lighting system you sell within the BER program?

ASK ALL RESPONDENTS

Satisfaction and recommendation

S1. On a scale from 1 to 10 (where 1 = not at all satisfied and 10 = very satisfied), how would you rate your overall satisfaction with the Business Energy Rebates program?

Scale:

S1a. If $S1 < 8$, would you care to share the reason or reasons for such a score?

Reason(s):

S2. On a scale from 1 to 10 (where 1 = not at all satisfied and 10 = very satisfied), what is your satisfaction level in regard to program support and communications?

Scale:

S2a. If $S2 < 8$, would you care to share the reason or reasons for such a score?

Reason(s):

S3. On a scale from 1 to 10 (where 1 = not at all satisfied and 10 = very satisfied), what is your satisfaction level in regard to rebate processing, tracking and reporting?

Scale:

S3a. If $S3 < 8$, would you care to share the reason or reasons for such a score?

Reason(s):

S4. Do you have any suggestion to improve the program?

☐ No

☐ Yes

S4a. If "Yes," please explain the nature of the improvement(s):

Those are all the questions I have for you today. Would you like to add anything else regarding the program or talk about any other topic that was not covered during the interview?

X. My colleagues, from Extract Marketing Research, are currently doing a short study on the introduction of new Codes and Standards in the Nova Scotia market. It's possible that someone may call you about this subject. The interview would last no longer than 10 minutes. Would that be alright with you?

THANK YOU FOR TAKING THE TIME TO RESPOND TO THIS INTERVIEW.

APPENDIX III – ON-SITE VISIT PROTOCOL

1. General Information

Date of visit: _____

Project Name: _____

Project Tracking sheet #: _____

Company Name: _____

Contact Name: _____

Address: _____

Telephone: _____

Type of facility:

Retail: ☐	Manufacturing/ Industrial: ☐	Grocery/ Supermarket: ☐
College/ University: ☐	Multi-Unit Res.: ☐	Other (Specify): ☐

Is it a new construction? _____

2. Building Heating/Cooling System Description

Heating Systems:

Please fill the table below for each heating system at the site

	Heating system 1	Heating system 2	Heating system 3
Heat source			
% of heat			
Type of system			
Efficiency or COP			

Cooling Systems:

Please fill the table below for each cooling system at the site

	Cooling system 1	Cooling system 2	Cooling system 3
% of cooling			
Type of system			
SEER or COP			

Domestic Water Heating System:

Water heating source: ☐ Electric ☐ Non-Electric (Specify: _____)

Tank size (in gallons): _____

Notes:

3. Facility Operation Hours and Lighting Usage

Please fill the table below for each occupancy schedule reported by the site contact as occupancy could vary for each section of the facility. Use additional sheets if necessary.

Facility occupancy schedule:

Occupancy schedule	1: Normal		2 (specify):		3 (specify):	
	Weekdays	Weekend	Weekdays	Weekend	Weekdays	Weekend
Number of days/year with regular schedule						
Number of days/year with regular holidays schedule		----		----		----
Number of days/year with no occupancy (e.g.: seasonal closure)						
Total number of days/year	261	104	261	104	261	104

Normal week/holidays lighting operation schedule (hours per day):

Please fill the table below for each lighting schedule reported by the site contact as usage could vary for each section of the facility. Use additional sheets if necessary.

Normal Lighting Schedule	Mon.	Tues.	Wed.	Thu.	Fri.	Sat.	Sun.	Holidays
Operating hours (e.g.: 8:00 to 17:00)								
Hours per day								

Notes:

4. Measures information

Lighting

Collect the information in the table below **if lighting measures were installed**. Use on-site observation and contact declaration. Use additional sheets if required. The information collected will then be compared with the information in the tracking sheet by Econoler.

Date of installation:

Section 1 (Specify):

Hours of use for equipment
(Indicate the corresponding schedule
number for each section where lighting
measures were implemented):

Section 2 (Specify):

Section 3 (Specify):

Section 4 (Specify):

Section 5 (Specify):

Section 1:

Section 2:

Hours of use for equipment
(Indicate the corresponding annual hours
[h/yr]):

Section 3:

Section 4:

Section 5:

Is cooling installed in the section with the lighting
measure?

☐ Yes

% time with lights AND cooling ON: _____%

Cooling system number: _____

☐ No

Is heating installed in the section with the
measure?

☐ Yes

% time with lights AND heating ON: _____%

Heating system number: _____

☐ No

The percentage of lighting that remains on when
the facility is closed:

Validate if lamps are still installed and not burnt: _____

If some are burnt or missing, indicate how many: _____

When was the lamp removed or when did it burn? _____

Is the facility manager planning to have them replaced? _____

If, not why? Are they OK with the reduced light level? _____

Use the table below to record the information on the lighting measures installed on site. For each type of equipment, indicate the number of equipment with a specific wattage. Use additional sheets if required.

New equipment installed						Baseline equipment					
Type	Number		Wattage		Additional information	Type	Number		Wattage		Additional Info
	Tracking Sheet	On-Site validation	Tracking Sheet	On-Site validation			Tracking Sheet	On-Site validation	Tracking Sheet	On-Site validation	
LED Decorative Area Lighting / Walkway Lighting											
LED Canopy / Parking Garage Lighting											
LED Exit Signs						☐ Inc ☐ Fluo ☐ Other					
LED Troffers											
LED Lamps for Fluorescent Fixtures	____ units ____ ft	____ units ____ ft				☐ T12 ☐ T8 ☐ Other					

New equipment installed						Baseline equipment					
Type	Number		Wattage		Additional information	Type	Number		Wattage		Additional Info
	Tracking Sheet	On-Site validation	Tracking Sheet	On-Site validation			Tracking Sheet	On-Site validation	Tracking Sheet	On-Site validation	
LED Parking Lot Lights				☐ 30-50W ☐ 51-100W ☐ 101-145W ☐ 146-200W ☐ Other: ____				☐ ≥100W ☐ ≥150W ☐ ≥400W ☐ Other: ____			
Reduced Wattage Metal Halide Lamps				☐ 150-250W ☐ 400-750W ☐ 1000W ☐ Other: ____	Is it a pulse start? _____			☐ ≥400W ☐ ≥1000W ☐ ≥1500W ☐ Other: ____			
Pin-based CFLs						☐ Inc ☐ Fluo ☐ Other					

New equipment installed						Baseline equipment					
Type	Number		Wattage		Additional information	Type	Number		Wattage		Additional Info
	Tracking Sheet	On-Site validation	Tracking Sheet	On-Site validation			Tracking Sheet	On-Site validation	Tracking Sheet	On-Site validation	
T8 Low-Bay Fixtures					Do the fixtures use high performance T8 or reduced wattage T8? How many lamps per fixture?	☐ Metal Halide ☐ Other _____					
T8 Dimmable Stairwell Lighting					Does it dim to <25% full output when no occupants are detected? Does it operate 24h/day? How many lamps per fixture? Do the fixtures use high performance T8 or reduced wattage T8?						Does it replace non-dimmable stairwell fixture? _____

New equipment installed						Baseline equipment					
Type	Number		Wattage		Additional information	Type	Number		Wattage		Additional Info
	Tracking Sheet	On-Site validation	Tracking Sheet	On-Site validation			Tracking Sheet	On-Site validation	Tracking Sheet	On-Site validation	
Park Light Induction Lamp Fixtures											
Induction Canopy/ Parking Garage Lighting											
Photo-luminescent Exit Signs					Is the product ENERGYSTAR® rated?	☐ Inc ☐ Fluo ☐ Other					

Motors and Drives

Collect the information in the table below **if motors and drives measures were installed**. Use on-site observation and contact declaration. Use additional sheets if required. The information collected will then be compared with the information in the tracking sheet by Econoler.

Date of installation: _____

Motors

Total number of motors installed: _____

	<u>Motor 1</u>	<u>Motor 2</u>	<u>Motor 3</u>
Manufacturer:	_____	_____	_____
Model number:	_____	_____	_____
Motor Size [hp]:	_____	_____	_____
NEMA Nominal Efficiency (nameplate):	_____	_____	_____
Hours of use (<i>Indicate the corresponding schedule number</i>):	_____	_____	_____
Approx. product run time [hr/week]:	_____	_____	_____
Approx. hours of operation [h/yr]:	_____	_____	_____
Do the new motors operate at least 2,000 hours a year?	_____	_____	_____
Are the new motors listed in the CEE Premium Efficiency Motors List ²¹ ?	_____	_____	_____
Specify the type of application:	_____	_____	_____

²¹ Web Site : www.cee1.org/resrc/news_items/CEEMotorsList.php3

Variable Speed Drives (VSDs)

Total number of VSDs installed:

	<u>VSD 1</u>	<u>VSD 2</u>	<u>VSD 3</u>

Validate that the new VSDs do not replace old VSDs?

Validate that the new VSDs are operational?

If not, why and since when?

VSDs are automatically controlled? (Y/N):

If yes, specify the type of control (pressure, flow or T°):

Specify the hp of the motor controlled by the VSDs:

Specify the type of equipment controlled:
(Supply fan, return fan, exhaust fan, chilled water pump, boiler feed water, or other (Specify)):

Hours of use (Indicate the corresponding schedule number):

Approx. product run time [hr/week]:

Approx. hours of operation [h/yr]:

Load profile:

Use table below to record the information provided by contact declaration

Load profile (kWh or flow: circle the appropriate one)										
Full load percent	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
% yearly hours at each load										

HVAC

Collect the information in the table below **if HVAC measures** were installed. Use on-site observation and contact declaration. Use additional sheets if required. The information collected will then be compared with the information in the tracking sheet by Econoler.

Date of installation: _____

Total number of AC & Air-Source Heat Pumps (Split & Unitary) installed: _____

Total number of Ground & Water Source Heat Pumps installed: _____

	<u>HVAC 1</u>	<u>HVAC 2</u>	<u>HVAC 3</u>	<u>HVAC 4</u>	<u>HVAC 5</u>	<u>HVAC 6</u>
<u>AC & Air-Source Heat Pumps:</u>						
Original heat source (Electricity or other (specify)):	_____	_____	_____	_____	_____	_____
Specify if condensing unit or evaporator coil:	_____	_____	_____	_____	_____	_____
Seasonal Energy Efficiency Ratio (SEER):	_____	_____	_____	_____	_____	_____
Energy Efficiency Ratio (EER):	_____	_____	_____	_____	_____	_____
System size [Btu/h]:	_____	_____	_____	_____	_____	_____

Number of tons per unit:	_____	_____	_____	_____	_____	_____
Hours of use (<i>Indicate the corresponding schedule number</i>):	_____	_____	_____	_____	_____	_____
Total cooling full load hours [hr/yr]:	_____	_____	_____	_____	_____	_____
Total heating full load hours [hr/yr]:	_____	_____	_____	_____	_____	_____
Validate if the HVAC systems are still operational:	_____	_____	_____	_____	_____	_____
If no, why, and since when?	_____	_____	_____	_____	_____	_____
<u>Ground & Water Source Heat Pumps:</u>						
Original heat source (Electricity or other (specify)):	_____	_____	_____	_____	_____	_____
Specify if open or closed loop:	_____	_____	_____	_____	_____	_____
Specify if water-to-air, water-to-water, or air-to-water:	_____	_____	_____	_____	_____	_____
Energy Efficiency Ratio (EER):	_____	_____	_____	_____	_____	_____
Coefficient Of Performance (COP):	_____	_____	_____	_____	_____	_____
System size [Btu/h]:	_____	_____	_____	_____	_____	_____

Nominal tons:	_____	_____	_____	_____	_____	_____
Hours of use for equipment (<i>Indicate the corresponding schedule number for each section</i>):	_____	_____	_____	_____	_____	_____
Total cooling full load hours [hr/yr]:	_____	_____	_____	_____	_____	_____
Total heating full load hours [hr/yr]:	_____	_____	_____	_____	_____	_____
Validate if the HVAC systems are still operational:	_____	_____	_____	_____	_____	_____
If no, why, and since when?	_____	_____	_____	_____	_____	_____

Refrigeration

Collect the information in the table below **if refrigeration measures were installed**. Use on-site observation and contact declaration. Use additional sheets if required. The information collected will then be compared with the information in the tracking sheet by Econoler.

Date of installation:

Equipment installed

Strip-curtains – Length installed [ft]:

Is the equipment still used?

If not, why and since when?

Cooler night covers – Length installed [ft]:

Is the equipment still used?

If not, why and since when?

Open to closed cooler conversion – Length installed [ft]:

Is the equipment still used?

If not, why and since when?

Was the original equipment replaced an open multi-deck cooler?

Zero-energy doors and frames (Reach-in type)
– Number of doors:

Is the equipment still used?

If not, why and since when?

Hours of use [hr/yr]:

Door/frame heater controls (Humidity-based) –
Number of doors controlled:

Is the equipment still used?

If not, why and since when?

Hours of use [hr/yr]:

Evaporator fan motor controllers – Number of controllers:

Is the equipment still used?

If not, why and since when?

Hours of use [hr/yr]:

Does the control system turn off evaporator fans at least 70% of the time when the compressor is not running?

Does the control system reduce the evaporator fan air flow while compressors are in their off-cycle and while no refrigerant is flowing through the evaporator?

Does the control system control a minimum fan load of 1/20 hp when fans operate at full speed.

Intelligent freezer defrost controllers (for walk-in freezer evaporator coils) – Number of controllers:

Is the equipment still used?

If not, why and since when?

Hours of use [hr/yr]:

Do the controllers control the defrost cycle of 3 or more evaporator fans?

Outside air economizers for walk-in coolers – Number of economizers:

Is the equipment still used?

If not, why and since when?

Hours of use [hr/yr]:

Is the walk-in cooler 1000 cu. Ft. or large?

Refrigerated vending machine controllers –
Number of controllers:

Is the equipment still used?

If not, why and since when?

Do the controllers use occupancy sensor
based controls to de-energize refrigerated
vending machines when the surrounding
area is not occupied?

Hours of use [hr/yr]:

Agriculture

Collect the information in the table below **if agriculture measures were installed**. Use on-site observation and contact declaration. Use additional sheets if required. The information collected will then be compared with the information in the tracking sheet by Econoler.

Date of installation:

High Efficiency Fans

Ventilation fan – Number installed:

Is the equipment still used?

If not, why and since when?

Size of the fans [inches]:

Ventilating Efficiency Ratio (VER) [cfm/watt]:

Hours of use [hr/yr]:

Circulation fan – Number installed:

Is the equipment still used?

If not, why and since when?

Size of the fans [inches]:

Thrust Efficiency Ratio (TER) [lbs/kW]:

Hours of use [hr/yr]:

High volume speed fan – Number installed:

Is the equipment still used?

If not, why and since when?

Size of the fans [feet]:

Hours of use [hr/yr]:

Livestock Waterers

Livestock waterer – Number installed:

Is the equipment still used?

If not, why and since when?

Wattage [W]:

Does it contain an adjustable thermostat?

Agriculture Heat Pads

Agriculture heat pad – Number installed:

Is the equipment still used?

If not, why and since when?

Single or double?

Wattage [W]:

Does it replace incandescent heat lamps?

Engine Block Heater Equipment

Engine block heater timer – Number installed:

Is the equipment still used?

If not, why and since when?

Engine block heater wattage [W]:

Dairy Farm Equipment

Dairy scroll compressor – Number installed:

Compressor HP:

Milk pre-cooler/heat recover – Number installed:

Pre-cooler or heat recover?

Number of cows milked:

VSD on milk vacuum pump – Number installed:

Number of cows milked:

Milking setup (parlor or tie stall):

Pump type (rotary vane or blower):

Number of HP controlled:

Validate that it does not replace an existing
VSD:

Compressed Air

Collect the information in the table below **if compressed air measures were installed**. Use on-site observation and contact declaration. Use additional sheets if required. The information collected will then be compared with the information in the tracking sheet by Econoler.

Date of installation:

Compressed Air Products Installed

Cycling refrigerated air dryer – Number installed:

Is the equipment still used?

If not, why and since when?

Dryer capacity [cfm]:

Compressor operation [hr/week]:

Does the cycling refrigerated air dryer automatically turn on and off in response to load instead of running continuously?

VSD screw compressor – Number installed:

Is the equipment still used?

If not, why and since when?

Hp rating [hp]:

Compressor operation [hr/week]:

Air-entraining air nozzle – Number installed:

Is the equipment still used?

If not, why and since when?

Compressor type:

Capacity [cfm]:

Compressor operation [hr/week]:

No-loss drain – Number installed:

Is the equipment still used?

If not, why and since when?

Compressor type:

System pressure [psi]:

Compressor operation [hr/week]:

Air tank for load / No-load screw compressor –
Number installed:

Is the equipment still used?

If not, why and since when?

Compressor type:

Compressor hp rating [hp]:

Air receiver tank size [gallons]:

Compressor operation [hr/week]:

Kitchen

Collect the information in the table below **if commercial kitchen measures** were installed. Use on-site observation and contact declaration. Use additional sheets if required. The information collected will then be compared with the information in the tracking sheet by Econoler.

Date of installation:

Commercial Dish Washers Installed (Low T°)

Under-counter commercial dish washer –
Number installed:

Manufacturer:

Model number:

Is the equipment used for commercial
purpose?

Is the equipment still used?

If not, why and since when?

Does it use electricity heated hot water?

Validate the equipment is ENERGY STAR
rated:

Operation [days/year]:

Operation [number of racks washed/day]:

Single-tank door type commercial dish washer –
Number installed:

Manufacturer:

Model number:

Is the equipment used for commercial
purpose?

Is the equipment still used?

If not, why and since when?

Does it use electricity heated hot water?

Validate the equipment is ENERGY STAR
rated:

Operation [days/year]:

Operation [number of racks washed/day]:

Single/Multi-tank conveyor commercial dish
washer – Number installed:

Specify if single or multi-tank:

Manufacturer:

Model number:

Is the equipment used for commercial
purpose?

Is the equipment still used?

If not, why and since when?

Does it use electricity heated hot water?

Validate the equipment is ENERGY STAR
rated:

Operation [days/year]:

Operation [number of racks washed/day]:

Commercial Dish Washers Installed (High T°)

Under-counter commercial dish washer –
Number installed:

Manufacturer:

Model number:

Is the equipment used for commercial
purpose?

Is the equipment still used?

If not, why and since when?

Does it use electricity heated hot water?

Validate the equipment is ENERGY STAR
rated:

Does it use a built-in booster heater?

If yes, specify booster water heater fuel type:

Operation [days/year]:

Operation [number of racks washed/day]:	_____
Single-tank door type commercial dish washer – Number installed:	_____
Manufacturer:	_____
Model number:	_____
Is the equipment used for commercial purpose?	_____
Is the equipment still used?	_____
If not, why and since when?	_____
Does it use electricity heated hot water?	_____
Validate the equipment is ENERGY STAR rated:	_____
Does it use a built-in booster heater?	_____
If yes, specify booster water heater fuel type:	_____
Operation [days/year]:	_____
Operation [number of racks washed/day]:	_____
Single/Multi-tank conveyor commercial dish washer – Number installed:	_____
Specify if sigle or multi-tank?	_____
Manufacturer:	_____
Model number:	_____
Is the equipment used for commercial purpose?	_____
Is the equipment still used?	_____
If not, why and since when?	_____
Does it use electricity heated hot water?	_____
Validate the equipment is ENERGY STAR rated:	_____
Does it use a built-in booster heater?	_____
If yes, specify booster water heater fuel type:	_____

Operation [days/year]:

Operation [number of racks washed/day]:

Commercial Fryers

Standard capacity commercial fryer – Number installed:

Specify if electric or gas?

Does it replace an electric fryer?

Is it a new installation?

Is the equipment still used?

If not, why and since when?

Validate the equipment is ENERGY STAR rated:

Operation [days/year]:

Operation [hours/day]:

Commercial Hot Food Holding Cabinet

Commercial hot food holding cabinet – Interior volume [ft³]:

Specify if ½, ¾ or full size?

Is the equipment still used?

If not, why and since when?

Validate the equipment is ENERGY STAR rated:

Operation [days/year]:

Operation [hours/day]:

Commercial Griddles

Commercial griddle – Length installed [ft]:

Specify if electric or gas?

Does it replace an electric griddle?

Is it a new installation?

Is the equipment still used?

If not, why and since when?

Validate the equipment is ENERGY STAR rated:

Operation [days/year]:

Operation [hours/day]:

Commercial Refrigeration

Commercial refrigeration – Volume installed in cubic feet [ft³]:

Specify if solid door or glass door:

Manufacturer:

Model number:

Is it a standalone unit?

Does it replace an existing solid door refrigerator?

Does it replace an existing glass door refrigerator?

Is the equipment still used?

If not, why and since when?

Validate the equipment is ENERGY STAR rated:

Commercial Freezers

Commercial freezer – Volume installed in cubic feet [ft³]:

Specify if solid door or glass door:

Manufacturer:

Model number:

Is it a standalone unit?

Does it replace an existing solid door freezer?

Does it replace an existing glass door freezer?

Is the equipment still used?

If not, why and since when?

Validate the equipment is ENERGY STAR rated:

Commercial Ice Makers

Ice making head – Number installed:

Manufacturer:

Model number:

Harvest [lbs/day]:

Is the equipment still used?

If not, why and since when?

Does it replace non- ENERGY STAR ice maker?

Validate the equipment is ENERGY STAR rated:

Remote condensing unit – Number installed:

Manufacturer:

Model number:

Harvest [lbs/day]:

Is the equipment still used?

If not, why and since when?

Does it replace non- ENERGY STAR ice maker?

Validate the equipment is ENERGY STAR rated:

Self-contained – Number installed:

Manufacturer:

Model number:

Harvest [lbs/day]:

Is the equipment still used?

If not, why and since when?

Does it replace non- ENERGY STAR ice maker?

Validate the equipment is ENERGY STAR rated:

Commercial Convection Ovens

Standard convection commercial oven –
Number installed:

Specify if electric or gas:

Specify if full size or half size:

Oven efficiency:

Idle [kW]:

Pre-heat[kW]:

Is the equipment still used?

If not, why and since when?

Does it replace an electric convection oven?

Is it a new installation?

Validate the equipment is ENERGY STAR rated:

Commercial Kitchen Ventilation Hoods

VSD for kitchen exhaust fans – Number
installed:

Size of the fan controlled by the VSD [hp]:

Is the equipment still used?

If not, why and since when?

Is the equipment controlled by T° and
optical sensors located in exhaust hood?

Operation [hours/year]:

Laundry

Collect the information in the table below **if commercial laundry measures** were installed. Use on-site observation and contact declaration. Use additional sheets if required. The information collected will then be compared with the information in the tracking sheet by Econoler.

Date of installation: _____

Water heating source: _____

Commercial Washing Machines Installed

ENERGY STAR commercial washing machine –
Number installed: _____

Manufacturer: _____

Model number: _____

Size [cubic feet]: _____

Is the equipment used for commercial
purpose? _____

Is the equipment still used? _____

If not, why and since when? _____

Validate the equipment is ENERGY STAR
rated: _____

Operation [cycles/week]: _____

CEE Tier 2 commercial washing machine –
Number installed: _____

Manufacturer: _____

Model number: _____

Size [cubic feet]: _____

Is the equipment used for commercial
purpose? _____

Is the equipment still used? _____

If not, why and since when? _____

Validate the equipment is CEE Tier 2 listed: _____

Operation [cycles/week]: _____

CEE Tier 3 commercial washing machine –
Number installed:

Manufacturer:

Model number:

Size [cubic feet]:

Is the equipment used for commercial
purpose?

Is the equipment still used?

If not, why and since when?

Validate the equipment is CEE Tier 3 listed:

Operation [cycles/week]:

APPENDIX IV – FIRMOGRAPHICS

The profile of the program participants interviewed for the survey is presented in the following tables.

Energy costs account for 14.7% of the annual operating budget on average.

Table 43: Energy Costs as a Percentage of Annual Operating Budget

Percentage of Budget	2011 (#*)	2012 (%*)
<i>Sample Size</i>	<i>15</i>	<i>43</i>
Less than 10%	6	37%
10-19%	2	26%
20% or more	7	37%
Don't know	--	--
Average Percentage	20.3%	14.7%
*Don't know removed from table		

Farming (23%), property management (13%) and food manufacturing (9%) make up the top three activities conducted by participants.

Table 44: Principal Building Activity

Principal Building Activity	2011 (%)	2012 (%)
<i>Sample Size</i>	<i>43</i>	<i>56</i>
Farming	7%	23%
Property management	14%	13%
Food processing/manufacturing	5%	9%
Service	--	7%
Manufacturing	9%	4%
Government	7%	4%
Food service (restaurant)	5%	4%
Lodging	2%	4%
Office	--	4%
Automotive repair	--	4%
Education	--	4%
Transportation	--	4%
Retail (other than mall)	19%	2%
Mercantile/Retail (enclosed and strip malls)	2%	2%
Food sales (grocery)	2%	2%
Religious worship	--	2%
Health care – inpatient	--	2%
Electrical distribution	7%	--
Health care – outpatient	2%	--
Warehouse/storage	2%	--
Public assembly	--	--
Commercial property services	--	--
Forestry	--	--
Others	16%	11%

One-third of participants employ fewer than five full-time workers (32%).

Table 45: Full-Time Equivalent Workers

Full-Time Employees	2011 (%)	2012 (%)
<i>Sample Size</i>	43	56
Fewer than 5	21%	32%
5 to 9	9%	14%
10 to 19	14%	14%
20 to 49	12%	18%
50 to 99	12%	4%
100 to 249	12%	4%
250 or more	16%	13%
Don't know	5%	2%

Eight in ten participants are from an independent company (80%), while 16% are part of a larger company.

Table 46: Type of Company

Type of Company	2011 (%)	2012 (%)
<i>Sample Size</i>	43	56
Independent	67%	80%
Part of a larger company	30%	16%
Don't know	2%	4%

The majority (86%) of participating companies have between one and five facilities in Nova Scotia.

Table 47: Number of Facilities in Nova Scotia

Number of Facilities	2011 (%)	2012 (%)
<i>Sample Size</i>	43	56
1-5	72%	86%
6 or more	21%	13%
Don't know	7%	2%
Average*	6.5	10.9
*Don't know removed from calculation		

APPENDIX V – PARTICIPANT SURVEY QUESTIONNAIRE

Participant Survey

ENSC Business Energy Rebates Program

October 18, 2012

Could I speak with [INSERT NAME]?

1. Yes [GO TO INTRODUCTION]
2. No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

[INTRODUCTION]

Hello, I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you or your firm recently participated in Efficiency Nova Scotia Corporation’s Business Energy Rebates Program. We would appreciate your collaboration in answering questions related to your participation in this program. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve the program. The survey will take about fifteen minutes. Is this a good time for you?

Verification and Recall

- V1. Our records indicate that your company or organization participated in Efficiency Nova Scotia’s Business Energy Rebates Program. Is this correct?
1. Yes (Go TO V3)
 2. No
- V2. Is there someone else at your company or organization who would know about your company / organization’s participation in Efficiency Nova Scotia’s Business Energy Rebates Program?
1. Yes (Ask for name: _____ and telephone #: _____) (Thank and terminate; schedule interview with best contact)
 2. No (Thank and terminate)
- V3. Are you the person in your company or organization who is most knowledgeable about your experience with the Business Energy Rebates Program?
1. Yes (if YES go to P1)
 2. No

V4. We would like to talk to the person who is the most knowledgeable about your experience with the Business Energy Rebates Program. Could you give me the name and telephone number of this person? [Probe if respondent is unsure who best to forward the call to. This individual may be an engineer, equipment contractor, or utility account manager].

Name: _____

Telephone #: _____

(Note: Thank and terminate call. Schedule interview with best contact regarding experience with the program.)

V5. According to our information, through its participation in the Business Energy Rebates Program, your company or organization received a rebate of [Rebate] in the month of [DATE COMPLETED IN DSMDS] to install [MEASURE CATEGORY] measures. When answering the survey questions, please take into account this specific application.

Program Awareness and Participation [P series]

P1. Did your company or organization participate in any other Nova Scotia Power or Efficiency Nova Scotia programs before the Business Energy Rebates Program?

- 1. Yes
- 2. No (Go to P4)
- 98. (Don't know) (Go to P4)
- 99. (Refused) (Go to P4)

P2. [IF P1 = 1] Which programs did your company or organization participate in prior to the Business Energy Rebates Program? (DO NOT READ. If respondent cannot recall the program names record a short description verbatim.)

- 1. (Custom program)
- 2. (Small Business Energy Solutions (SBES))
- 3. (Commercial Direct Install (CDI))
- 4. (Smart Lighting Choices (SLC))
- 96. (Other, please specify: _____)
- 98. (Don't know)
- 99. (Refused)

- P4. How did you learn about the Business Energy Rebates Program? Probe: Anything else? [DO NOT READ - MULTIPLE RESPONSES]
1. From Efficiency Nova Scotia literature
 2. From Efficiency Nova Scotia presentation
 3. From Efficiency Nova Scotia staff person
 4. From Efficiency Nova Scotia's website
 5. From a contractor or vendor
 6. From a business associate or friend (word of mouth)
 7. From someone who had previously participated in the Business Energy Rebates Program
 97. Or some other way? (Please specify: _____)
 100. (Don't know)
 101. (Refused)
- P5. What was the SINGLE most important reason your company or organization chose to participate in the Business Energy Rebates program? (DO NOT READ – accept one response)
1. (to take advantage of program rebates)
 2. (this was part of an already planned project)
 3. (to save on energy/to save on energy costs)
 4. (to reduce maintenance costs)
 5. (to improve existing lighting conditions)
 6. (to find ways to reduce carbon footprint)
 7. (to help protect the environment)
 8. (to replace non-working equipment)
 9. (recommended by a contractor)
 10. (past participation in another utility program)
 96. (Other: Please Specify: _____)
 98. (Don't know) (Go to P7)
 99. (Refused) (Go to P7)
- P6. [DO NOT POSE IF 98 OR 99 IN Q.P5] What was SECOND most important reason your company or organization chose to participate in the program? (DO NOT READ – accept one response – SAME LIST AS P5)
- 96 No other reason

- P7. Some companies work with a design professional, project architect, engineer, equipment contractor, or a utility account manager as part of the project design phase. Who do you feel was most responsible for specifying the measures to install in your company or organization through the Business Energy Rebates Program? [RANDOMIZE AND READ - ACCEPT ONE RESPONSE]
1. Outside design professional (architect, engineer)
 2. Contractor
 3. Manufacturer representative
 4. Utility account manager
 5. Someone within your company / organization
 96. (Other, please specify: _____)
 98. (Don't know)
 97. No one specific group or person
 99. (Refused)
- P8. What ONE factor was most important in motivating your company or organization to install energy efficient [MEASURE CATEGORY] equipment or upgrades? (DO NOT READ – accept one response)
- P9. What factor was SECOND most important in motivating your company or organization to install energy efficient [MEASURE CATEGORY] equipment or upgrades? (DO NOT READ – accept one response)
1. (to take advantage of program rebates)
 2. (this was part of an already planned project)
 3. (to save on energy/to save on energy costs)
 4. (to reduce maintenance costs)
 5. (to improve existing lighting conditions)
 6. (to find ways to reduce carbon footprint)
 7. (to replace non-working equipment)
 8. (recommended by a contractor)
 9. (past participation in another utility program)
 10. (old equipment, replace prior to failure)
 11. (part of a building renovation or addition)
 12. (newly-constructed building)
 13. (Other: Please Specify: _____)
 98. (Don't know)
 99. (Refused)
 96. No other reason

Free-Ridership [FR Series]

FR1. Did your company or organization decide to implement the *energy-efficient* [MEASURE CATEGORY] measure before participating in the Business Energy Rebates Program?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

FR1a. IF FR1= YES, THEN ASK: I just want to make sure I understand - **Before** you decided to participate in the Efficiency Nova Scotia Business Energy Rebate Program, you had already made the decision to install the *energy efficient* [MEASURE CATEGORY] measure.

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Business Energy Rebates Program.

If your company or organization had not participated in the Business Energy Rebates Program, what is the likelihood that you would have taken one of the following actions. Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action." AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT, In the absence of the Program, would you have . . . : DO NOT ACCEPT A RANGE – POSE FR2 SEQUENCE IN ORDER/DO NOT RANDOMIZE

FR2a. . . . installed exactly the same energy-efficient [MEASURE CATEGORY] equipment that you installed through the Program?

___ Response ___ 98 Don't Know ___ 99 Refused

FR2b. . . . installed standard [MEASURE CATEGORY] equipment instead of energy-efficient [MEASURE CATEGORY] equipment?

___ Response ___ 98 Don't Know ___ 99 Refused

FR2c. . . . installed the energy-efficient [MEASURE CATEGORY] equipment that you installed through the Program *but at a later date*?

___ Response ___ 98 Don't Know ___ 99 Refused

IF FR2c > 5, then ask:

FR2cc. DO NOT POSE FR2cc IF DON'T KNOW OR REFUSED IN Q.FR2c You indicated in your response to a previous question that if the Business Energy Rebates Program had not been available there was an [FR2c] in 10 likelihood that you would have installed the same equipment *but at a later date*. Approximately how many months later would you have installed this equipment? DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE

1. _____ months later
97. (At the same time)
98. (Don't Know)
99. (Refused)

IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2cc ANSWER IN MONTHS, READ:

Would it have been within...

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FR3. Efficiency Nova Scotia paid your company or organization \$[REBATE VALUE FROM SAMPLE BY CATEGORY] for the *energy-efficient* [MEASURE CATEGORY] measure. If your company had not received the rebate from Efficiency Nova Scotia, would you have paid for the full cost of the *energy-efficient* [MEASURE CATEGORY] measure, including the portion covered by the rebate? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Paid” and a 10 indicating that you “Definitely **Would Have** Paid.” PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE

____ Response ____ 98 Don't Know ____ 99 Refused

FR4. Next, I'm going to ask you to rate the importance of factors that might have influenced your decision to implement the *energy-efficient* [MEASURE CATEGORY] measure you implemented through the Business Energy Rebates Program. Using a scale from 0 to 10, where 0 means “Not at all important” and 10 means “Extremely important”, please rate the

importance of each of the following in your decision to implement the energy-efficient [MEASURE CATEGORY] measure you implemented through the Program.

Factor (READ AND RANDOMIZE)	Responses
a. The Efficiency Nova Scotia rebate(s)	___ Response ___98 Don't Know ___99 Refused
b. Information received during the initial contact by the program representative.	___ Response ___98 Don't Know ___99 Refused
c. Information provided through the Business Energy Rebates Program outreach and marketing activities	___ Response ___98 Don't Know ___99 Refused
d. Your company or organization's corporate policy or guidelines regarding the purchase of equipment	___ Response ___98 Don't Know ___99 Refused
e. The standard practice in your industry	___ Response ___98 Don't Know ___99 Refused
f. Previous experience with the Business Energy Rebates Program, or a similar program either from Efficiency Nova Scotia or Nova Scotia Power	___ Response ___98 Don't Know ___99 Refused

Satisfaction [S series]

S1. On a scale of 1 to 5, where 1='not at all satisfied' and 5='very satisfied', how was your company or organization's experience with each OF THE FOLLOWING aspects of the Business Energy Rebates Program? If your company / organization did not have experience with one of the aspects please tell me. [DO NOT RANDOMIZE] [97 = Not Applicable, 98 = Don't know, 99 = Refused] DO NOT ACCEPT A RANGE

1. The Program application, forms and associated paperwork
2. Interaction and communication with Efficiency Nova Scotia staff
3. Initial confirmation of eligibility
4. Rebate or incentive amounts
5. Time required to receive rebate or incentive
6. The program overall

-
- S2. [IF DISSATISFIED—S1.6= 1, 2 or 3] You indicated a score of [ANSWER S1.6] on a 5-point scale for your overall satisfaction with the program. For what reasons were you not satisfied with the program overall? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE]
1. (Too difficult to sign up/too much work)
 2. (Rebate/incentive is too small)
 3. (Too long before getting rebate)
 4. (I don't like the products/measures rebated)
 5. (ENS Staff were not helpful)
 96. (Other) [SPECIFY _____]
 98. (Don't know)
 99. (Refused)
- S3. Using a 5-point scale, where '1' is very difficult and '5' is very easy, how would you rate the process to participate in the program? [1-5 scale, 98 = Don't know/Don't recall, 99 = Refused]
- S4. [IF S3 = 1, 2 or 3] What was difficult about participating in the program? [MULTIPLE RESPONSE – RECORD VERBATIM] Probe: Anything else?
97. (Record answer)
 98. (Don't know)
 99. (Refused)
- S5. Have you recommended the Business Energy Rebate Program to another potential participant?
1. Yes
 2. No
 98. (Don't know)
 99. (Refused)
- S6. On a scale of 1 to 5, where 1='not at all likely' and 5='very likely', how likely will your company or organization be to purchase energy efficient products, including but not limited to energy efficient lighting, when installing or replacing energy-using products for your business in the future? [9=Don't know/Don't recall]

Barriers to Actions & Recommendations for Improvements

[B Series]

- B1. Were there any challenges or barriers that you faced in implementing the energy efficient measures for which you received a rebate from the Business Energy Rebates Program?
1. Yes
 2. No (SKIP TO B4)
 98. (Don't know) (SKIP TO B4)
 99. (Refused) (SKIP TO B4)
- B2. What was the SINGLE most important barrier? (DO NOT READ - ACCEPT ONE RESPONSE)
1. (concern that actual bill savings would be less than estimated)
 2. (lack of information to make an informed decision)
 3. (rebate/incentive was too little)
 4. (paperwork/process required too much work)
 5. (too little information about the program)
 6. (cost savings not worth the effort of applying)
 7. (approval takes too long)
 8. (lack of financing)
 9. (energy efficient equipment does not meet payback requirements)
 10. (decision made elsewhere)
 11. (do not own building – have to work through owner)
 12. (lack of technical knowledge)
 13. (lack of time / too busy)
 14. (focused on core business)
 96. (Other – SPECIFY: _____)
 98. (Don't know) (Go to B4)
 99. (Refused) (Go to B4)
- B3. What was the SECOND most important barrier? (DO NOT READ - ACCEPT ONE RESPONSE – SAME LIST AS B2)
- B4. On a scale of 1 to 5, where 1= 'not at all important' and 5 = 'very important', how important is **reducing energy usage** to your company/organization? [98 = Don't know, 99 = Refused]
- B5. On a scale of 1 to 5, where 1= 'not at all important' and 5 = 'very important', how important is **managing energy costs** to your company/organization? [98 = Don't know, 99 = Refused]

- B6. Do you have any suggestions on how to improve the Business Energy Rebates Program? Consider all aspects of the program: process, measures covered, marketing, interactions with utility staff, and program forms. PROBE: Anything else?
1. (Provide more information/information sessions)
 2. (Better marketing/awareness)
 3. (More direct contact with customer)
 4. (Increase/better rebates)
 5. (Clarify which products are eligible for rebates)
 6. (Make forms more user-friendly)
 7. (ENS staff should be more knowledgeable)
 8. (No recommendation)
 96. (Other [SPECIFY _____])

Firmographics [F Series]

These final questions are asked for statistical purposes only. The information collected is strictly confidential.

- F1. What is the main activity of your company? [DO NOT READ—BUT CONFIRM WITH RESPONDENT THAT THE CATEGORY YOU CHOOSE IS CORRECT]
1. Education
 2. Food Sales (grocery)
 3. Food Service (restaurant)
 4. Health Care - Inpatient
 5. Health Care - Outpatient
 6. Lodging
 7. Mercantile— Retail (Enclosed and Strip Malls)
 8. Mercantile – Retail (Other than Mall)
 9. Office
 10. Public Assembly
 11. Public Order and Safety
 12. Religious Worship
 13. Service
 14. Warehouse / storage
 15. Manufacturing
 16. Building is vacant
 17. Agriculture
 18. Other (SPECIFY: _____)
 98. (Don't know)
 99. (Refused)

F2. Energy costs account for approximately what percentage of your organizations' annual operating budget? [998 = Don't know, 999 = Refused] PROBE TO RECEIVE A SPECIFIC RESPONSE, AND ACCEPT A RANGE ONLY IF NECESSARY

____ %

F3. Approximately how many full-time equivalent workers DOES YOUR COMPANY OR ORGANIZATION employ at all locations within Nova Scotia? DO NOT READ, CODE APPROPRIATE CATEGORY

1. Fewer than 5
2. 5 to 9
3. 10 to 19
4. 20 to 49
5. 50 to 99
6. 100 to 249
7. 250 or more
98. (Don't know)
99. (Refused)

F5. Is your company independent, or part of a larger company?

1. Independent
2. Part of a larger company
96. Other (_____)
98. (Don't know)
99. (Refused)

F6. How many business locations does your organization have in Nova Scotia? [RECORD A NUMBER 1-99; 998 = Don't know, 999 = Refused]

END. Those are all the questions I have for you. I thank you very much for your time and cooperation and have a nice day!

APPENDIX VI – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

FR2a. If your company had not participated in the program, what is the likelihood that you would have installed exactly the same energy-efficient equipment that you installed through the program? (Scale 0 to 10)	IF Pre-FR3 = Yes: FR2a = (Answer x 10%) / 2 OTHERWISE: FR2a = Answer x 10%
FR2b. If your company had not participated in the program, what is the likelihood that you would have installed standard equipment instead of energy-efficient equipment? (Scale 0 to 10)	IF Pre-FR1 = No: FR2b = (10 – Answer) x 10% / 2 OTHERWISE: FR2b = (10 – Answer) x 10%
PA1 Score:	MEAN VALUE OF: (FR2a ; FR2b)
FR1. Did your company decide to implement the energy efficiency measures before participating in the program?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just to make sure I understand - Before you decided to participate in the program, you had already made the decision to install the energy efficiency measures?	IF 1. Yes: FR1 = 100% IF 2 OR 9 : FR1 = 0% IF PRE-SCREENING FR1 = 0%
FR3. If your company had not received the rebate from ENSC, would you have paid for the full cost of the energy efficiency measures, including the portion covered by the rebate? (Scale 0 to 10)	FR3 = Answer x 10%
PA2 Score:	IF FR1 = 0% : FR3 / 2 IF FR1 = 100% : FR3
FR4. Level of influence (Scale 0 to 10) Factors a, b, c and f = Program factors Factors d and e = Non Program factors	FR4_P = SUM(a; b; c; f) FR4_NP = SUM(d; e)
PA3 Score:	100% - [FR4_P/(FR4_P+FR4_NP)]
FR2c. If your company had not participated in the program, what is the likelihood that you would have installed the energy-efficient equipment but at a later date ? (Scale 0 to 10)	IF FR2c > 5 : ASK FR2cc Otherwise: PA4 = EMPTY
FR2cc. Approximately how many months later would you have installed this equipment? 1. Less than 6 months? 2. 6 months to less than 1 year later? 3. 1 to less than 2 years later? 4. 2 to less than 3 years later? 5. 3 to less than 4 years later? 6. 4 or more years later? 7. (Never) 9. (Don't know / Refused)	IF 1. : FR2cc = 100% IF 2. : FR2cc = 50% IF 3. : FR2cc = 25% IF 4. : FR2cc = 0% IF 5. : FR2cc = 0% IF 6. : FR2cc = 0% IF 7. : FR2cc = 0% IF 9. : FR2cc = 0%
PA4 Score:	IF Pre-FR2 = Yes: FR2cc/2 OTHERWISE: FR2cc
Final Free-Ridership	MEAN VALUE OF : (PA1 ; PA2 ; PA3 ; PA4)
Inconsistency Test #1	IF ABS(FR2a – FR2b) ≥ 30%: PA1 = MIN OF (FR2a ; FR2b)
Inconsistency Test #2	IF FR3 ≥ 70% AND IF (FR2a OR FR2b < 70%: PA2 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)

APPENDIX VII – CALCULATION EXAMPLE

This Appendix presents a sample worksheet showing step-by-step calculations that support results for one of the projects reviewed under the impact evaluation of the BER mail-in rebate. First, the equations used for the savings calculations are presented, followed by the tracked savings estimated by ENSC and the savings results that were revised during this evaluation, mainly based on on-site visit results and documentation analysis.

The project chosen for the example is part the HVAC measure category, which corresponds to the main category of the BER mail-in rebate in terms of participation and savings. This project includes the replacement of an electric baseboard heating system with two heat pump units.

Savings Equations

For each heat pump with a capacity of less than 65,000 Btu/hr., as is the case in this example, the savings were calculated using the following equations:

$$\text{Annual Demand Savings} \left[\frac{kW}{\text{year}} \right] = \text{Capacity} \times \left(\frac{1}{HSPF_{Base}} - \frac{1}{HSPF_{EE}} \right)$$

$$\text{Annual Energy Savings}_h \left[\frac{kWh}{\text{year}} \right] = \text{Capacity} \times \left(\frac{1}{HSPF_{Base}} - \frac{1}{HSPF_{EE}} \right) \times \text{Full Load Hours}_h$$

$$\text{Annual Energy Savings}_c \left[\frac{kWh}{\text{year}} \right] = \text{Capacity} \times \left(\frac{1}{SEER_{Base}} - \frac{1}{SEER_{EE}} \right) \times \text{Full Load Hours}_c$$

Where:

19. the h subscript means “heating” and the c subscript means “cooling”;
20. the capacity represents the real capacity of the heat pump installed in Btu/hr.;
21. the HSPF_{Base} represents the Heating Seasonal Performance Factors of the base measure;
22. the HSPF_{EE} for the new energy-efficient heat pump installed is based on the information provided on the specification sheet and adjusted for the region V;
23. and two different annual full load hours are used for both heating and cooling energy savings.

Tracked Savings Calculations

For each heat pump unit of the selected project, ENSC proceeded to calculate energy and demand savings with the information available on the worksheet submitted by the participant, as well as on the heat pump specification sheets. HSPF values for region IV, as provided on the manufacturer’s specification sheet, were adjusted for region V, which Nova Scotia is a part of, by dividing them by a

factor of 1.15. The value of 1.15 is what is generally used by other organizations, including Natural Resources Canada²². The HSPF values of the two heat pumps studies (respectively of 9.1 and 9.2 for region IV) were therefore adjusted to respectively 7.91 and 8.00 to take into account the climate for region V.

The table below presents the values used by ENSC in their calculations. The baseline HSPF is based on electric heating, while the baseline SEER (for heating) corresponds to the minimal performance for an air conditioning unit required by the government as of 2012. These values are defined in the evaluation plan.

Parameter	Unit 1	Unit 2	Source
Capacity (kBTU/h)	18	18	Participant worksheet
HSPF _{Base} (BTU/W·h)	3.416	3.416	Baseline for electric baseboard heating
HSPF _{EE} (BTU/W·h)	7.91	8.00	Product specifications
SEER _{Base} (BTU/W·h)	13	13	Standard efficiency
SEER _{EE} (BTU/W·h)	16.3	19.5	Product specifications
Full Load Hours in Heating (hr./year)	2728	2728	Participant worksheet
Full Load Hours in Cooling (hr./year)	312	312	Participant worksheet
Tracked Demand Savings (kW)	2.99	3.02	Calculation
	6.01		
Tracked Energy Savings (kWh)	8,259	8,385	Calculation
	16,644		

Revised Savings Calculations

Econoler based their savings review on the result of the on-site visit conducted at the site where the heat pumps were installed and on documentation analysis. During the on-site visit, the following elements were verified: occupancy schedule, usage of existing heating and cooling systems, manufacturer and model number of the new heat pumps, number of heat pumps installed, nameplate information (SEER), and capacity of each unit.

For this project, no major discrepancies between the documentation used by ENSC and the on-site visit findings were noticed. The installed capacity of each unit and their number was validated and corresponded to values declared by the participant. However, a small adjustment was made to the HSPF_{Base}, as it seemed that the value used by ENSC contained a typo. The correct value is

²² Natural Resources Canada, Air Conditioners and Heat Pumps under 19kW (65,000 Btu/h) - March 2005, <<http://oee.nrcan.gc.ca/regulations/2166>>

3.142 BTU/W·h, which corresponds to the seasonal efficiency of an electric baseboard (100% of electricity converted to heat). A second adjustment was made on full load hours. Econoler used 2,200 hours per year for heating and 800 hours per year for cooling as default values for all HVAC projects, as suggested by Efficiency Vermont. The on-site visits demonstrated that very few participants were able to provide a reliable value for full load hours, and so it appears that applying the estimate provided by Efficiency Vermont to all projects is more suitable. Nevertheless, the Evaluator is aware that the real values for full load hours vary significantly depending on the building's characteristics, and consequently made recommendations in this report to improve the estimate of this number.

Therefore, the following revised values were used by Econoler in the calculation of evaluated savings.

Parameter	Unit 1	Unit 2	
Capacity (kBTU/h)	18	18	Participant worksheet
HSPF _{Base} (BTU/W·h)	3.412	3.412	Baseline for electric baseboard heating
HSPF _{EE} (BTU/W·h)	7.91	8.00	Product specifications
SEER _{Base} (BTU/W·h)	13	13	Evaluation plan
SEER _{EE} (BTU/W·h)	16.3	19.5	Product specifications
Full Load Hours in Heating (hr./year)	2,200	2,200	Efficiency Vermont
Full Load Hours in Cooling (hr./year)	800	800	Efficiency Vermont
Tracked Demand Savings (kW)	3.00	3.03	Calculation
	6.03		
Tracked Energy Savings (kWh)	6,826	7,025	Calculation
	13,851		

Adjustment ratios

The modification to the HSPF_{Base} value had an insignificant impact on revised energy and demand savings. However, the adjustments to full load hours lead to a decrease in total annual energy savings, as heating savings are more important than cooling savings. Thus, the energy saving adjustment ratio calculated for this project is of 0.83:

$$\text{Adjustment Ratio on Energy Savings}_{\text{Project}} = \frac{\text{Revised kWh}}{\text{Tracked kWh}} = \frac{13,851 \text{ kWh}}{16,644 \text{ kWh}} = 0.83$$

This ratio was used, along with those calculated for all other projects reviewed during this evaluation, to calculate a weight-averaged adjustment ratio that was then applied to all projects of the HVAC measure category.



CUSTOM RETROFIT

IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 6, 2013



ECONOLER

ACRONYMS

BES	Business Energy Solutions
BNI	Business, Non-profit and Institutional
CATI	Computer-Assisted Telephone Interviewing
CRA	Corporate Research Associates
DSMDS	Demand-Side Management Data System
EMIS	Energy Management Information System
ENSC	Efficiency Nova Scotia Corporation
HST	Harmonised Sales Tax
HVAC	Heating, Ventilating and Air Conditioning
IREP	Ice Rink Energy Program
M & V	Measurement and Verification
NTGR	Net-to-Gross Ratio
NRCan	Natural Resources Canada
NSPI	Nova Scotia Power Incorporated
NVP	Net Present Value
OPA	Ontario Power Authority
PDA	Project Development Agreement
PM	Program Manager

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Diversity factor	The ratio of the sum of the individual maximum demands of the various subsystems to the maximum demand of the whole system.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.

Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Spillover (internal)	Percentage of savings attributable to participants who continue to implement the energy efficiency measures introduced by a program after participating in it once, without participating in the program a second time.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Custom Retrofit, which is a component of the Custom program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM) and two consultants, 31 on-site visits and one telephone survey with 27 participants.

PROGRAM OVERVIEW

Custom Retrofit by Efficiency Nova Scotia Corporation (ENSC) provides large business, non-profit and institutional (BNI) customers with technical assistance, financial incentives and project financing to help reduce their electricity consumption and demand. By offering these services, Custom Retrofit targets retrofit projects aimed at increasing energy efficiency of the existing equipment.

Custom Retrofit provides eligible ENSC customers with incentives to help them conduct scoping and feasibility studies, implement technical changes in their facilities, and carry out the required measurement and verification (M&V) of project performance. In contrast to other ENSC programs, Custom Retrofit has been designed to serve projects requiring a customized approach.

Custom Retrofit comprises two components, with one targeting retrofit projects and the other targeting new construction or major renovations to the existing buildings. In 2012, the Custom Retrofit and Custom New Construction components were evaluated separately.

Custom Retrofit aimed to generate 26.3 GWh in net electricity savings and 3.7 MW in demand savings for 2012.

KEY FINDINGS

The 2012 evaluation of Custom Retrofit demonstrated that the program has many desirable strengths and is producing satisfactory results. For the year of 2012, the program saw a total of 155 projects implemented, similar to the year of 2011 (159 projects). In terms of net energy savings, the program generated 28.941 GWh in 2012, similar to those of 2011 (30.323 GWh), but represented a considerable increase compared to 2010 (19.413 GWh). In 2012, 3.490 MW was achieved in peak demand savings.

Awareness

Program awareness constitutes an important aspect of the program strategy in ensuring program continuity in the years to come. The evaluation revealed that the main source of awareness for Custom Retrofit was ENSC's marketing outreach and activities (ENSC staff, presentations, website and literature), by which 41 percent of participants found out about the program. In addition to ENSC's actions, contractors and vendors also served as an important source of awareness by providing

37 percent of the participants with program information. The validated importance of ENSC and contractors/vendors in promoting program awareness is a positive outcome of ENSC's actions in following the Evaluator's 2011 recommendations about enhancing program awareness and continuing to collaborate with contractors and design professionals to promote the program.

Satisfaction

On one hand, as with its performance in 2011, satisfaction with Custom Retrofit was still strong for the year of 2012, as revealed by the 2012 evaluation, with the vast majority of participants reporting being satisfied with the program overall. In addition, satisfaction with the interaction and communication with consultants has increased compared to 2011, which would indicate that ENSC's efforts in involving professionals in program promotion were successful. In fact, in 2012, the PM initiated training and awareness activities, partnerships were established with HVAC contractors, and the BNI sector created a business development team whose mission is to promote and inform distributors about this and other BNI programs.

On the other hand, wait times required to confirm eligibility and receive rebates were the two aspects receiving the lowest satisfaction ratings. In this regard, one consultant interviewed under the Custom Retrofit evaluation corroborated this by underlining the long wait times before receiving the incentives. Despite the above, satisfaction was generally strong.

Program Energy Savings

To calculate the net savings of Custom Retrofit in 2012, the Evaluator used an approach that involved conducting on-site visits of sample projects and in-depth interviews with sample participants. Then, the Evaluator calculated the gross energy and peak demand savings for all the sample projects based on the specific characteristics of each project type. These calculation results allowed establishing the adjustment factors to be used to estimate the overall gross savings.

Afterwards, the Evaluator determined the appropriate net-to-gross ratios (NTGRs) to be applied by evaluating the free-ridership and internal spillover effects. With this approach, a free-ridership level of 9 percent was established, which represents a slight increase compared to that of 2011 (7 percent). No potential spillover was identified. The NTGR allowed calculating the net energy and peak demand savings of Custom Retrofit for 2012. The details of the NTGR calculations are presented in the following table.

Table 1: Distortion Effects and Net-to-Gross Ratio

Distortion Factors	2012
Free-Ridership Level	9%
Spillover Level	0%
Net-to-Gross Ratio	0.91

The evaluation revealed that Custom Retrofit generated 28.941 GWh in net energy savings at the generator in 2012. As for electricity demand reduction, the program achieved 3.490 MW in net peak demand savings at the generator in 2012. The following table presents Custom Retrofit savings, along with the savings targets and the savings tracked by ENSC for 2012.

Table 2: 2012 Net Savings at the Generator of Custom Retrofit

	Initial Gross Savings	Adjusted Gross Savings	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	32.536 GWh	31.885 GWh	0.93	29.653 GWh
Evaluation Results	32.536 GWh	31.803 GWh	0.91	28.941 GWh
Demand Savings				
Tracked Savings from ENSC	3.300 MW	3.383 MW	0.93	3.146 MW
Evaluation Results	3.300 MW	3.836 MW	0.91	3.490 MW

As shown in the table above, the adjusted gross energy savings of Custom Retrofit were lower than those tracked by ENSC by approximately 0.25 percent. The Evaluator made some minor adjustments to ENSC's energy savings, due to issues found in interactive effect calculations under lighting retrofit projects or small discrepancies in energy efficiency equipment count observed during the on-site visits. The overall gross energy savings adjustment factor calculated for 2012 (0.977) turned out to be very similar to the one used by ENSC for internal monitoring (0.980). The 2012 net energy savings following the adjustment by Econoler were 2.4 percent lower than ENSC's figure because the free-ridership level set for 2012 was 2 percent higher than that of 2011. Nevertheless, the Evaluator believes that the free-ridership level of Custom Retrofit is under control and remains consistent with the special characteristics of the participants in such a custom program. In short, Econoler considers the 2012 energy savings adjustment factors to be minor and thereby the energy savings tracking process for Custom Retrofit quite efficient in 2012.

With regard to gross demand savings, the evaluated values were higher than those tracked by ENSC by approximately 13 percent. The main reason for this is that Econoler adjusted upward a number of diversity factors used for computing the peak demand savings of the sample projects, based on the equipment's operating conditions. The Evaluator considers that the diversity factors used by ENSC were sometimes too conservative and not tailored to the actual energy efficiency equipment operations. Finally, the difference between ENSC's and Econoler's net demand savings decreased to almost 11 percent because of the higher free-ridership percentage of 2012.

RECOMMENDATIONS

Econoler has found that Custom Retrofit has many desirable strengths and is producing satisfactory results. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator makes specific recommendations at various places in the report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- Custom-R1. Consider diverting or assigning a proportion of the simple lighting retrofit projects to other prescriptive measure programs:** When reviewing the project list of 2012, Econoler noticed a high percentage of simple projects, i.e. projects involving only one or a limited number of different energy efficiency measures. For instance, the projects including only lighting retrofit accounted for almost 60 percent of the projects claiming savings in 2012 and achieved more than 52 percent of these savings. Many of these projects are small or medium lighting retrofits that could have been supported by other BNI programs, such as Business Energy Solutions (BES). When possible, the Evaluator therefore recommends diverting and assigning other such upcoming simple projects to other BNI programs so that they could be tracked and managed in a more efficient and cost-effective way.
- Custom-R2. Improve tracking on implemented measures and savings:** In several projects whose expected savings had been calculated in a feasibility study prepared by a third-party consultant, there was no clear statement on which measures were selected for implementation by the participant. Figure 3 of PDA Form 4 often provided some information about this, but for a number of projects the Figure 3 was not filled out or did not give the full details, which prevented knowing about the exact energy efficiency measures implemented. Consequently, the Evaluator had to investigate the status of project implementation during on-site visits, which might cause errors, especially when the person met during the visit knew little about the project or did not have an adequate understanding of all the technical aspects of the measures implemented. Thus, the Evaluator suggests that ENSC improve the tracking on the list of measures implemented and the savings related to each measure for every participating project.
- Custom-R3. Improve the method for diversity factor calculations and document the assumptions used:** When reviewing the project gross impacts, Econoler observed that diversity factors used by ENSC were generally obtained by dividing annual operation hours by the total of hours in one year (8760). This practice is very conservative and does not reflect the reality. Since an operating schedule is available for each project, it is possible to refine this calculation method by excluding the number of hours during which the facility is closed, or in some cases by taking into consideration that the equipment operates continuously during the peak demand hours.

- Custom-R4. Promote more active and extensive use of the M&V procedures:** Standard Custom Retrofit projects must have an M&V plan compliant with the IPMVP (Section 6.7 of the program manual). For the majority of the 31 projects evaluated, the Evaluator did not observe any satisfactory M&V plans or reports during the in-depth reviews of the sample projects. Although M&V requires both the participant and ENSC to spend time and money, these additional resources would add key value to projects that yield such significant savings. As a major priority, M&V should thus be first and foremost conducted on large projects. In addition, M&V should be conducted on projects for which the savings to be realized depend heavily on equipment operating conditions, namely those involving industrial components such as compressors, variable speed drives and manufacturing equipment. As it was proposed in 2011, basic M&V procedures for any particular project should be defined at the earliest stage of project planning and execution (e.g. PDA signature) to ensure that baseline consumption data are metered (if required) before energy efficiency measures are implemented. This would greatly facilitate M&V activities and reduce their costs.
- Custom-R5. Consider performing independent M&V on Custom Retrofit projects that are already carrying out M&V:** The Evaluator believes that this recommendation from the 2011 report is still applicable. In fact, ENSC should consider performing independent M&V on projects where the implementation firm has already planned to conduct M&V within its project scope. It is possible that such M&V performed by implementation firms will not be in compliance with the IPMVP. It is also likely that such M&V will cover measures both eligible and ineligible for the Custom Retrofit program and that it is impossible to distinguish between them in the M&V results. In addition, assigning the sole responsibility of M&V to the firm that also implements the project may be risky. To reduce this risk, the Evaluator recommends that ENSC perform an independent M&V on such projects. A minimum threshold of energy savings (e.g. 500 MWh/year) could also be established to differentiate projects that automatically require independent M&V from those for which it is optional.

1 PROGRAM DESCRIPTION AND BACKGROUND

Efficiency Nova Scotia Corporation's (ENSC) Custom Retrofit provides large business, non-profit and institutional (BNI) customers with technical assistance, financial incentives and project financing to help reduce their electricity consumption and demand. By offering these services, Custom Retrofit targets retrofit projects aimed at increasing the energy efficiency of existing equipment.

Custom comprises two components, with one targeting retrofit projects and the other targeting new construction or major renovations to the existing buildings. In 2012, the Custom Retrofit and Custom New Construction components were evaluated separately.

1.1 PROGRAM OVERVIEW

Custom Retrofit provides eligible ENSC customers with incentives to help them conduct scoping and feasibility studies, implement technical changes in their facilities and carry out the required measurement and verification (M&V) of project performance. In contrast to other ENSC programs, Custom Retrofit has been designed to serve projects that require a customized approach.

The program is meant to accommodate a wide range of customer requirements and support a variety of energy efficiency and demand reduction initiatives. Program delivery is structured in such a way that customers may participate in any phase of their project prior to installation regardless of their current level of energy management expertise or their funds available for such projects.

Custom Retrofit aims to generate net electricity savings of 26.3 GWh and demand savings of 3.7 MW for 2012. Savings generated by Custom Retrofit are accounted for under the Custom program as outlined in the 2012 Demand Side Management Plan.

1.2 PROGRAM ELIGIBILITY

As stated in its program manual, project sites eligible to participate in Custom Retrofit must be institutional, charitable, commercial or industrial facilities. Eligible accounts typically have a peak electricity demand, from a Nova Scotia electric utility, of 250 kW (kVA) or higher. However, customers may group multiple smaller (<250 kW) facilities into a single project that would be eligible as long as this approach remains cost-effective and all other requirements are fulfilled.

As for project size, ENSC usually accepts applications for projects with expected electricity savings of more than 20 MWh per year. Projects with no expected electricity savings are automatically ineligible. Moreover, the project energy and demand savings cannot exceed the actual usage provided by the utility. Accordingly, energy savings from a non-utility supply, such as cogeneration, self-generation or deliveries from another commodity supplier, do not qualify for technical and financial support from the program.

For the eligible project, no energy-saving technologies have been specifically prescribed. ENSC evaluates the eligibility of each measure on a case-by-case basis. Typical approved measures involve lighting, compressed air, industrial processes, refrigeration, motors and drives, along with heating, ventilating and air-conditioning (HVAC) systems. In 2012, the new measures under investigation included facility compressed air leak management and the implementation of energy management information systems (EMIS). Measures involving demand limiting controls or power factor correction systems are ineligible due to the reasons explicitly detailed in the program manual.

As for project cost eligibility, the expenses considered eligible for assistance are typically incurred by the customer in completing the preliminary studies or implementing the project on site. For instance, the following costs are eligible for assistance under the program:

- > engineering (consultant or in-house staff) fees;
- > equipment purchase and delivery costs;
- > installation labour; and
- > harmonized sales tax (HST) (if the customer pays HST and is not eligible for an HST rebate).

Contingency amounts are not considered as eligible project costs.

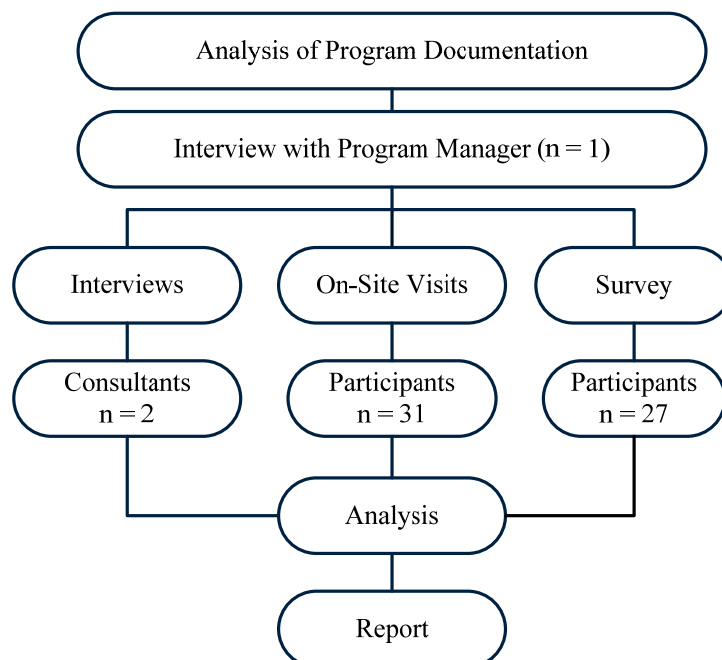
Finally, the Custom Retrofit selection process includes free-ridership screening questions to potential participants in order to identify customers that would have completed the project without ENSC assistance.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for Custom Retrofit. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was obtained primarily from the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews respectively in July and August 2012 with the Program Manager (PM). Among other things, these interviews were intended to follow up on the 2011 evaluation recommendations regarding process issues and to understand the main changes that occurred in program delivery in 2012. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the process evaluation was prepared.

2.2.3 Interviews with Consultants

In October 2012, two interviews were conducted with consultants to understand, among other things, their involvement in the program, their participation process, as well as their perception of and satisfaction with the program.

The protocol used for the interviews with the consultants is presented in Appendix II for reference.

2.2.4 On-Site Visits

By the end of 2012, 31 on-site visits were conducted to the facilities that had participated in Custom Retrofit this year. These visits were conducted by Econoler's subcontractor, Equilibrium Engineering, for the purpose of validating the technical specifications of the new and old equipment as well as its operation schedule. In addition, the Evaluator collected information on the facility characteristics.

Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocol is also included in Appendix III.

2.2.5 Participant Survey

A telephone survey with a total of 27 program participants was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in November 2012 utilizing computer-assisted telephone interviewing (CATI) technology. The average length of the survey was 14 minutes.

The participant survey was meant to generate feedback on the following aspects of Custom Retrofit:

- > spillover and free-ridership;
- > program awareness;
- > participant motivations, concerns and barriers;
- > satisfaction with the program; and
- > recommendations for improvements.

The profile of the organizations interviewed through the survey and the survey questionnaire are shown in Appendices IV and V respectively. The table below shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2011 and 2012 telephone surveys.

Table 3: Sample Size and Sampling Error

Survey	Population	Sample Size (n)	Sampling Error at 90% Confidence Level
2011 Participants	159 ¹	27	±14.4%
2012 Participants	155 ²	27	±14.4%

¹ The sampling population for the 2011 survey was 68 participants, which was the number of program participants at the time when the survey was being conducted.

² The population of Custom Retrofit participants for the 2012 survey was 53 (after duplicates removal) at the time when the survey was being conducted.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

In 2011, Econoler performed a comprehensive process evaluation of this program. The 2010 evaluation report and recommendations, the program manual and website, the application forms, the logic model and program theory were among the program elements examined in the process evaluation. The PM was interviewed along with program associates (consultants) and participants. The 2011 approach generated a series of recommendations to improve the program performance and management.

The 2012 process evaluation is a continuation of the 2011 evaluation and covers the following aspects:

- > follow-up on the 2011 evaluation recommendations regarding process issues;
- > new and/or updated program documentation including program modifications since the last evaluation;
- > program tracking sheet;
- > program consultants' perspectives on process issues; and
- > program participants' perspectives on process issues.

Recommendations and follow-ups regarding impact evaluation (energy or demand) will be presented in the Impact Evaluation section of this report.

3.2 PROGRAM DOCUMENTS ANALYSIS AND INTERVIEW WITH THE PROGRAM MANAGER

The following section presents the Evaluator's key findings and recommendations resulting from the analysis of several program documents and the interview with the PM. It also reviews the follow-ups on the recommendations made as part of last year's evaluation in each applicable section.

One of the most common recommendations made by the Evaluator in 2011 concerned the lack of a program memory, in which all the information about the program would be available in a standardized format. Another major recommendation was to develop an evaluation plan for each program based on a template provided by the Evaluator.

In 2012, the Evaluator noted that the program memory has been included in the program manual along with its various Appendices. The Evaluator is also pleased to report that Custom Retrofit now has an evaluation plan, which is discussed in the following sections.

3.2.1 Program Manual

A program manual is an important tool for the entire program staff, as well as for the Evaluator. Indeed, it serves as a program memory and can be particularly useful in case of staff changes. The program manual is intended to capture information about the program, such as its characteristics, the parameters used to determine its objectives and the changes that have been made.

The Custom Retrofit program manual is now presented in a standardized template, which applies to all ENSC programs and includes the same table of contents with 10 sections. This is a considerable improvement on the 2011 format and has followed one of the Evaluator's major recommendations.

This new format shows that most recommendations regarding the program manual have all been satisfactorily integrated, such as explaining the purpose of the Client Response Process Form, eliminating the term "preliminary energy audit" to keep only "scoping study", providing the parameters used to estimate program objectives. Moreover, Appendix I of the program manual, which is a Safety Program Manual, is an excellent addition to complement the program documentation.

The following table compares the content of the 2011 program manual and that of the new 2012 version. Parts of the program manual content are included in the form of a reference to another document or file to reduce the manual's length. This is an appropriate practice.

Table 4: Program Manual Content – Custom Retrofit

Program Manual Content	2011	2012
Document revisions	✓	✓
Program description (including nature or type of program)	✓	✓
Program justification	✓	✓
Program objectives	⚠	✓
Incentives	✓	✓
Eligibility criteria	✓	✓
Program partners and their roles	✓	✓
Program barriers	✓	✓
Total savings objectives (with details of gross savings and hypotheses for free-ridership and other effects)	N/A	✓
Details about the savings calculations and types of measure	⚠	✓
Budget per year	✓	✓
Cost-effectiveness test results	✓	✓
Market study or technical study supporting program elements or assumptions	⊘	✓
Marketing plan	✓	✓
Evaluation plan	⊘	✓
Program theory	⊘	✓
Logic model	✓	✓
Program process flow chart	✓	✓
Partner or participant process flow chart	✓	✓
Program forms	✓	✓
✓ Information included in the program manual ⚠ Information partially included in the program ⊘ No information		

The 2012 program manual is a considerable improvement over the 2011 version. Econoler has a few minor recommendations for further improvement.

- > **Provide a more detailed program description and justification:** In Section 3.0, the program description and justification need to be more detailed. The justification of a custom program within a program portfolio is essential to capturing lost opportunities and measures that could not have been otherwise designed in a prescriptive manner as long as they meet some macro eligibility criteria. Moreover, it is recommended to include a comprehensive description and justification of the rationale underlying the introduction of the two new measures, namely compressed air leak management and EMIS implementation.
- > **State in clear terms that typical measures are mentioned only as examples:** Mentioning typical eligible measures in a custom program (such as compressed air, industrial processes, refrigeration, motors, lighting, controls, other electrical end uses, as well as the two possible new measures) could be quite misleading to a potential participant unless the program literature clearly states that these measures are just examples. The Evaluator recommends mentioning as much as possible in all program literature that the program is also open to other measures in addition to those cited as examples.
- > **Include references to marketing documents in the Marketing Process section:** In the program manual, the Marketing Process section refers to Appendix B of the program manual (Custom Marketing Plan), which in turn refers to other documents related to the marketing strategy. The Evaluator recommends providing direct references to the original sources in the program manual without unnecessary detours.

3.2.2 Logic Model

The logic model is a diagram representation of the program theory which describes 1) how the program is expected to work; and 2) how it contributes to the intended or observed outcomes. In 2012, ENSC made many changes to its programs and they should be reflected in each program's logic model. Econoler is currently working with ENSC to make sure that each program's updated logic model reflects the current program strategy, and the performance indicators established based on the program theory. The programs' logic models will all be finalized and included in the programs' manuals in the coming months.

3.2.3 Evaluation Plan

ENSC has adopted the template recommended by the Evaluator for an evaluation plan, which has been included as an Appendix in the Custom Retrofit program manual. The PM provided positive feedback on this important tool that complements the program manual and makes it possible to evaluate the program.

The addition of the evaluation plan to the program documentation is a great improvement on previous years. For further improvement, the Evaluator has the following recommendation about the evaluation plan:

- > **Adapt the evaluation plan template to meet program needs:** The evaluation plan template has been designed mainly for the programs with prescriptive measures or resource acquisition programs. It has not been designed for performance or custom programs. So the base-case section is not really appropriate or relevant since savings cannot be forecasted or projected for such programs, the savings of which are assessed and calculated on a case-by-case basis. In the table of the base case, all the lines containing no information or N/A should be deleted.

3.2.4 Program Charts

In the Getting Started section of Appendix B of the program manual, the illustration explaining the participation process is very clear and can serve as a participant process chart.

Econoler has the following recommendation:

- > **Make the process chart available in more sections of the website:** The participation process chart, which is very well done, is available on the program website in the “Contact Us” section under the “Download all the materials in one package” hyperlink. In addition, the Evaluator suggests adding this chart in the “Start Now” section or in a new section such as “How does it work” so that it will be easier for potential participants to access and locate.

3.2.5 Marketing and Outreach Activities

ENSC is moving away from program-specific marketing to a more all-inclusive approach with increased focus on offering a full suite of energy saving services and rebates for businesses. Moving in this direction, ENSC has developed a master marketing plan for the BNI sector.

In 2011, the evaluation report included three recommendations related to program marketing and awareness: enhancing program awareness; focusing on the financial benefits of the program; and continuing to collaborate with contractors and design professionals to promote the program. All these recommendations have been followed satisfactorily. First, the BNI marketing plan involves a series of activities that address the awareness issue. Second, the financial benefits are still calculated in payback periods, but the net present value (NPV) calculation is used to convince and win over potential, hesitating participants with “borderline” cases and projects. Finally, training and awareness activities have been initiated by the PM, partnerships have been established with HVAC contractors, and the BNI sector now has a business development team who promotes and informs distributors about this and other BNI programs; all these initiatives are in response to last year’s recommendation about using professionals to promote the program.

Custom Retrofit is now an established program. Program information is made available to existing and potential participants through the following:

- > ENSC website;
- > public speaking events by business development team and other ENSC staff;
- > marketing case studies;
- > brochures and mailings;
- > marketing video series presenting the program and case studies; and
- > word of mouth via agencies, consultants, contractors and previous participants.

The marketing strategy implemented can make the difference between a program's success and failure. To assess the effectiveness of any marketing campaign, performance indicators are required for every action of the marketing plan. The Evaluator noticed that performance indicators have been integrated into the marketing plan since the 2011 evaluation report. This is a very good practice, because efficient performance indicators make performance visible, reinforce focus on the objectives to be achieved, clarify reasonable expectations and, finally, improve the overall execution of the marketing strategy.

For additional improvement, the Evaluator has the following recommendation on the marketing plan:

- > **Make the performance indicators more quantitative:** To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the activity. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

3.3 TRACKING SHEET

As part of the program process evaluation, the Evaluator reviewed the contents and structure of ENSC's tracking sheet for Custom Retrofit. In general, the tracking sheet is useful and provides the PM with a way to continuously monitor project progress and program savings. Most of the necessary details for program administration and evaluation purposes are present.

The program projects can also be tracked online through the Demand Side Management Data System (DSMDS). The DSMDS contains useful information on Custom Retrofit projects, such as the contact details of each participant. In regard to program impact calculations, this tracking tool has not been used much by the Evaluator since it was more complicated and time-consuming to extract data from this system than directly using the PM's tracking sheet. Furthermore, the project folders submitted by ENSC contained more documents for each project than those available in the DSMDS for those same projects. Therefore, the Evaluator did not review the complete contents of the DSMDS and elected to rely only on the program tracking sheet and electronic folders provided by ENSC for program impact evaluation. Nevertheless, the PM confirmed that the program data on the DSMDS are kept up to date and are used frequently by program staff.

The tracking sheet submitted by ENSC is an Excel spreadsheet containing six tabs, among which the tab named "Program Status" was especially useful for evaluation purposes. The "Program Status" tab presents key information on all the projects approved 2012, including contact information, project status, incentive amounts granted (or to be granted) as well as forecasted energy and demand savings. On this sheet, the energy and peak demand savings are calculated using the forecast data (from either the Project Development Agreement (PDA) or the M&V) and a percentage of installation for each year.

The other five tabs of the tracking sheet are described as follows:

- > The "Projects" tab is a comprehensive database of all the present, past and upcoming Custom Retrofit projects. The key tracking tool used by Econoler was actually an extract of the "Projects" database describing the 2012 projects only.
- > The "BNi Staff" tab presents the entire Custom Retrofit team along with the contact details of each team member. The contact table includes not only the technical staff but also the four members of the sales team.
- > The "Reporting" tab presents the savings achieved and costs incurred through the program as a function of various parameters (type of energy efficiency measures, project status, month of the year, etc.). This reporting table is for internal use only and was not reviewed by Econoler.
- > The "DB Info" and "Other" tabs include the information used by the drop-down lists of other sheet tabs as well as contact details of program partners.

In addition to the electronic tracking spreadsheet, ENSC also keeps an electronic folder for each project. In general, the structure of each project folder was quite consistent. The Evaluator also

noticed that there were several notes in the project folders and subfolders that helped the user understand the contents of the respective folder/subfolder. Furthermore, many archive subfolders could be found in the project folders. Such subfolders are used to store old versions of electronic files, which could be useful to tracking project history.

Econoler's review of the tracking sheet showed that ENSC took into consideration a number of recommendations from the 2011 program evaluation. For instance, Econoler noticed an improvement on last year in the way the information is systematically presented for each project. Moreover, the tracking sheet has now integrated a drop-down list of answers for the relevant cells and only uses values in kW for the demand savings. These adjustments facilitated the administration and evaluation of the program.

Nevertheless, the Evaluator has other recommendations for additional improvement. In fact, Econoler noticed that several 2011 recommendations had not been considered or properly integrated into the 2012 version of the tracking sheet. For instance, the project and customer names are still mixed up in the "Customer Name" field, which makes it impossible to easily filter the projects by customer identity. Since a number of projects were implemented by the same customers (e.g. large supermarket chains, chain stores, cities), it would have been helpful and efficient to be able to quickly classify or sort the projects by customer identity. Moreover, not all the contact information of program participants was initially included in the tracking sheet. This information had to be collected by Econoler during the program evaluation process. And even then, ENSC was unable to provide the complete and accurate address for each project.

In the 2011 evaluation report, the Evaluator also recommended that ENSC systematically compile in the tracking sheet the results from the free-ridership screening process for each Custom Retrofit project. Unfortunately, this information was still not included in the tracking sheet and was only available in paper records.

In light of these observations, the Evaluator concludes that the 2012 tracking sheet for Custom Retrofit is overall complete and consistent, but there is still room for improvement. Knowing that ENSC is currently improving the DSMDS to facilitate program monitoring and evaluation, the Evaluator makes the following recommendations that should be followed in developing the reporting option for the DSMDS in 2013.

- > **Split the customer name field in two columns:** When conducting the tracking sheet evaluation, there was no project description column. There was only a "Customer Name" column, which occasionally contained information related to the project type along with the customer identification (e.g. "Customer Name – Lighting Retrofit"). To eliminate this sort of confusion, the Evaluator recommends creating a "Project Name" column to give a relevant description of the project. The PM should then ensure that the "Customer Name" field is fully dedicated to customer identification using standardized names, where applicable. With the existing tracking sheet, it is difficult to filter or sort projects by program participant identity. The

addition of this new “Project Name” column along with the standardization of “Customer Name” column entries would help address this issue.

- > **Include contact name, phone, email address:** This information was added upon the request of the Evaluator. It should have already been in the tracking sheet. In addition, the full address was not given, only the city and/or postal code. The complete address should be in the tracking sheet, with all the fields properly separated (civic number, street name, apartment number, city, postal code, etc.)
- > **Compile the results of the free-ridership pre-screening process:** ENSC should systematically compile the data from the answers given by participants to the 5 pre-screening free-ridership questions. This would have allowed the PM to monitor whether approved participants had been flagged as free-riders. Also, since this information is taken into account by the Evaluator for the free-ridership calculation, it is necessary to have it easily available for calculation purposes.
- > **Include comments in separate cells:** Several cells in the savings calculation section of the tracking sheet contain pertinent information and explanations in comment bubbles. Considering the large size of the database, it may be helpful to present this information in a way that facilitates tracking. For instance, the PM could create a column named “Comments” in the tracking sheet where important comments on each project status and savings calculation could be written.
- > **Develop a standardized nomenclature to name and classify the electronic files:** This recommendation has been motivated by the difficulties encountered by the Evaluator when searching for technical specifications, formulae and assumptions used for savings calculations. A nomenclature for naming and classifying project documents already exists in the program manual, but it seems that it is not being systematically applied. When searching for documentation, Econoler found out that relevant documents were sometimes hidden and difficult to gather. In addition, it was not always possible to know which version of the same document was the most up-to-date. Furthermore, a number of template files, which typically contained either no data or data unrelated to the project, were found in project folders, leading to confusion on the correct tracked savings. Econoler also experienced some problems when using the DSMDS. Many project documents had the same name although they were not connected to the same project, which was confusing when many documents from different projects were downloaded during the same session on the DSMDS. Consequently, Econoler recommends that the names of documents downloaded directly from the DSMDS include more detailed information, such as the project number, the document type (form 2, form 7, etc.) and the revision of the file.

3.4 CONSULTANT PERSPECTIVES

Two consultants were interviewed as part of the Custom Retrofit evaluation to understand their involvement in the program, their participation process, as well as their perception of and satisfaction with the program. Under this program, the consultants' role involves helping clients access the ENSC program, conducting feasibility studies and audits, verifying technical calculations, as well as conducting M&V activities and project inspections.

During their respective interviews, the two consultants were questioned about the recent changes that occurred to Custom Retrofit. Both consultants indicated that the addition of new components to Custom Retrofit, namely compressed air leak management and EMIS implementation, had caused minor changes in the way they worked. The consultants considered their participation process easy. However, one consultant indicated that the lighting forms were not user-friendly and not easy to complete. On this matter, ENSC has introduced many user-friendly changes to the lighting forms in the past and has communicated the revised versions to the consultants' network. The most up-to-date forms are also available on ENSC's website, which is a very good practice.

The Evaluator also questioned the consultants about their satisfaction on some aspects of the program. Regarding the program marketing and outreach activities, both consultants affirmed being very satisfied with the program marketing carried out so far. They were also both highly satisfied with their relationship with ENSC staff and the clients. The only negative remark they made was about the wait times for customers to obtain their incentives, which was sometimes too long.

However, opinions were divided regarding other aspects of the program. While one consultant expressed a very high level of overall satisfaction with the program, the M&V support and the positive impact of Custom Retrofit on their business, the other one expressed a lower level of satisfaction with these aspects. According to the latter consultant, Business Energy Rebates (BER), which provides lighting incentives at the supplier level, had negatively affected their business, and therefore claimed to prefer an incentive at the customer level only. In fact, this consultant mentioned that some of their usual customers are bypassing them by going directly to the suppliers when purchasing their products. Finally, this same consultant suggested that the fuel/gas/propane savings measures be granted with financial support, in addition to electric measures.

3.5 PARTICIPANT PERSPECTIVES

3.5.1 Previous Program Participation

Before participating in Custom Retrofit, 44 percent of the respondents had previously taken part in an ENSC program. Of the 12 respondents who participated in previous NSPI or ENSC programs, five reported participating in Small Business Energy Solutions, five in Smart Lighting Choices, one in Commercial Direct Install, and one in an unspecified program.

Table 5: Previous Program Participation

Previous Program Participation	2011	2012
<i>Sample Size</i>	<i>27</i>	<i>27</i>
Yes	44%	44%
No	52%	52%
Don't know	4%	4%

3.5.2 Program Awareness

Participants were asked how they had learned about the program. The primary means by which participants found out about the program (41%) were ENSC sources, including ENSC staff (19%), presentations (7%), the Internet or the ENSC website (7%), and ENSC literature (7%). In addition to ENSC as primary source of awareness, contractors and vendors were also mentioned by about four in 10 participants (37%). Word of mouth was mentioned by one in 10 participants (11%). The results indicate the effectiveness of ENSC and contractor/vendor in raising program awareness.

Table 6: Sources of Program Awareness

Sources of Program Awareness*	2011	2012
<i>Sample Size</i>	27	27
TOTAL ENSC SOURCES	--	41%
ENSC staff	22%	19%
ENSC presentation	19%	7%
Internet/ENSC website	19%	7%
ENSC literature	4%	7%
Contractor/vendor	22%	37%
Word of mouth: someone in program/business associate/friend	15%	11%
From Eco Efficiency Centre	7%	--
From when NSPI ran the program	7%	--
Others	4%	11%
Don't know	--	4%
*Multiple mentions		

3.5.3 Motivations and Barriers to Participation

When asked about their reasons for participating in the program, nearly all the participants mentioned a cost-related motivation, with over one-half stating they participated to save on energy costs (56%), and a further one-third for the incentives (33%). Secondary motivations included environmental protection (15%), improving lighting conditions, comfort or equipment performance (22%), or because it was a project already planned (7%).

Table 7: Motivations for Participating

Motivations for Participating	2011		2012	
	Most Important Motivation	Second Most Important Motivation	Most Important Motivation	Second Most Important Motivation
<i>Sample Size</i>	27	27	27	27
Save on energy/energy costs	59%	7%	56%	33%
Incentives	30%	15%	33%	19%
Protect environment	--	22%	4%	15%
For quality improvement-lighting conditions, comfort, equipment performance	7%	11%	--	22%
It was part of an already planned project	--	4%	--	7%
Past participation in other utility programs	4%	--	--	--
Energy efficiency	--	15%	--	--
Replace non-operational equipment	--	4%	--	--
Others	--	11%	7%	--
Refused/Don't know	--	11%	--	4%

The majority of participants reported there were no barriers to program participation (89%). The three participants who reported barriers when implementing energy efficiency measures through Custom Retrofit mentioned that M&V requirements were the most important barrier.

Table 8: Barriers to Program Participation

Barriers	2011		2012	
	Most Important Barrier	Second Most Important Barrier	Most Important Barrier	Second Most Important Barrier
<i>Sample Size</i>	27	27	27	27
No barriers	74%	74%	89%	89%
M&V requirements	4%	--	11%	--
Approval took too long	11%	--	--	--
Payback timeframe	4%	--	--	--
Others	7%	--	--	--
Don't know	--	26%	--	11%

3.5.4 Attitudes with Respect to Energy Management

Participants were asked about the importance of energy management to their organization. All the 2012 participants indicated that it is important to reduce energy usage (100%) and the vast majority believed it is important for their organization to manage energy costs (93%).

Table 9: Importance of Energy Management

Aspect*	2011	2012
<i>Sample Size</i>	27	27
Reducing energy usage	93%	100%
Managing energy costs	100%	93%
*Those giving a rating of 5 or 4 on a scale with 5 indicating 'very important' and 1 'not at all important'.		

3.5.5 Organizational Decision Making

Almost seven in 10 participants (67%) reported that someone outside their organization was centrally responsible for specifying the measures to be implemented through the program. Similar to previous findings, contractors (33%), outside design professionals (15%) and manufacturer representatives (15%) were listed as parties often responsible for specifying the measures implemented. Therefore, they represent channels that may be effectively utilized to promote the program.

Table 10: Parties Most Responsible for Specifying Measures

Parties Responsible for Specifying Measures	2011	2012
<i>Sample Size</i>	27	27
Contractor	30%	33%
Someone within the organization	15%	30%
Outside design professional	30%	15%
Manufacturer representative	15%	15%
Utility account manager	--	4%
Others	7%	4%
Don't know	4%	--

3.5.6 Program Influence

The incentives or on-bill financing was the most important factor influencing participants' decision to implement energy efficiency measures through the program (mean of 8.7 on an importance scale of 0 to 10). The funded scoping or feasibility study was also considered important (mean of 8.0), followed by recommendations and technical assistance provided by the program staff when the company was engaged in discussions with contractors and consultants about equipment selection (mean of 7.0). The organization's corporate policy or guidelines regarding equipment purchase (mean of 6.6), the standard practice in their industry (mean of 6.4), and the technical assistance offered by the program during project implementation and M&V process (mean of 6.2) were considered moderately important. Finally, the existing energy efficiency code (mean of 5.5) and previous experience with similar programs (mean of 5.2) were less important.

Table 11: Importance of Factors in Influencing Decision

Importance of Factors in Influencing Decision to Implement Energy Efficiency Measures	2011		2012	
	Sample Size*	Mean	Sample Size*	Mean
Mean (0=Not at all important, 10=Extremely important)				
Program financial incentives and/or on-bill financing	27	8.4	27	8.7
The Funded Scoping and/or Feasibility study	n/a	n/a	3	8.0
Recommendations and technical assistance provided by the program staff when my company was engaged in discussions with contractors and consultants about equipment choices	24	6.3	27	7.0
Your company's or organization's corporate policy or guidelines regarding the purchase of equipment	24	6.3	26	6.6
Standard practice in your industry	21	4.6	25	6.4
Technical assistance offered by the program during project implementation and the M&V process	27	6.4	26	6.2
Existing energy efficiency code	20	4.1	21	5.5
Previous experience with the C&IC/Custom Retrofit program or a similar program either from ENSC or NSPI	25	4.7	25	5.2
*Don't know/Refused/Not applicable responses excluded from calculations				

3.5.7 Satisfaction with the Program

As far as satisfaction with the program was concerned, the vast majority of participants were satisfied with the interaction and communication with contractors and consultants (96%), the program overall (93%), the availability of staff (93%), the project rebate amount (89%), the project implementation (88%), the interaction and communication with program staff (85%), and the initial confirmation of eligibility (85%). Seven in ten participants were satisfied with the paperwork and procedures required to receive the rebate (70%), and the project savings verification (68%). Finally, the wait time received the lowest satisfaction rating. Actually, 64 percent of the participants were satisfied with the time required to confirm eligibility and 60 percent of them were satisfied with the time required to receive rebates or incentives. In this regard, one consultant interviewed under the Custom Retrofit evaluation corroborated this by underlining the long wait times before receiving the incentives.

Table 12: Satisfaction with Program

Aspects of Program	2011		2012	
	<i>n</i>	Satisfied	<i>n</i>	Satisfied
<i>Sample Size*</i>				
Interaction and communication with contractors/consultants	24	79%	24	96%
Program overall	27	100%	27	93%
Availability of staff	27	89%	27	93%
Project rebate amount	26	77%	27	89%
Project implementation	25	76%	26	88%
Interaction and communication with program staff	27	85%	27	85%
Initial confirmation of eligibility	27	85%	26	85%
Paperwork and procedures required to receive rebate or incentives	27	70%	27	70%
Project savings verification	21	53%	22	68%
Time required to confirm eligibility	<i>n/a</i>	<i>n/a</i>	25	64%
Time required to receive rebates or incentives	<i>n/a</i>	<i>n/a</i>	25	60%
	<i>n</i>	Satisfied	<i>n</i>	Satisfied (#)
Program on-bill financing**	<i>n/a</i>	<i>n/a</i>	3	3
Preliminary energy audit/scoping study rebate amount**	23	87%	2	2
Feasibility study/ assessment**	20	80%	2	2
Feasibility study/ assessment incentive amount**	20	85%	2	2
Preliminary energy audit/Scoping study**	23	78%	2	1
Those giving a rating of 5 or 4 on a scale with rating 5 indicating 'very satisfied' and 1 'not at all satisfied'. *Don't know/Refused/Not applicable responses excluded from calculations. **Base: participants who were identified in the sample as scoping, feasibility, or financing.				

3.5.8 Participant Recommendations for Improvements

Survey respondents were asked if they had any recommendations for improving the program. Over four in 10 participants (44%) were unable to provide any suggestions, and a further 11 percent stated that they were satisfied with the program, indicating that there are few issues with the current program. That said, a small number of participants would like to see better advertising (15%), broadening the scope of energy savings (7%), increased knowledge of staff (7%), more information in general (7%), or a quicker approval process (4%).

One participant noted: *“Make sure the information is a little clearer, and it would be good and helpful to have a timeline from the get-go about how long it's going to take to do the various steps of the program.”*

In regard to the broadening of the energy savings scope, one participant stated: *“The program is saving energy and when it comes to saving energy they should consider more than just electrical energy savings. They should consider oil, solar, natural gas and wind.”*

Another participant made a comment related to more knowledgeable staff and concerns with ENSC turnover. Specifically, the participant noted: *“The only thing that went wrong is that twice we had a changeover in staff on your side and I had to train them on where we were and it got a little confusing after a while, but everything worked out.”*

Table 13: Recommendations for Improvements

Recommendations for Improvements	2011	2012
<i>Sample Size</i>	<i>27</i>	<i>27</i>
Increase/better advertising/marketing	7%	15%
Everything was fine/satisfied with the program/it's a good program	22%	11%
Broadening the scope of energy savings, including oil and fuel, other utilities, not just electricity/Offer more products/energy savings options	11%	7%
Increase staff technical knowledge/more knowledgeable staff	11%	7%
More information available	--	7%
Faster approval/takes too long	--	4%
More staff, more site visits to get things moving, quicker process	11%	--
Provide forms to be completed in an electronic format, not just as a PDF file	4%	--
Others	--	7%
Don't know/no suggestion	34%	44%

4 IMPACT EVALUATION

This section presents the Evaluator's assessment of the actual impact (energy and peak demand savings) of Custom Retrofit in 2012. It first presents a short overview of the methodology used for impact evaluation and then a detailed assessment of the gross and net savings for 2012, along with explanations on how the net-to-gross ratios (NTGR) for net savings calculations were determined.

4.1 OBJECTIVES AND APPROACH OF THE IMPACT EVALUATION

The Custom Retrofit impact evaluation aims at determining the gross and net savings for the year of 2012. Both energy and demand savings were considered in this evaluation. To do so, Econoler analyzed the following key documents in relation to each project:

- > feasibility studies, engineering calculations and any other pertinent technical reports prepared to evaluate the energy savings expected to be generated by the proposed set of energy efficiency measures prior to implementation;
- > ENSC's reports on the on-site project validation and on M&V activities undertaken before, during and after energy efficiency measure implementation;
- > findings and observations made on site through the facility visit and discussions with program participants.

As mentioned in Section 2 (Methodology), the Evaluator conducted on-site visits for a sample of projects and made a technical review of the contents of each project folder submitted by ENSC. Thereafter, the Evaluator calculated the gross energy and peak demand savings for all the sample projects in accordance with the specifics of each project type. Those calculations allowed finding the appropriate adjustment factors by comparing the evaluated gross savings with those presented in the tracking sheet for each sample project. Using a weighted average, Econoler then calculated an overall adjustment factor for all the Custom Retrofit projects in relation to the adjustments factors and the size of each sample project. The overall adjustment factor was finally used to calculate the adjusted gross savings of all the Custom Retrofit projects in 2012.

After the calculation of gross savings, the Evaluator determined the proper NTGR to be applied using data collected through the participant survey. For this year's evaluation, Econoler considered two main effects on participant behaviour, namely free-ridership and internal spillover. Finally, the net energy and peak demand savings was calculated for the year of 2012 using the NTGR found.

4.1.1 On-Site Visit Sampling and Protocol

As part of the 2012 program evaluation, 25 on-site visits for Custom Retrofit were planned, along with 7 other on-site visits for the Ice Rink Energy Program (IREP)³. The latter 7 visits aimed at validating non-electric savings generated by IREP projects. Since only three IREP projects were expected to achieve non-electric savings by the end of 2012, four on-site visits planned for IREP were transferred to Custom Retrofit. Moreover, two of the three IREP projects achieved electric savings under Custom Retrofit in addition to the non-electric savings claimed within the provincial component of IREP. As a result, the number of on-site visits to be conducted by Econoler in 2012 was increased from 25 to 31, including the two aforementioned IREP projects.

In October 2012, the tracking sheet of Custom Retrofit included 80 projects. Their implementation process was advanced enough to allow for on-site visiting by the Evaluator. More precisely, these projects were either claimed or completed (at least partially)⁴ by then. The list also included two projects still undergoing implementation at the time of sampling, but which were likely to be completed and tracked by the end of 2012. By October 2012, the forecasted savings at the generator for the 80 projects were estimated at 16.4 GWh/year and 1.76 MW.

The following table presents additional details on Custom Retrofit project status along with a breakdown of energy and peak demand savings at the generator for the 80 projects used for on-site visit sampling.

Table 14: Total Number of Projects and Tracked Savings Used for On-Site Visit Sampling⁵

Project Status	Number of Projects	Expected Gross Energy Savings at the Generator (GWh/yr)	Expected Gross Peak Demand Savings at the Generator (MW)
Closed	50	5.91	0.617
Completed	20	3.19	0.536
Implementation	1	2.99	0.000
Partial Completion	9	4.32	0.609
Total	80	16.40	1.762

³ IREP is a program targeting ice rinks in Nova Scotia. This program is overseen by the Recreation Facility Association of Nova Scotia (RFANS). The electric savings achieved under IREP are incentivized and claimed under ENSC's Custom Retrofit, while the non-electric savings are promoted at the provincial level.

⁴ "Partially completed" projects are usually large-scale projects which last for over one year. A part of the expected savings is therefore claimed each year, in accordance with the actual status of project implementation on site.

⁵ As of October 2012.

The sampling for on-site visits was made from this population of 80 projects. The following set of criteria was used to identify the sample of 31 sites to be visited. The criteria are ranked by order of importance with the first one being the most important criterion applied for site selection:

- > **Project size:** the respective size of the projects in terms of annual energy savings was considered as the most important criterion for project sampling. In fact, adjustments to the larger projects in terms of energy savings have a greater impact on the overall program savings than those to smaller projects. In addition, there was a wide range of variability in claimed annual energy savings per project (it ranged from less than 3 MWh/year to more than 3,500 MWh/year). For these two reasons, it was decided that the project population would first be sampled according to their respective size before applying other selection criteria.
- > **Type of project:** The types of energy efficiency measure covered by Custom Retrofit are highly varied. In fact, only a small number of demand management measures are ineligible for the program, thus encouraging participants to submit a wide range of energy efficiency projects for approval. This situation has created problems for impact evaluation since some types of energy efficiency measures are easy to verify while others require more efforts when it comes to measuring their realized energy savings. In light of this particularity, it was decided to represent the distribution of the population of measure types in the sample as reliably as possible. For this year's evaluation, the Evaluator defined six types of energy efficiency projects, namely lighting, refrigeration, EMIS, HVAC systems, ice rinks, and various. The last type (various) included some small projects involving electrical motor replacement, variable-speed drive installation, compressed air system improvement and fuel switching, along with five projects which consisted of varied energy efficiency measures. Finally, the two ice rink projects that achieved electric and non-electric savings in 2012 were automatically selected in the sample.
- > **Participant's market sector:** The participants' market sector is another factor that may influence project impacts. Actually, a project's feasibility and financial viability may vary significantly depending on whether the project is carried out in industrial, commercial or municipal sector facilities. The sampling therefore took the market sector criterion into account.
- > **Project location:** For logistics purposes, the projects located near large urban areas were prioritized in the sampling process over those located in remote areas of the province. For instance, large urban areas included the metropolitan regions of Halifax, Sydney, Truro, New Glasgow and Kentville.

Using these four sampling criteria, the Evaluator established a list of 31 sample projects to be visited. The following table shows an overall comparison of the sample with the total population of Custom Retrofit projects for 2012.

Table 15: Comparison of the Final Sample with the Population for Custom Retrofit⁶

Description	Number of Projects	Expected Gross Energy Savings at the Generator (GWh/yr)	Expected Gross Demand Savings at the Generator (MW)
Population	80	16.40	1.762
Sample	31	12.63	1.272

On-Site Visit Protocol

The Evaluator used two key documents for conducting its on-site visits. The first was a two-page protocol, which showed a project's general information, such as the project name and contact details, and allowed collecting general information on building space heating and cooling systems. This information was used to validate the interactive effects of the energy efficiency measures on space heating and cooling systems. In addition, this document defined the facility operation schedules, including daily time of use (e.g. 8 a.m. to 5 p.m.) and the number of operating hours per day. The Evaluator used these data to verify the operating hours estimated by the program participants in their respective energy savings calculations. This protocol is included in Appendix III of this report.

During the Custom Retrofit on-site visits, the Evaluator also used copies of the feasibility study and M&V reporting files (if any) that ENSC had provided. These files were used to validate technical information, such as the quantity and type of equipment installed (e.g. lighting fixtures) along with their respective efficiency. As each Custom Retrofit project is different, the Evaluator assumed that using ENSC files would be more time-effective than developing several specific on-site visit protocols.

4.2 GROSS SAVINGS

The gross savings evaluation of Custom Retrofit was based on the information available in the tracking sheet and project folders submitted by ENSC, as well as on the data collected and observations made during on-site visits. Because of the customized approach in use under Custom Retrofit, the Evaluator conducted a different gross savings analysis for each project tailored to its specificities, such as the type of energy efficiency measures implemented through the project.

As mentioned before, the Evaluator carried out 31 on-site visits with the aim of fine-tuning the estimated savings achieved by every measure implemented at each site. These on-site visits offered an opportunity to verify the installation and technical specifications of the new energy-efficient

⁶ As of October 2012.

equipment, as well as the environment and circumstances in which the M&V activities had been performed. After reviewing the savings for each project, the Evaluator calculated an adjustment ratio for each project by comparing the savings obtained through on-site visits and the expected savings from the tracking sheet.

4.2.1 Adjustment Methodology

The next subsections outline the gross savings verification procedure that Econoler followed when evaluating each Custom Retrofit project. The validation process varied slightly depending on the project type.

Building Lighting Retrofits

For 2012, lighting retrofits were the energy efficiency measure that generated the bulk of the energy and demand savings. In fact, over 50 percent of the tracked energy savings for 2012 was contributed by projects involving lighting retrofit only. Similarly, 16 out of the 31 sampled projects in 2012 involved lighting retrofit only.

In light of the large proportion of building lighting retrofit projects in the 2012 sample, the Evaluator developed a detailed on-site visit methodology aimed at verifying the key factors that impacted the gross savings estimate of each lighting project. These factors are listed below.

Unitary Wattage

The unitary wattage of retrofitted lamps was the first factor considered by the Evaluator. For most lighting retrofit projects, ENSC had already developed a project impact calculation spreadsheet. This file listed and described all the old fixtures to be replaced along with their new high-efficiency equivalents. This information was validated on site by the Evaluator, who also ensured that the unitary wattages concurred with standard values.

The ballast might also have had a relevant impact on the power load of a lighting fixture (due to the ballast factor). Accordingly, the Evaluator collected additional information on new and old ballasts (where possible, the Evaluator noted down the nameplate of spare ballasts) during on-site visits. When not written on the nameplate, the ballast factor could be found on the Internet on the manufacturer website.

Installation Rate

Where possible, the Evaluator conducted a survey of all new lighting fixtures. When the facility was too large and the fixtures too numerous, the Evaluator inspected a sample of fixtures assumed to be representative of the entire population. For instance, in a multi-story office building, a survey was

conducted on a representative floor and then all the other similar floors were assumed to have the same number of fixtures installed⁷. In addition, the Evaluator prioritized the inspection of lighting groups that were expected to generate more relative energy savings than other lighting systems within the facility.

Moreover, if the Evaluator had noted significant discrepancies between the ENSC M&V report data and the actual fixture count, the Evaluator would have audited additional areas of the facility since a more extensive lighting fixture count provides a more precise estimate of the actual gross savings of the project. Additional fixture inspections were not required when the Evaluator found no (or very few) discrepancies between its fixture count and ENSC's.

Hours of Operation

To evaluate the hours of operation, the Evaluator first looked at the operating schedules of old and new lighting equipment that program participants had provided to ENSC. The Evaluator then confirmed these figures with the customer during the on-site visit. When ENSC had adjusted the operating schedules through the use of metering data, the Evaluator also discussed the adjusted data with the program participant in order to confirm whether these data reflected the reality.

Occupancy sensors and photocells were also installed in combination with lighting measures for a number of sample projects. For such measures, the energy impact was quantified as a reduction in operating hours, based on the discussion between the Evaluator and the customer during the on-site visit.

Interactive Effects

In its energy and demand savings calculations, ENSC took into account the potential effects of energy efficiency measures on electric space heating and/or electric space cooling systems. Where applicable, the Evaluator therefore confirmed with the program participant on the type of heating and/or cooling system that served the target areas of the facility as well as the primary energy used by the equipment. Where possible, the Evaluator also collected the nameplate information of the installed electric space heating and/or cooling systems to confirm their efficiency and nominal capacity.

Furthermore, the interactive effects were adjusted when special circumstances were observed, such as those related to the space condition set points (dry bulb temperature and relative humidity) to be maintained or to the annual operation schedules.

⁷ When such a survey was conducted, the Evaluator previously confirmed with the participant that all the floors were similar and had not been configured too differently under the tenant leases.

Diversity Factor

During the on-site visits, the Evaluator discussed the annual operating schedules of the old and new lighting systems. This assessment helped Econoler estimate the diversity factor to be used for the calculation of coincident peak demand savings. As with the 2011 evaluation, Econoler elected to use the 5:00 pm to 7:00 pm timeframe on non-holiday weekdays of December, January or February, as the peak load period for the 2012 evaluation. This peak load period was used for calculating the appropriate diversity factors for all types of Custom Retrofit projects.

Refrigeration and HVAC Projects

In the 2012 sample, there were three HVAC projects and one refrigeration project. To evaluate the impact of these projects, Econoler first collected the key technical information from the feasibility study. Then, the Evaluator verified on site the proper installation of all the energy-efficient HVAC and refrigeration equipment as well as the nameplate technical specifications (at least capacity and efficiency) of each main component. During the on-site visits, the Evaluator also collected the operation schedules and setpoints of the old and new equipment, which helped estimate the systems' operating conditions as well as the diversity factors to be used for energy and demand savings calculations. Moreover, Econoler reviewed the other operating assumptions included in the feasibility study of the refrigeration project with the customer.

Finally, the Evaluator assessed the potential interactive effects on space heating or cooling needs of each building targeted by the energy efficiency projects. This was done by collecting technical data on the HVAC systems other than those affected by the energy efficiency projects.

Ice Rink Projects

The 2012 Custom Retrofit sample included a total of 3 ice rink projects which were expected to generate electric savings in 2012. The implementation scheme of the IREP projects is slightly different from that of other Custom Retrofit projects. For this reason, Econoler slightly customized the on-site visit protocols used for these projects and performed an adapted evaluation of their technical documentation.

Energy efficiency measures implemented under IREP projects are rather generic. They typically included energy-efficient lighting, low-e ceiling, heat recovery or water treatment system. Since these measures were relatively small and similar regardless of the facility where they were implemented, IREP project coordinators decided to conduct a feasibility study for the first IREP projects and then use the results of this first study to estimate savings in other comparable ice rinks. Savings were replicated in IREP projects using a set of pre-determined parameters, which varied according to the type of energy efficiency measure implemented.

During the IREP on-site visits, Econoler verified the proper installation and operating conditions of the newly implemented energy efficiency equipment. Moreover, the on-site visits allowed gathering the minimum technical data of these systems.

Other Energy Efficiency Projects

For all the other energy efficiency projects supported by Custom Retrofit in 2012, the Evaluator reviewed the technical documentation and conducted on-site visits in order to verify the following parameters:

- > The key technical specifications of the old and new equipment, especially the nominal efficiency, the capacity and the load factor, where applicable;
- > The operating conditions of the old and new equipment, including the number of operating hours and the schedule of operation (e.g. from 8 am to 5 pm), along with the setpoints and loading variations, where applicable;
- > The proper installation of the new energy-efficient systems as well as the difference between the number of systems before and after project implementation, if any;
- > Any other relevant information for the calculations of the diversity factor to be used.

The information collected and verified by the Evaluator allowed for the calculation of proper factors for adjusting each project's energy and demand savings.

4.2.2 Adjusted Gross Savings

The 2012 gross energy and demand savings recorded in the ENSC tracking sheet were revised by incorporating the adjustments calculated by the Evaluator following a comparison of the project savings computed by Econoler and their counterparts presented in the tracking sheet. To increase adjustment precision, it was decided to divide the savings adjustment calculation into three categories according to the type of energy efficiency measure implemented.

Adjustments to the Projects Involving Lighting Retrofit Only

Due to the predominance of projects containing lighting retrofitting in the 2012 population of Custom Retrofit projects, their adjustment factors were properly calculated to correct their energy and demand savings. These factors were calculated upon completion of the technical documentation review and the on-site visits for the 16 lighting retrofit projects selected for the 2012 Custom Retrofit impact evaluation. The average energy and demand savings adjustment factors were then computed by taking into account the respective weight (i.e. amount of energy or demand saved) of every project visited. Econoler finally corrected the energy and demand savings of all 2012 lighting retrofit projects based on the weighted average energy and demand adjustment factors calculated.

Most adjustments to energy savings were attributable to two kinds of minor errors: small discrepancies between the quantity of fixtures declared by the participant and the on-site count, or correction of

operation hours resulting from on-site validation or ENSC's data logging. Except for one case where the installation rate was very low in comparison with the number of fixtures claimed by the participants, most of these discrepancies were very small and called for only minimal adjustments to ENSC's savings.

Reviewing the 31 project folders also allowed identifying a small issue with the interactive effect calculation methodology used within ENSC's model spreadsheet for lighting retrofit project. Specifically, the formula in this ENSC spreadsheet automatically computed interactive effects on electric heating systems using a heating fraction of 0.39 taken from the ASHRAE⁸ for a location with a number of heating degree days similar to Halifax (namely the city of Green Bay, Wisconsin). Then, the file used a factor of 0.40 to account for the percentage of lights installed in perimeter zones among all the lights installed, considering that only the lights installed in perimeter zones significantly contribute to the heating load. These two coefficients have resulted in an interactive effect factor for heating of 0.156, which is low but acceptable taking into consideration that most of the Custom Retrofit participant buildings are rather large.

The problem found in this calculation was that the lighting spreadsheet added another 0.50 factor to the previous values to account for the length of the heating season. This resulted in an overall interactive effect of 0.078, which was much lower than those used for other ENSC's programs. This inconsistency was probably due to the fact that the ASHRAE's heating fraction has already accounted for the length of the heating season. Therefore, Econoler corrected the energy savings of all the lighting retrofit projects implemented in electrically-heated buildings by using an interactive heating factor of 0.156. Ultimately, this adjustment had a minor impact on the total program savings since the modified interactive effect factor was rather small and that only a small percentage of the participant buildings were electrically-heated. Taking into account all the aforementioned findings, the Evaluator set the energy savings adjustment factor at 0.976, which was applied to the tracked savings provided by ENSC.

While the energy savings adjustment factor calculated for lighting retrofit projects was rather small, the adjustments made by the Evaluator to the peak demand savings claimed were more significant. The main issue was the way in which the diversity factors were calculated for each project. In most cases, it appeared that the diversity factors were calculated on the basis of the number of operation hours per day, regardless whether the energy-efficient fixtures were turned on during the peak period or not. For instance, a retrofitted fixture operating from 7 am to 11 pm on weekdays, year-round, was given a diversity factor of 66.7 percent (16 hours/24 hours), but it should have been 100 percent since this fixture is likely to be on during the peak period. Accordingly, Econoler reviewed all the diversity factors used by ENSC and modified many of them in accordance with the peak period of Nova Scotia.

⁸ RUNDQUIST, Robert A. et al, *Calculating Lighting and HVAC Interactions*, ASHRAE Journal, November 1993, p. 28 to 37. The heating fractions given by this article are of perimeter zone lighting heat only.

Otherwise, most of the demand savings figures calculated and validated by ENSC were accurate and well detailed. This assessment resulted in adjusting the tracking sheet demand savings by a factor of 1.106.

Adjustments to the Ice Rink Projects (IREP)

As for IREP projects, due to the particularities of the impact evaluation activities as well as the simplicity and replicability of the typical energy efficiency measures implemented, Econoler decided to determine adjustment factors in such a way that they were specifically adapted to such projects. However, as the sample developed in October 2012 included only three ice rink projects, it was not justifiable to apply the average adjustment ratio found for this limited number of sample projects to all the 18 IREP projects in 2012; otherwise, the typical error would be too high. Consequently, case-by-case energy and demand adjustments were made to electrical savings on the three visited projects only. These adjustments were calculated upon completion of the technical documentation review and the on-site visits. In all three cases, it was found that the energy efficiency measures were properly implemented and that the facility characteristics corresponded to the values that had been used for savings predictions. Hence, 100 percent of the energy savings claimed in 2012 were approved. The Evaluator also adjusted upward the demand savings of one IREP project because the diversity factor used by ENSC was considered too conservative and inappropriate. The demand savings of the two other projects visited were kept unchanged.

In conclusion, the evaluation of IREP sample projects resulted in demand savings adjustment of 1.056 while the energy savings claimed by ENSC were completely approved (adjustment factor: 1.000).

Adjustments to the other Custom Retrofit Projects

The savings achieved by all the Custom Retrofit projects not classified as “Lighting Retrofit Only” or “Ice Rink” projects were fine-tuned using the same energy and demand savings adjustment factors. These two factors were calculated using the adjustments established upon completion of the other 12 on-site visits that targeted neither Lighting Retrofit Only nor the Ice Rink project type. More precisely, average energy and demand savings adjustment factors were computed by taking into account the respective weight (i.e. amount of energy or demand saved) of each project visited. Econoler finally corrected the energy and demand savings of all the 2012 Custom Retrofit projects which were neither Lighting Retrofit Only nor Ice Rink, based on the weighted average energy and demand adjustment factors calculated.

Energy savings adjustments made by Econoler for this category of projects were quite small. They were mainly due to discrepancies in the count of energy-efficient equipment installed. Considering the high complexity of some of these projects, the Evaluator was not able to collect all the data required to fully evaluate and measure the savings achieved by all the energy efficiency measures. For the most complicated measures, the Evaluator verified that the energy efficiency equipment was properly installed and in operation.

Then, Econoler limited its activities to the review and verification of the technical documentation provided by ENSC. This in-depth technical assessment also led to some savings adjustments when mistakes were found in the feasibility study's calculations or when there was no M&V done to update feasibility study's values. For example, the formula used for one of the 2012 projects to calculate its energy savings contributed by motor replacements did not take into account the motors' respective load factor, though this information was made available by the consultant. Hence, it was assumed that the motors were running at full load year-round, which was not the case. For this particular project, the full-load motor efficiency used by the program participant was also higher than the nominal efficiency at full load written on the motor nameplate. Econoler's modifications of the initial calculations thus led to an energy savings adjustment of -44 percent for this project. In the end, an overall adjustment factor of 0.978 was applied to the tracked energy savings for this category of Custom Retrofit projects.

As for the lighting retrofit projects, Econoler considered that the way some of the diversity factors had been calculated was inappropriate. Again, Econoler used the operating schedules of the newly installed energy efficiency equipment to estimate diversity factors to be used for peak demand savings calculations. Moreover, the Evaluator added peak demand savings for at least one project, for which all the available information allowed calculating such savings. In general, Econoler's estimates were similar to or higher than those of ENSC, leading to a positive adjustment of 1.290 to the peak demand savings tracked in 2012.

Calculation of Adjusted Gross Savings

The following table shows the adjustment factors used by the Evaluator for the gross energy and demand savings calculations.

Table 16: Adjustment Factors for Gross Energy and Demand Savings Calculations

Project Type	Adjustment Ratios	
	Gross Energy Savings	Gross Peak Demand Savings
Lighting Retrofit Only	0.976	1.106
Ice Rink Projects (IREP)	1.000	1.056
Other Custom Retrofit Projects	0.978	1.290

It is worth noting that the entire gross impact assessment described by Econoler so far in the report has already taken into account the interactive effects on space heating and cooling systems as well as the diversity factor. There is no need for additional calculations with regard to those two aspects of project impact calculations.

The details of the energy and peak demand savings calculated for the three project types mentioned above are presented in the table below, which indicates the savings at both the meter and the generator. Savings at the generator level were calculated using the line loss factor of each participant,

which takes into account the transmission and distribution losses on the grid. The line loss factor values used were provided by Nova Scotia Power. For reference purposes, the weighted average line loss factors of each project category are presented in Table 17.

The 2012 overall gross energy savings for Custom Retrofit are estimated at 30.102 GWh at the meter and at 31.960 GWh at the generator. Moreover, the total gross peak demand savings are respectively estimated at 3.451 MW at the meter and 3.679 MW at the generator.

Table 17: Evaluation Results – Revised Savings in Tracking Sheet

Program Path	Lighting Retrofit Only	Ice Rink Projects	Other Energy Efficiency Projects	Total for all Custom Retrofit Projects
Number of Projects	91	18	46	155
Program Tracking Sheets				
Total Tracked Energy Savings – at the Meter (GWh) *	16.135	0.936	13.573	30.644
Total Tracked Demand Savings – at the Meter (MW) *	2.038	0.094	0.963	3.096
Evaluated Energy Savings				
Adjustment Ratio on Energy Savings	0.976	1.000	0.978	0.977
Total Gross Energy Savings – at the Meter (GWh)	15.740	0.936	13.278	29.953
Average Line Loss Factor**	1.063	1.079	1.059	1.062
Total Gross Energy Savings – at the Generator (GWh)	16.725	1.010	14.067	31.803
Evaluated Demand Savings				
Adjustment Ratio on Demand Savings	1.106	1.056	1.290	1.142
Total Gross Peak Demand Savings – at the Meter (MW)***	2.255	0.100	1.242	3.597
Average Line Loss Factor**	1.063	1.081	1.071	1.066
Total Gross Peak Demand Savings – at the Generator (MW)	2.397	0.108	1.331	3.836
Notes: * The program tracking savings values (energy and demand) already included the interactive effects of energy efficiency measures on existing electrical heating or cooling systems. Accordingly, the adjustment factors calculated by Econoler also took into account any potential interactive effects on space heating and cooling systems. ** The line loss factors shown in this table are weighted averages calculated using the unitary line loss factor of each participant pertaining to each project category, on the basis of the gross savings (energy or demand) of each participant. *** The adjustment factors used on tracked demand savings have already taken into account the weighted average diversity factor of each project category.				

4.3 NET-TO-GROSS RATIO

The NTGR evaluation of Custom Retrofit was based on a self-report approach which relied on a series of questions designed to measure the influence of the program on participants' decision to implement energy efficiency projects promoted under Custom Retrofit. These questions were included in the participant survey.

This section presents the methodology used to convert the survey responses into an appropriate NTGR for the program. The NTGR calculation method includes the assessment of two key distortion effects: free-ridership and internal spillover. Once each effect is quantified, the NTGR is calculated using the following equation.

$$\text{NTGR} = (1 - \% \text{ free-ridership} + \% \text{ internal spillover})$$

The next section outlines how the two above-mentioned distortion effects (free-ridership and internal spillover) have been calculated for Custom Retrofit.

4.3.1 Free-Ridership

In Custom Retrofit, free-ridership occurs when participants declare that they would still have implemented the energy efficiency measures in the absence of the program. In 2012, Econoler evaluated free-ridership of Custom Retrofit using a telephone survey with a sample of participants. This telephone survey included eight free-ridership questions divided into four groups, which attempted to measure the following:

- > the probability that the customer would have implemented the same energy efficiency measures in the absence of the program and, if yes, the likelihood that the program encouraged the customer to implement the measures earlier than they would have otherwise;
- > the probability that the participant would have paid the full cost of the project in the absence of the program incentives and/or on-bill financing;
- > the probability that the customer would have installed a piece of standard efficiency equipment instead of the energy-efficient equivalent model;
- > the factors other than the program that might have affected the customer's decision; and
- > the temporal sequence of the program and the customer's decision.

Each group of questions were transposed into a level of program attribution, which was used to calculate the overall free-ridership level for each participant. The algorithm behind this calculation is presented in Appendix VI. Moreover, the answers provided by the participant during ENSC's pre-screening process were taken into account in conjunction with the telephone survey answers.

Using this approach, survey results revealed a free-ridership level of 9 percent for the program. This free-ridership level was slightly higher than the result obtained for the 2011 evaluation (7 percent), but still lower than the free-ridership level found for 2010 (10 percent). In short, the free-ridership

percentage calculated for 2012 remained at roughly the same level as those of the previous two years. Moreover, the percentage found is considered consistent with what is expected for such a custom program, which would suggest that the free-ridership is well managed under Custom Retrofit. As mentioned in Section 0, it would be a good practice to record participants' answers to the pre-screening questions to help the PM identify potential free-ridership cases and to allow the Evaluator to fine-tune the free-ridership evaluation.

4.3.2 Spillover

For typical programs, the internal spillover effects are defined as the additional energy and demand savings that may be generated due to program influence without any direct financial or technical support from the program (technical assistance, incentives, on-bill financing, etc.). For Custom Retrofit, internal spillover occurs when participants implement eligible energy efficiency measures after their previous participation in the program and under its influence without having additional support of any kind from the program.

For the year of 2012, the Evaluator investigated internal spillover effects for Custom Retrofit using a participant telephone survey. During this survey, participants were asked if there were any energy efficiency measures that had been recommended in the project's feasibility study, but they had decided not to implement through the program. If such was the case, the surveyed participants were then asked if they had implemented (or were implementing) any or all of these energy efficiency measures; and if they had implemented or were implementing some or all of these measures, they were asked to define each energy efficiency measure (to allow the Evaluator to validate program eligibility) and identify the reason(s) why they had chosen not to implement the measures during their participation.

The evaluations in previous years revealed no internal spillover. Likewise, neither did the impact evaluation for 2012 reveal any internal spillover. During the telephone survey, none of the participants declared having implemented additional energy efficiency measures following their participation in the program. For the 2012 impact evaluation, Econoler has therefore considered the internal spillover level of Custom Retrofit to be null.

4.4 NET SAVINGS

The net savings for the program were estimated using the NTGR calculated under the previous section. The following equation was used to calculate the net savings.

$$\text{Net savings} = \text{gross evaluation savings} \times \text{net-to-gross ratio}$$

This equation was used for both demand and energy savings. The results obtained are presented in the following table.

Table 18: 2012 Net Demand and Energy Savings for Custom Retrofit

	Energy Savings – at the Meter (GWh)	Energy Savings – at the Generator (GWh)	Demand Savings – at the Meter (MW)	Demand Savings – at the Generator (MW)
Evaluation Results – Gross Savings	29.953	31.803	3.597	3.836
NTGR	0.91	0.91	0.91	0.91
Evaluation Results – Net Savings	27.258	28.941	3.273	3.490

The following table compares the net energy savings values calculated in the previous table with the program tracked net savings for 2012.

Table 19: Comparison of Tracked and Evaluated Savings at the Generator⁹

	Initial Gross Savings	Adjusted Gross Savings	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	32.536 GWh	31.885 GWh	0.93	29.653 GWh
Evaluation Results	32.536 GWh	31.803 GWh	0.91	28.941 GWh
Demand Savings				
Tracked Savings from ENSC	3.300 MW	3.383 MW	0.93	3.146 MW
Evaluation Results	3.300 MW	3.836 MW	0.91	3.490 MW

As shown in the table above, the adjusted gross energy savings of Custom Retrofit were lower than those tracked by ENSC by approximately 0.25 percent. The Evaluator made some minor adjustments to ENSC's energy savings, for instance due to issues found with interactive effect calculations for the lighting retrofit projects or to small discrepancies in energy efficiency equipment count observed during on-site visits. However, the overall gross energy savings adjustment factor calculated for 2012 (0.977) turned out to be very similar to the one used by ENSC for internal monitoring (0.980).

⁹ Both ENSC's and Econoler's savings values presented in this table include interactive effects on space heating and cooling loads, as well as the installation rate of energy efficiency equipment. In addition, the table shows ENSC's energy and demand savings at the generator following the adjustment of tracking sheet values using the gross adjustment factors calculated in the 2011 program evaluation, namely 0.977 for the energy savings and 1.025 for the demand savings.

In comparison, the 2012 net energy savings adjusted by Econoler were 2.4 percent lower than those of ENSC since the free-ridership level found for 2012 was 2 percent higher than that of 2011. Nevertheless, the Evaluator has noticed that the free-ridership level of Custom Retrofit has remained relatively stable and consistent with the particularities of the participants in such a custom program.

In short, Econoler considers the 2012 energy savings adjustment factors to be rather small and thereby the energy savings tracking process for Custom Retrofit to be quite efficient in 2012.

With regard to gross demand savings, the evaluated values were higher than those tracked by ENSC by approximately 13 percent. The main reason for this is that Econoler adjusted upward a number of diversity factors used for computing the peak demand savings of sample projects, based on the equipment's operating conditions and particularities. The Evaluator considers that the diversity factors used by ENSC were sometimes too conservative and not tailored to the actual energy efficiency equipment operations. Finally, the difference between ENSC's and Econoler's net demand savings decreased to almost 11 percent because of the higher free-ridership percentage of 2012.

CONCLUSION

The 2012 evaluation of Custom Retrofit demonstrated that the program had undergone a series of positive changes that helped to improve and simplify its implementation and evaluation. Custom Retrofit was initially one of the two distinct components of a program named Custom, with one component targeting retrofit projects (Custom Retrofit) and the other targeting new constructions or major renovations to existing buildings (Custom New Construction). In 2012, Custom Retrofit and Custom New Construction were evaluated separately.

The Evaluator has noticed major improvements to the program since the last evaluation window in 2011. The final 2011 evaluation report was submitted to ENSC in February 2012, leaving not much time for ENSC to follow up on all the process and impact recommendations before the new evaluation period, which started in July 2012. Despite this, the most important recommendations were implemented. The Evaluator commends ENSC on its diligence in rapidly implementing the suggested changes. Among the improvements, the Evaluator noted that new tools are now available to improve program performance and management, such as the various process charts, the evaluation plan and a standardized program manual. Moreover, additional efforts were made in involving professionals in program promotion.

This year's evaluation revealed that the main source of awareness of Custom Retrofit was ENSC's marketing and outreach activities, as well as contractors or distributors. The validated importance of these actors in program awareness reflects the improvement made in enhancing program awareness and collaborating with contractors and design professionals to promote the program, as recommended by the Evaluator in the 2011 evaluation.

As was the case with the 2011 evaluation, the satisfaction with Custom Retrofit in 2012 was very strong with the majority of participants reporting being very satisfied with the program overall and most of its aspects. The two aspects less satisfactory were the wait times required to confirm eligibility and receive rebates. Despite the above, satisfaction was generally strong.

The program saw a total of 155 projects implemented for the year 2012, which was similar to that of 2011 (159 projects). The evaluation revealed that Custom Retrofit generated 28.941 GWh in net energy savings and 3.490 MW in demand savings at the generator in 2012, compared respectively to 30.323 GWh and 3.764 MW for the year of 2011. To calculate the net savings of Custom Retrofit in 2012, the Evaluator used an approach that involved conducting on-site visits of sample projects and an in-depth review of each sample project's technical documentation (e.g. feasibility study, metered data, energy billing, M&V reports, etc.). Then, the Evaluator calculated the gross energy and peak demand savings for all sample projects, based on the specific characteristics of each project type. The adjustment factors that resulted from this calculation were used to estimate the overall gross savings. Moreover, Econoler took into consideration the free-ridership and internal spillover, both measured on the basis of the participant survey.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Consider diverting or assigning a proportion of the simple lighting retrofit projects to other prescriptive measure programs: When reviewing the project list of 2012, Econoler noticed a high percentage of simple projects, i.e. projects involving only one or a limited number of different energy efficiency measures. For instance, the projects including only lighting retrofit accounted for almost 60 percent of the projects claiming savings in 2012 and achieved more than 52 percent of these savings. Many of these projects are small or medium lighting retrofits that could have been supported by other BNI programs, such as BES. When possible, the Evaluator therefore recommends diverting and assigning other such upcoming simple projects to other BNI programs so that they could be tracked and managed in a more efficient and cost-effective way.
	2. Improve tracking on implemented measures and savings: In several projects whose expected savings had been calculated in a feasibility study prepared by a third-party consultant, there was no clear statement on which measures were selected for implementation by the participant. Figure 3 of PDA Form 4 often provided some information about this, but for a number of projects the Figure 3 was not filled out or did not give the full details, which prevented knowing about the exact energy efficiency measures implemented. Consequently, the Evaluator had to investigate the status of project implementation during on-site visits, which might cause errors, especially when the person met during the visit knew little about the project or did not have an adequate understanding of all the technical aspects of the measures implemented. Thus, the Evaluator suggests that ENSC improve the tracking on the list of measures implemented and the savings related to each measure for every participating project.

Sections	Recommendations
Executive Summary	3. Improve the method for diversity factor calculations and document the assumptions used: When reviewing the project gross impacts, Econoler observed that diversity factors used by ENSC were generally obtained by dividing annual operation hours by the total of hours in one year (8760). This practice is very conservative and does not reflect the reality. Since an operating schedule is available for each project, it is possible to refine this calculation method by excluding the number of hours during which the facility is closed, or in some cases by taking into consideration that the equipment operates continuously during the peak demand hours.
	4. Promote more active and extensive use of the M&V procedures: Standard Custom Retrofit projects must have an M&V plan compliant with the IPMVP (Section 6.7 of the program manual). For the majority of the 31 projects evaluated, the Evaluator did not observe any satisfactory M&V plans or reports during the in-depth reviews of the sample projects. Although M&V requires both the participant and ENSC to spend time and money, these additional resources would add key value to projects that yield such significant savings. As a major priority, M&V should thus be first and foremost conducted on large projects. In addition, M&V should be conducted on projects for which the savings to be realized depend heavily on equipment operating conditions, namely those involving industrial components such as compressors, variable speed drives and manufacturing equipment. As it was proposed in 2011, basic M&V procedures for any particular project should be defined at the earliest stage of project planning and execution (e.g. PDA signature) to ensure that baseline consumption data are metered (if required) before energy efficiency measures are implemented. This would greatly facilitate M&V activities and reduce their costs.

Sections	Recommendations
Executive Summary	5. Consider performing independent M&V on Custom Retrofit projects that are already carrying out M&V: The Evaluator believes that this recommendation from the 2011 report is still applicable. In fact, ENSC should consider performing independent M&V on projects where the implementation firm has already planned to conduct M&V within its project scope. It is possible that such M&V performed by implementation firms will not be in compliance with the IPMVP. It is also likely that such M&V will cover measures both eligible and ineligible for the Custom Retrofit program and that it is impossible to distinguish between them in the M&V results. In addition, assigning the sole responsibility of M&V to the firm that also implements the project may be risky. To reduce this risk, the Evaluator recommends that ENSC perform an independent M&V on such projects. A minimum threshold of energy savings (e.g. 500 MWh/year) could also be established to differentiate projects that automatically require independent M&V from those for which it is be optional.
Program Manual	6. Provide a more detailed program description and justification: In Section 3.0, the program description and justification need to be more detailed. The justification of a custom program within a program portfolio is essential to capturing lost opportunities and measures that could not have been otherwise designed in a prescriptive manner as long as they meet some macro eligibility criteria. Moreover, it is recommended to include a comprehensive description and justification of the rationale underlying the introduction of the two new measures, namely compressed air leak management and EMIS implementation.
	7. State in clear terms that typical measures are mentioned only as examples: Mentioning typical eligible measures in a custom program (such as compressed air, industrial processes, refrigeration, motors, lighting, controls, other electrical end uses, as well as the two possible new measures) could be quite misleading to a potential participant unless the program literature clearly states that these measures are just examples. The Evaluator recommends mentioning as much as possible in all program literature that the program is also open to other measures in addition to those cited as examples.

Sections	Recommendations
Program Manual	8. Include references to marketing documents in the Marketing Process section: In the program manual, the Marketing Process section refers to Appendix B of the program manual (Custom Marketing Plan), which in turn refers to other documents related to the marketing strategy. The Evaluator recommends providing direct references to the original sources in the program manual without unnecessary detours.
Evaluation Plan	9. Adapt the evaluation plan template to meet program needs: The evaluation plan template has been designed mainly for the programs with prescriptive measures or resource acquisition programs. It has not been designed for performance or custom programs. So the base-case section is not really appropriate or relevant since savings cannot be forecasted or projected for such programs, the savings of which are assessed and calculated on a case-by-case basis. In the table of the base case, all the lines containing no information or N/A should be deleted.
Program Charts	10. Make the process chart available in more sections of the website: The participation process chart, which is very well done, is available on the program website in the “Contact Us” section under the “Download all the materials in one package” hyperlink. In addition, the Evaluator suggests adding this chart in the “Start Now” section or in a new section such as “How does it work” so that it will be easier for potential participants to access and locate.
Marketing and Outreach Activities	11. Make the performance indicators more quantitative: To make the current performance indicators in the marketing plan more precise, specific and effective, they should be modified to reflect more quantitative or measurable data. In addition, they should focus more on the performance of each selected marketing strategy tool and less on the general status of the activity. The performance indicators should provide feedback on each element of the marketing strategy and help the user make informed decisions. Finally, considering the dynamic nature of the performance indicators, the marketing plan should indicate the revision date.

Sections	Recommendations
Tracking Sheet	12. Split the customer name field in two columns: When conducting the tracking sheet evaluation, there was no project description column. There was only a “Customer Name” column, which occasionally contained information related to the project type along with the customer identification (e.g. “Customer Name – Lighting Retrofit”). To eliminate this sort of confusion, the Evaluator recommends creating a “Project Name” column to give a relevant description of the project. The PM should then ensure that the “Customer Name” field is fully dedicated to customer identification using standardized names, where applicable. With the existing tracking sheet, it is difficult to filter or sort projects by program participant identity. The addition of this new “Project Name” column along with the standardization of “Customer Name” column entries would help address this issue.
	13. Include contact name, phone, email address: This information was added upon the request of the Evaluator. It should have already been in the tracking sheet. In addition, the full address was not given, only the city and/or postal code. The complete address should be in the tracking sheet, with all the fields properly separated (civic number, street name, apartment number, city, postal code, etc.)
	14. Compile the results of the free-ridership pre-screening process: ENSC should systematically compile the data from the answers given by participants to the 5 pre-screening free-ridership questions. This would have allowed the PM to monitor whether approved participants had been flagged as free-riders. Also, since this information is taken into account by the Evaluator for the free-ridership calculation, it is necessary to have it easily available for calculation purposes.
	15. Include comments in separate cells: Several cells in the savings calculation section of the tracking sheet contain pertinent information and explanations in comment bubbles. Considering the large size of the database, it may be helpful to present this information in a way that facilitates tracking. For instance, the PM could create a column named “Comments” in the tracking sheet where important comments on each project status and savings calculation could be written.

Sections	Recommendations
Tracking Sheet	16. Develop a standardized nomenclature to name and classify the electronic files: This recommendation has been motivated by the difficulties encountered by the Evaluator when searching for technical specifications, formulae and assumptions used for savings calculations. A nomenclature for naming and classifying project documents already exists in the program manual, but it seems that it is not being systematically applied. When searching for documentation, Econoler found out that relevant documents were sometimes hidden and difficult to gather. In addition, it was not always possible to know which version of the same document was the most up-to-date. Furthermore, a number of template files, which typically contained either no data or data unrelated to the project, were found in project folders, leading to confusion on the correct tracked savings. Econoler also experienced some problems when using the DSMDS. Many project documents had the same name although they were not connected to the same project, which was confusing when many documents from different projects were downloaded during the same session on the DSMDS. Consequently, Econoler recommends that the names of documents downloaded directly from the DSMDS include more detailed information, such as the project number, the document type (form 2, form 7, etc.) and the revision of the file.

APPENDIX II – INTERVIEW GUIDE WITH CONSULTANTS

PROGRAM NAME: CUSTOM PROGRAM

How to complete this form

This is a Word document that integrates some form features. To enter your answers, simply position your cursor on the shaded sections and begin typing. Since this is a form, you cannot write anywhere else in the document. For the boxes, just click on the one next to your answer. Click again to uncheck it.

Please complete this form within the next 48 hours, save the file and send it back to us at ldouville@econoler.ca.

Thank you!

Part I: General Questions

Please indicate your company name.

Q1a. How would you describe your role(s) as an ENSC energy efficiency program associates?

Q1b. How long have you held that role/those roles (specify months or years)?

Q2a. How would you qualify your participation process in this program?

- ☐ Simple
☐ Complex

Q2b. If you checked “Complex,” please indicate which parts of your involvement or participation process have been the most complex.

Q2c. If you checked “Simple,” please indicate which parts of your involvement or participation process have been simple.

Q3. On a scale from 1 to 10, where 1 is very poor and 10 is excellent, please rate your satisfaction in regard to the:

Aspects of the program	Score	Reason
	1 = very poor 10 = excellent NA = Not Applicable	If you answered 8 or less, please share the reason(s) for your score.
Overall program		
Technical / M&V support		
Processing delay by ENSC		At what stage(s) did you encounter delays:
Program marketing and outreach activities		
Relationship with ENSC staff		
Relationship with clients		

Q4. Next, we would like you to rate the Custom program's impact on your business. Using a scale from 1 to 10, where 1 is "No impact" and 10 is "Significant impact", please indicate to what degree has the program incentives as well as the program support and marketing driven your sale of professional services and design work?

Score (1=No impact / 10=Significant impact):

Q5. In your opinion, what are the main barriers to the delivery of the program, in order of importance?

Q6a. Approximately how many complaints have you received from participants thus far in 2012?

Number of complaints:

Q6b. What was the complaint/were the complaints about?

Q7a. Regarding program on-course modifications, (new measures such as facility compressed air leak management and energy management information systems) do you feel they:

- ☐ Are easily adapted into the way you work
- ☐ Require minor changes in the way you work
- ☐ Require major changes in the way you work
- ☐ Not applicable

Q7b. If you answered “Require major changes in the way you work,” would you say those major changes have caused problems in the way the program is managed or delivered?

- ☐ Yes
☐ No

Q7c. If you answered “Yes,” what have those problems been?

Q8. What suggestions do you have to improve program performance?

Part II: Questions Specific to the Custom Program

Q9. As a Verification Partner, in which of the following program components are you involved?

- ☐ The scoping study
☐ The feasibility study
☐ Site inspections
☐ Measurement & Verification (M&V)
☐ Technical assistance to participants
☐ Other:

Q10a. If you selected “Measurement and Verification (M&V)” in the previous list, are you or one of your staff members a certified Measurement & Verification Professional (CMVP)?

- ☐ Yes
☐ No

Q10b. If you selected “Measurement and Verification (M&V)” in the previous list, approximately how many projects involving M&V have you done with ENSC’s support?

- ☐ 1 to 5 M&V projects
☐ 6 to 10 M&V projects
☐ 11 to 20 M&V projects
☐ More than 21 M&V projects

Q10c. If you selected “Measurement and Verification (M&V)” in the previous list, approximately how many projects involving M&V have you done without ENSC’s support?

- ☐ 1 to 5 M&V projects
- ☐ 6 to 10 M&V projects
- ☐ 11 to 20 M&V projects
- ☐ More than 21 M&V projects

Q11. To conclude, do you have any other comments or suggestions, or are there any issues not addressed within this questionnaire that you would like to mention?

Thank you very much for your time and co-operation.

Your answers will be treated in strict confidence—no names will ever be mentioned in the evaluation report. Our hope is that these results will contribute to improving program performance. You may be contacted by phone if we need to clarify your answers.

Date	
Your name	
Area code and phone number	
Email	

APPENDIX III – ON-SITE VISIT PROTOCOLS

The on-site visit protocols for Custom Retrofit are attached in PDF format to this report.

APPENDIX IV – FIRMOGRAPHICS

The profile of the program participants interviewed for the survey is presented in the following tables.

Although five respondents reported that energy costs represented less than 10 percent of their annual operating budget, the average for all those who provided a response was 22 percent.

Table 20: Energy Costs as a Percentage of Annual Operating Budget

Percent of Budget	2011* (%)	2012* (#)
<i>Sample Size</i>	<i>20</i>	<i>15</i>
Less than 10%	45%	5
10-19%	20%	2
20-29%	10%	3
30-39%	15%	2
40-49%	5%	1
50-59%	--	2
60-69%	5%	--
70-79%	--	--
80-89%	--	--
90-99%	--	--
Average Percent	17%	22%
*Note: <i>Don't know</i> responses were removed from 2011 and 2012 data.		

Just over two in ten respondents (22%) were retail businesses (other than malls) and 15% were recreation centres or community halls.

Table 21: Business Type

Business Type	2011 (%)	2012 (%)
<i>Sample Size</i>	27	27
Retail (other than mall)	4%	22%
Recreation centre/community hall	--	15%
Education	11%	7%
Food manufacturing	--	7%
Office	--	7%
Lodging	--	7%
Manufacturing	19%	4%
Government	11%	4%
Health Care (inpatient)	7%	4%
Health Care (outpatient)	--	4%
Transportation	--	4%
Food sales (grocery)	15%	--
Real estate/Property Management	11%	--
Service	7%	--
Warehouse and storage	4%	--
Enclosed and strip malls	4%	--
Sports facility	--	--
Fire station and civic center	--	--
Cold storage/refrigeration	--	--
Industry – mining/saw mill/foundry/metal distribution	--	--
Distribution	--	--
Hospital	--	--
Heavy equipment repair	--	--
Others	7%	15%

Three in 10 respondents were organizations with 250 or more full-time workers (30%), while one-quarter have between 50 and 249 full-time workers (26%). Nearly two in 10 have fewer than 10 full-time workers in their organization (19%).

Table 22: Full-time Equivalent Workers

Full-time Equivalent Workers	2011 (%)	2012 (%)
<i>Sample Size</i>	27	27
Fewer than 5	4%	15%
5 to 9	7%	4%
10 to 19	--	4%
20 to 49	11%	15%
50 to 99	7%	11%
100 to 249	22%	15%
250 or more	41%	30%
Don't know	7%	7%

One-half (52%) of the respondents were independent organizations, while nearly four in 10 (37%) were respectively part of a larger company.

Table 23: Type of Company

Type of Company	2011 (%)	2012 (%)
<i>Sample Size</i>	27	27
Independent	67%	52%
Part of a larger company	26%	37%
Franchise	7%	--
Others	--	11%

Over six in 10 respondents (63%) were organizations with 5 or fewer locations.

Table 24: Number of Business Locations in Nova Scotia

Number of Locations	2011 (%)	2012 (%)
<i>Sample Size</i>	27	27
1-5	59%	63%
6-10	7%	11%
11-20	11%	15%
21-50	7%	7%
100 and more	4%	--
Depends/Don't know	11%	4%

APPENDIX V – PARTICIPANT SURVEY QUESTIONNAIRE

**Participant Survey
ENSC C&I Custom Program
November 1, 2012**

Could I speak with [INSERT NAME]?

1. Yes [GO TO INTRODUCTION]
2. No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

INTRODUCTION

Hello, my name is _____ and I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you or your firm recently participated in Efficiency Nova Scotia Corporation’s Commercial and Industrial Custom Program. We would appreciate your collaboration in answering questions related to your participation in this program. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve the program. The survey will take about fifteen minutes. Is this a good time for you?

Verification and Recall [V Series]

- V1. The Custom program helps businesses implement electrical energy-saving projects. The Custom program offers technical assistance, financial incentives and financing to offset the cost of engineering studies, energy efficiency equipment and installation.
- Our records indicate that your company or organization participated in Efficiency Nova Scotia’s Custom Program in 2012. Is this correct?
1. Yes (GO TO V3)
 2. No
- V2. Is there someone else at your company or organization who would know about your company or organization’s participation in Efficiency Nova Scotia’s Custom Program?
1. Yes (Ask for name: _____ and telephone #: _____) (THANK AND TERMINATE; SCHEDULE INTERVIEW WITH BEST CONTACT)
 2. No (THANK AND TERMINATE)
- V3. Are you the person in your company or organization who is most knowledgeable about your experience with the Efficiency Nova Scotia’s Custom Program?
1. Yes (IF YES GO TO P1)
 2. No

- V4. We would like to talk to the person who is the most knowledgeable about your experience with the Efficiency Nova Scotia's Custom Program. Could you give me the name and telephone number of this person? [Probe this individual may be an engineer, equipment contractor, or utility account manager].

Name: _____

Telephone #: _____

[NOTE: THANK AND TERMINATE CALL. SCHEDULE INTERVIEW WITH BEST CONTACT REGARDING EXPERIENCE WITH THE PROGRAM]

Reasons for Participating [P Series]

- P1. Did your company or organization participate in any other Nova Scotia Power or Efficiency Nova Scotia energy efficiency programs before participation in the Custom Program?

1. Yes
2. No (GO TO P3)
98. (Don't know) (GO TO P3)
99. (Refused) (GO TO P3)

- P2. (IF P1 = YES) Which programs did your company or organization participate in prior to the Custom Program? [IF RESPONDENT CANNOT RECALL THE PROGRAM NAMES RECORD A SHORT DESCRIPTION VERBATIM]

1. (Small Business Energy Solutions / Small Business Lighting Solutions)
2. (Business Energy Rebates (BER))
3. (Commercial Direct Install (CDI))
4. (Smart Lighting Choices (SLC))
96. (Other, please specify: _____)
98. (Don't know)
99. (Refused)

- P3. How did you learn about the Custom Program? Probe: Anything else? [DO NOT READ - MULTIPLE RESPONSES]

1. (Efficiency Nova Scotia literature)
2. (Efficiency Nova Scotia presentation)
3. (Efficiency Nova Scotia staff)
4. (Efficiency Nova Scotia's website)
5. (Contractor or vendor)
6. (Someone who had previously participated in the Custom Program)
7. (Dalhousie Eco Efficiency Centre)

- 8. (Business associate or friend / Word of mouth)
- 9. (Trade show)
- 96. (Other way, specify: _____)
- 100. (Don't know)
- 101. (Refused)

P4. What was the SINGLE most important reason your company or organization chose to participate in the Custom program? [DO NOT READ – ACCEPT ONE RESPONSE]

- 1. (to take advantage of program incentives)
- 2. (this was part of an already planned project)
- 3. (to save on energy/to save on energy costs)
- 4. (for quality improvement (in terms of lighting conditions, comfort or equipment performance))
- 5. (to help protect the environment)
- 6. (to replace non-working equipment/equipment in poor conditions)
- 7. (past participation in another utility program)
- 8. (to take advantage of the technical support offered under the program)
- 96. (Other: Please Specify: _____)
- 98. (Don't know) (GO TO P6)
- 99. (Refused) (GO TO P6)

P5. What was the SECOND most important reason your company or organization chose to participate in the Custom program? [DO NOT READ – ACCEPT ONE RESPONSE – SAME LIST AS P4]

P6. Some companies work with a design professional, project architect, engineer, equipment contractor, or a utility account manager as part of the project design phase. Who do you feel was more responsible for specifying the measures to install through the Custom Program? Was it ...: [RANDOMIZE, READ, ACCEPT ONE RESPONSE]

- 1. An outside design professional (architect, engineer, etc.)
- 2. A contractor
- 3. A manufacturer representative
- 4. A utility account manager
- 5. Someone within your company or organization
- 96. (Other, please specify: _____)
- 98. (Don't know/Don't recall)
- 99. (Refused)

Free-Ridership [FR Series]

According to our information, through its participation in the Custom Program, your business or organization received incentives to implement electrical energy-saving projects in one or several facilities or buildings. When answering the next survey questions, please take into account only those Nova Scotia facilities or buildings where your company implemented energy-saving projects through the Custom program.

FR1. **Before participating** in the Custom Program, did your company or organization have plans to implement the specific energy efficiency measures that were implemented through the Custom Program?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

RFR1a. IF FR1=YES, THEN ASK: I just want to make sure I understand - **Before** you decided to participate in the Custom Program, you had already made the decision to implement the energy efficiency measures you implemented through the program?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Custom Program.

If your company or organization had not participated in the Custom Program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action." [AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT, In the absence of the Program, would you have . . . : DO NOT ACCEPT A RANGE – POSE FR2 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FR2a. . . . implemented exactly the same energy efficiency measures that you implemented through the program?

___ Response ___98 Don't Know ___99 Refused

FR2b. . . . installed standard equipment instead of energy-efficient equipment?

___ Response ___98 Don't Know ___99 Refused

FR2c. . . . implemented the energy efficiency measures that you implemented through the program, *but at a later date*?

___ Response ___98 Don't Know ___99 Refused

IF FR2C > 5, THEN ASK:

FR2cc. DO NOT POSE FR2cc IF DON'T KNOW OR REFUSED IN Q.FR2c You indicated in your response to the previous question that if the Custom Program had not been available there was an X in 10 likelihood that you would have implemented the same energy efficiency measures *but at a later date*. Approximately how many months later would you have implemented these measures? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. ___ months later
2. (Never)
3. (At the same time)
98. (Don't Know)
99. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FR2cc ANSWER IN MONTHS, READ]:

Would it have been within . . .

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FR3. As part of its Custom Program, Efficiency Nova Scotia offers financial incentives and on-bill financing to help the implementation of energy-saving projects. If your company or organization had not received the financial incentives and/or on-bill financing from Efficiency Nova Scotia, would you have paid and/or financed the full cost of the project you implemented? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Paid and/or Financed” and a 10 indicating that you “Definitely **Would** Have Paid and/or Financed.” [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

___ Response ___98 Don't Know ___99 Refused

FR4. Next, I'm going to ask you to rate the importance of factors that might have influenced your decision to implement the energy efficiency measures you implemented through the program. Using a scale from 0 to 10, where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of each of the following in your decision to implement the energy efficiency measures you implemented through the Program. [RANDOMIZE – READ - DO NOT ACCEPT A RANGE]

[RECORD RESPONSE 0-10; 97=NON APPLICABLE; 98=DON'T KNOW; 99=REFUSED]

- a. The program financial incentives and/or on-bill financing
[STATE IF ASKED WHAT 'ON BILL FINANCING' IS: Efficiency Nova Scotia's Custom program offers on-the-bill financing of eligible costs for qualified Custom program customers seeking such financing.]
- b. The recommendations and technical assistance provided by the program when your company was engaged in discussions with contractors and consultants about equipment choices
- c. The technical assistance offered by the program during the project implementation and the Measurement & Verification process
- d. [ASK IF, IN DATABASE, SCOPING STUDY OR FEASIBILITY STUDY=YES] The funded Scoping Study and/or the Feasibility Study
- e. Your company or organization's corporate policy or guidelines regarding the purchase of equipment
- f. The standard practice in your industry
- g. The existing energy efficiency code
- h. Previous experience with the Custom Program or a similar program either from Efficiency Nova Scotia or Nova Scotia Power

Spillover [SO Series]

ASK SO SERIES IF, IN DATABASE, FEASIBILITY STUDY=YES

SO1. Now I'd like you to think at the energy efficiency measures that were recommended in the Feasibility Study you conducted through the Custom program. Was there any energy efficiency measure recommended in this Feasibility Study that you decided not to implement through the program?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

[IF SO1 = 2 OR 98 OR 99, GO TO S Series]

SO2. [ASK IF SO1=1] I'd like to know the energy efficiency measures that were recommended in your Feasibility Study but that you decided not to implement under the program. Were the [SO2a-h] recommended in your Feasibility Study but not implemented?? [ASK FOR EACH ITEM]

[1 = YES 2 = NO, 98 = DON'T KNOW / DON'T REMEMBER, 99 = REFUSED] [READ AND ROTATE – ALWAYS POSE 'H' LAST]

- a. Lighting measures
- b. Building envelope improvement measures
- c. HVAC (heating, ventilating and air conditioning) system measures
- d. Refrigeration measures
- e. Compressed air system measures or compressed air leak management
- f. Motors and drives measures
- g. Energy management information systems
- h. Other energy efficiency measures? (specify)

[ASK SO3 FOR EACH ITEM IN SO2 ANSWERED BY YES (SO2a-h=1)]

SO3. Why did you decide not to implement the [SO2 'YES' RESPONSE] that were recommended in your Feasibility Study? [DO NOT READ]

1. (Too complicated to install or implement)
2. (Cost too much)
3. (Did not need these measures)
4. (Did not want to change, actual equipment works fine)
5. (Did not believe it will result in lower energy bills)
6. (Did not trust in energy professionals installing new measures)

96. (Other [SPECIFY: _____])
98. (Don't know)
99. (Refused)

You mentioned in a previous answer that there were some recommended measures in the Feasibility Study that you decided not to implement through the program.

SO4. **Since the time that you participated** in the Custom Program, have you implemented some of these recommended measures?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

SO5. [ASK IF SO4=1] Which of the following have you implemented since the time you participated in the Custom Program?" 1 Yes, 2 No

[LIST OF ELEMENTS RECORDED AS YES IN S02 (S02a-h=1)]	Responses
a. Lighting measures	___ Response ___ 98 Don't Know ___ 99 Refused
b. Building envelope improvement measures	___ Response ___ 98 Don't Know ___ 99 Refused
c. HVAC system measures	___ Response ___ 98 Don't Know ___ 99 Refused
d. Refrigeration measures	___ Response ___ 98 Don't Know ___ 99 Refused
e. Compressed air system measures or compressed air leak management	___ Response ___ 98 Don't Know ___ 99 Refused
f. Motors and drives measures	___ Response ___ 98 Don't Know ___ 99 Refused
g. Energy management information systems	___ Response ___ 98 Don't Know ___ 99 Refused
h. Other energy efficient measures?: specify	___ Response ___ 98 Don't Know ___ 99 Refused

Satisfaction [S Series]

S1. On a scale of 1 to 5, where 1='not at all satisfied' and 5='very satisfied', how was your company or organization's experience with each of the following aspect of the Custom Program? If your company or organization did not have experience with one of the aspects please tell me. [DO NOT RANDOMIZE, DO NOT ACCEPT A RANGE]

[97 = Not Applicable, 98 = Don't know/Don't recall, 99 = Refused]

- a. Interaction and communication with staff
- b. Availability of staff
- c. Interaction and communication with contractors/consultants
- d. Initial confirmation of eligibility
- e. Delays to confirm eligibility
- f. [READ IF, IN DATABASE, SCOPING STUDY=YES] Scoping Study
- g. [READ IF, IN DATABASE, SCOPING STUDY=YES] Scoping Study rebate amount
- h. [READ IF, IN DATABASE, FEASIBILITY STUDY=YES] Feasibility Study
- i. [READ IF, IN DATABASE, FEASIBILITY STUDY=YES] Feasibility Study incentive amount
- j. Project implementation
- k. Project rebate amount
- l. [READ IF, IN DATABASE, FINANCING=YES] Program on-bill financing
- m. Project savings verification
- n. Paperwork and procedures required to receive rebate or incentives
- o. Delays to receive rebates or incentives
- p. The program overall

Barriers to Actions and Recommendations [B Series]

- B1. Did you face any challenge or barrier when implementing energy efficiency measures through the Custom Program?
1. Yes
 2. No (SKIP TO B4)
 98. (Don't know) (SKIP TO B4)
 99. (Refused) (SKIP TO B4)
- B2. What was the most important barrier? [DO NOT READ - ACCEPT MULTIPLE RESPONSES BUT DO NOT PROBE]
1. (approval takes too long)
 2. (measurement and verification requirements)
 3. (payback time frame)
 96. (Other – SPECIFY: _____)
 98. (Don't know)
 99. (Refused)
- B4. On a scale of 1 to 5, where 1= 'not at all important' and 5 = 'very important', how important is **reducing energy usage** to your company or organization?
- [98 = Don't know, 99 = Refused] [DO NOT ACCEPT A RANGE]
- B5. On a scale of 1 to 5, where 1= 'not at all important' and 5 = 'very important', how important is **managing energy costs** to your company or organization?
- [98 = Don't know, 99 = Refused] [DO NOT ACCEPT A RANGE]
- B6. Approximately what percent of your annual operating budget do energy costs account for?
- [998 = Don't know, 999 = Refused] [DO NOT ACCEPT A RANGE]
- ____ %
- B7. Do you have any suggestions on how to improve the Custom Program? Consider all aspects of the program: Participation process or program components (Scoping Study, Feasibility Study, project implementation, and project savings verification), marketing, interactions with staff, interactions with contractors, and program forms. PROBE: Anything else?
- Record Verbatim
-

Firmographics [F Series]

- F1. What is the main activity of your company or organization? [DO NOT READ—BUT CONFIRM WITH RESPONDENT THAT THE CATEGORY YOU CHOOSE IS CORRECT]
1. Education
 2. Food Sales (grocery)
 3. Food Service (restaurant)
 4. Health Care - Inpatient
 5. Health Care - Outpatient
 6. Lodging
 7. Mercantile— Retail (Enclosed and Strip Malls)
 8. Mercantile – Retail (Other than Mall)
 9. Office
 10. Public Assembly
 11. Public Order and Safety
 12. Religious Worship
 13. Service
 14. Warehouse / storage
 15. Manufacturing
 16. Vacant building
 17. Other (SPECIFY: _____)
 98. (Don't know)
 99. (Refused)
- F3. Approximately how many full-time equivalent workers DOES YOUR COMPANY OR ORGANIZATION employ at all locations within Nova Scotia?
1. Fewer than 5
 2. 5 to 9
 3. 10 to 19
 4. 20 to 49
 5. 50 to 99
 6. 100 to 249
 7. 250 or more
 98. (Don't know)
 99. (Refused)

F5. Is your company independent, or part of a larger company?

- 1. Independent
- 2. Part of a larger company
- 3. Other (_____)
- 98. (Don't know)
- 99. (Refused)

F6. How many business locations does your organization have in Nova Scotia?

[RECORD A NUMBER 1-99; 998 = Don't know, 999 = Refused]

END: Those are all the questions I have for you. I thank you very much for your time and cooperation and have a nice day!

APPENDIX VI – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

FR2a. If your company had not participated in the program, what is the likelihood that you would have implemented exactly the same energy efficiency measures that you implemented through the program? (Scale 0 to 10)	FR2a = Answer x 10%
FR2b. If your company had not participated in the program, what is the likelihood that you would have installed standard equipment instead of energy-efficient equipment? (Scale 0 to 10)	FR2b = (10 – Answer) x 10%
PA1 Score:	MEAN VALUE OF: (FR2a ; FR2b) IF PRE-SCREENING: 0%
FR1. Before participating in the program, did your company have plans to implement the specific energy efficiency measures that were implemented through the program?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just want to make sure - Before you decided to participate in the program, you had already made the decision to implement the energy efficiency measures that you implemented through the program?	IF 1. Yes: FR1 = 100% IF 2 OR 9 : FR1 = 0%
FR3. If your company had not received the financial incentives and/or on-bill financing from ENSC, would you have paid and/or financed the full cost of the project you implemented? (Scale 0 to 10)	FR3 = Answer x 10%
PA2 Score:	IF FR1 = 0% : FR3 / 2 IF FR1 = 100% : FR3 IF PRE-SCREENING: 0%
FR4. Level of influence (Scale 0 to 10) Factors a, b, c, d and h = Program factors Factors f and g = Non Program factors	FR4_P = SUM(a; b; c; d; h) FR4_NP = SUM(f; g)
PA3 Score:	100% - [FR4_P/(FR4_P+FR4_NP)]
FR2c. If your company had not participated in the program, what is the likelihood that you would have implemented the energy efficiency measures but at a later date ? (Scale 0 to 10)	IF FR2c > 5 : ASK FR2cc Otherwise: PA4 = EMPTY
FR2cc. Approximately how many months later would you have implemented the measures? 1. Less than 6 months? 2. 6 months to less than 1 year later? 3. 1 to less than 2 years later? 4. 2 to less than 3 years later? 5. 3 to less than 4 years later? 6. 4 or more years later? 7. (Never) 9. (Don't know / Refused)	IF 1. : FR2cc = 100% IF 2. : FR2cc = 50% IF 3. : FR2cc = 25% IF 4. : FR2cc = 0% IF 5. : FR2cc = 0% IF 6. : FR2cc = 0% IF 7. : FR2cc = 0% IF 9. : FR2cc = 0%
PA4 Score:	FR2cc
Final Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)
Inconsistency Test #1	IF ABS(FR2a – FR2b) ≥ 30%: PA1 = MIN OF (FR2a ; FR2b)
Inconsistency Test #2	IF FR3 ≥ 70% AND IF (FR2a OR FR2b < 70%: PA2 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)

APPENDIX VII – ALGORITHM FOR IMPACT CALCULATION

This appendix presents a sample worksheet showing step-by-step calculations that have produced the results for one of the projects reviewed in the impact evaluation of Custom. Firstly, the equations used for the savings calculations are presented, followed by the tracked savings estimated by ENSC and the savings results revised in this evaluation, mainly based on on-site visit results and documentation analysis.

The project cited as example involves the replacement of five motors with more efficient equivalent models.

Savings Equations

For both the existing and new motors, the annual energy consumption is calculated. The annual energy savings (in kWh/year) are the result of subtracting the new motor consumption from the existing motor consumption. The same methodology is applied to calculate demand savings, on which a diversity factor is applied.

$$\text{Motor Consumption} \left[\frac{kWh}{\text{year}} \right] = \frac{\text{Nominal Power} \times 0.746 \times \text{Annual Operation Hours} \times \text{Load Factor}}{\text{Motor Efficiency}}$$

$$\text{Annual Energy Savings} \left[\frac{kWh}{\text{year}} \right] = \text{Motor consumption}_{\text{existing}} - \text{Motor Consumption}_{\text{new}}$$

$$\text{Motor Demand} [kW] = \frac{\text{Nominal Power} \times 0.746 \times \text{Load Factor}}{\text{Motor Efficiency}} \times \text{Diversity Factor}$$

$$\text{Demand Savings} [kW] = (\text{Motor Demand}_{\text{existing}} - \text{Motor Demand}_{\text{new}})$$

Where:

- > The “Nominal Power” is given in horsepower (hp), and 0.746 is the conversion factor for kW/hp;
- > the “Motor Efficiency” is the nominal efficiency at full load, as written on the nameplate;
- > the “Diversity Factor” is the likelihood that the motor will be operating during the peak load period in Nova Scotia. This factor is used for the calculation of coincident peak demand savings. As was the case with the 2011 evaluation, Econoler elected to use the 5:00 pm to 7:00 pm timeframe on non-holiday weekdays of December, January or February, as the peak load period for the 2012 evaluation.

Tracked Savings Calculation

ENSC proceeded to calculate energy and demand savings with the information available in the documentation submitted by the participant, namely Project Development Agreement forms and calculation spreadsheets. Below are the values used for calculating the energy savings of this project.

Table 25: Values Used for Tracked Savings Calculation

Parameter	Existing	New
Quantity of motors	5	5
Nominal power (hp)	50	50
Annual operation hours (hrs/year)	8,672	8,672
Load factor	80% (<i>not considered</i>)	80% (<i>not considered</i>)
Motor efficiency	88.7%	95.0%
Energy consumption (kWh)	1,823,658	1,702,529
Demand (kW)	<i>not calculated</i>	<i>not calculated</i>
Tracked Energy Savings (kWh)	120,918	
Tracked Demand Savings (kW)	0	

Although the program participants provided an actual motor loading value (80%) in the initial calculation spreadsheet, this value was not included in the energy savings calculation. Furthermore, tracked demand savings were nil.

Revised Savings Calculation

Econoler based its savings review on the results of the on-site visit conducted at the plant where the motors were installed, as well as on in-depth analysis of the technical documentation provided by ENSC. During the on-site visit, the following elements were verified: quantity and proper installation of new motors, operation schedule, nameplate data and the application for which the motors were used. It was found on site that the nominal full-load efficiency of the new motors stated by the participant did not correspond to the nameplate efficiency; in fact, the actual motor efficiency was 93 percent instead of 95 percent. Furthermore, it was confirmed that the motors operated continuously year-round, i.e. 24 hours a day and 7 days a week, to provide process cooling. This information matched with the operating hours estimated by the program participants (8,762 hours per year, assuming 1 percent of downtime).

The Evaluator then proceeded to analyze the calculation spreadsheet provided by the participant and reviewed by ENSC. It was observed that the load factor entered in the spreadsheet (80 percent) had been left out of the energy savings calculation. In addition, the information allowed for adding peak demand savings for this project. The values given in the table below were consequently used by Econoler to calculate the revised energy and demand savings.

Table 26: Values Used for Revised Savings Calculation

Parameter	Existing	New
Quantity of motors	5	5
Nominal power (HP)	50	50
Annual operation hours (hr/year)	8,672	8,672
Load factor	80%	80%
Motor efficiency	88.7%	93.0%
Energy consumption (kWh)	1,458,927	1,391,314
Diversity factor	100%	100%
Demand (kW)	168.2	160.4
Revised Energy Savings (kWh)	67,613	
Revised Demand Savings (kW)	7.8	

The difference between the revised energy savings and the tracked value was mainly due to two factors, i.e. the correction of the new motor efficiency and the addition of the actual load factor in the equation. Regarding the demand savings calculation, the Evaluator estimated the diversity factor to be used at 100 percent for the following reasons:

- > The program participant mentioned that the motors operated at a rather constant load. The installation of VSDs was not even considered cost-effective, which confirmed the participant's statement about the low variations in motor loading. Noteworthy is that the load factor (80 percent) was included in the demand savings calculation so that the demand savings were calculated for partially loaded motors.
- > The operation hours were very close to 100 percent of the year. Downtimes, which were estimated to 1 percent, might be due to maintenance activities or production shutdown (e.g. during holidays). In light of this information, it was impossible that any of these motors was turned off during the peak period as previously defined unless there was an unplanned production stoppage.

Final Adjustment Ratios

As mentioned previously, the inclusion of the load factor into the energy consumption equation, as well as the correction of the new motor efficiency, had a significant impact on the energy savings for this project, resulting in a 0.559 adjustment ratio. This ratio was applied only to this project's energy savings, but the adjusted savings of this project influenced the overall adjustment factor calculated for this category of project.

With regard to the demand savings, no adjustment ratio could be calculated for this project since the tracked demand savings were nil. Nevertheless, this project's revised demand savings contributed to the overall adjustment factors calculated for other Custom retrofit projects in the 2012 program impact evaluation, as was the case for the revised energy savings.



1. General Information

Site Visit Date: _____
Project ID: _____ Contact Name: _____
Project type: _____ Contact Phone: _____
Company name: _____ Email: _____
Address: _____

List of people met during the visit: _____

Type of building:

Commercial/institutional	☐	Industrial/manufacturing	☐
Municipal	☐	Other (specify)	☐

Specify: _____

2. Facility Operation Schedules

Facility Description: *Outlines a quick description of the facility and its purposes.*

Facility annual schedule: *Fill the table below for each occupancy schedule reported by the site contact as occupancy could vary for each section of the facility. Use additional sheets if necessary.*

Description	1 - Normal Schedule		2 - Specify:		3 - Specify:	
	Weekdays	Weekends	Weekdays	Weekends	Weekdays	Weekends
Number of day with regular schedule per						
Number of day with regular holidays schedule per year						
Number of days with no occupancy per year (For example: seasonal closure)						
Total number of day per year						

Facility daily schedule: *Fill the table below for each occupancy schedule reported by the site contact as occupancy could vary for each section of the facility. Use additional sheets if necessary.*

Schedules		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Holidays
Schedule 1: Normal	Time of use (e.g. 8:00 am to 5:00 pm)								
	Hours per day								
Schedule 2 (specified above)	Time of use								
	Hours per day								
Schedule 3 (specified above)	Time of use								
	Hours per day								

3. Building Heating/Cooling System Description

Heating Systems

Fill the table below for each heating system at the site

Description	Heating system 1	Heating system 2	Heating system 3	Heating system 4
Energy source (electricity, natural gas, oil, etc.)				
Heating system type (electric resistance, furnace, heat pump...)				
Nominal capacity (indicate the unit – kW, Mbtu/h...)				
Heating system efficiency or COP				
If any, changes in building set points (occ./ unocc. temp., % hum)				

Cooling Systems

Fill the table below for each cooling system at the site

Description	Cooling system 1	Cooling system 2	Cooling system 3	Cooling system 4
Energy source (electricity, natural gas, oil, etc.)				
Cooling system type (compressor, absorption...)				
Nominal capacity (indicate the unit – kW, tons, etc.)				
Cooling system SEER or COP				
If any, changes in building set points (occ./ unocc. temp., % hum)				

4. Pre-Visit Assessment of the Project

Indicate the key observations from the feasibility study and M&V report analysis. These notes will serve on site to guide the visit and identify the main information to collect and/or verify.

5. On-Site Observations and Findings

Report the on-site visit and indicate the key observations and findings made on site.

6. Energy and Demand Savings Adjustments

Energy Savings from Tracking Sheet:		kWh/yr
Demand Savings from Tracking Sheet:		kW
Energy Savings from M&V (ENSC):		kWh/yr
Demand Savings from M&V (ENSC):		kW
Diversity Factor Used by ENSC:		

Adjustment from the Evaluator

Adjustment - M&V Energy Savings:	
Adjustment - M&V Demand Savings:	
Diversity Factor Used by Econoler:	

% of Project Completed in 2012:	
% of Project Completed in 2011:	
Energy Savings from PDA (for ref.):	kWh/yr
Demand Savings from PDA (for ref.):	kW

Final Project Impacts at the Meter

Evaluated Energy Savings:	kWh/yr
Evaluated Demand Savings:	kW

7. Additional Notes (if required)

1. General Information

Site Visit Date: _____
Project ID: _____ Contact Name: _____
Project type: _____ Contact Phone: _____
Company name: _____ Email: _____
Address: _____
List of people met during the visit: _____
Type of measures:

Low-emissivity ceiling	☐	Water Treatment	☐
Heat Recovery	☐	Lighting retrofit	☐

Other: _____
Ice Area (sq. ft.): _____ Ice making days: _____ Hours per week: _____
Ice Season (Weeks): _____ Season start: _____ Season end: _____

2. Facility Operation Schedules

Facility Description: *Outlines a quick description of the facility and its purposes.*

Facility annual schedule: *Fill the table below for each occupancy schedule reported by the site contact as occupancy could vary for each section of the facility. Use additional sheets if necessary.*

Description	1 - Normal Schedule		2 - Specify:		3 - Specify:	
	Weekdays	Weekends	Weekdays	Weekends	Weekdays	Weekends
Number of day with regular schedule per						
Number of day with regular holidays schedule per year						
Number of days with no occupancy per year (For example: seasonal closure)						
Total number of day per year						

Facility daily schedule: *Fill the table below for each occupancy schedule reported by the site contact as occupancy could vary for each section of the facility. Use additional sheets if necessary.*

Schedules		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Holidays
Schedule 1: Normal	Time of use (e.g. 8:00 am to 5:00 pm)								
	Hours per day								
Schedule 2 (specified above)	Time of use								
	Hours per day								
Schedule 3 (specified above)	Time of use								
	Hours per day								

3. Building Heating/Cooling System Description

Heating Systems

Fill the table below for each heating system at the site

Description	Heating system 1	Heating system 2	Heating system 3	Heating system 4
Energy source (<i>electricity, natural gas, oil, etc.</i>)				
Heating system type (<i>electric resistance, furnace, heat pump...</i>)				
Nominal capacity (<i>indicate the unit – kW, Mbtu/h...</i>)				
Heating system efficiency or COP				
If any, changes in building set points (<i>occ./ unocc. temp., % hum</i>)				

Cooling Systems

Fill the table below for each cooling system at the site

Description	Cooling system 1	Cooling system 2	Cooling system 3	Cooling system 4
Energy source (<i>electricity, natural gas, oil, etc.</i>)				
Cooling system type (<i>compressor, absorption...</i>)				
Nominal capacity (<i>indicate the unit – kW, tons, etc.</i>)				
Cooling system SEER or COP				
If any, changes in building set points (<i>occ./ unocc. temp., % hum</i>)				

4. On-Site Observations and Findings

Report the on-site visit and indicate the key observations and findings made on site.

5. Lighting

Collect the information in the table below if **Lighting measures** were installed. Use on-site observation and contact declaration.

Hours of use for lighting over ice surface:	
Is cooling installed in the section with the lighting measure?:	
If Yes: % time with lights <u>AND</u> cooling ON:	
Is heating installed in the section with the measure?:	
If Yes: % time with lights <u>AND</u> heating ON:	
The percentage of lighting that remains on when the facility is closed:	
Validate if lamps are installed, and if burnt how many:	
Is the facility manager planning to replace burnt lamp?	
If, not why? Are they OK with the reduced light level?	

6. Heat Exchangers

Collect the information in the table below if **Heat Exchangers** were installed. Use on-site observation and contact declaration.

Capacity of the chiller (specify unit):	Hot water purpose:
Cooling efficiency of the chiller (COP):	Hot water tank size:
Heat exchanger efficiency (%):	Annual hot water consumption:
Old hot water system energy:	Date of installation:

7. Low Emissivity Ceiling

Collect the information in the table below if a **Low Emissivity Ceiling** was installed. Use on-site observation and contact declaration.

Old ceiling type:	Date of installation:

8. Water Treatment

Collect the information in the table below if a **Water treatment system** was installed. Use on-site observation and contact declaration.

Water quality:	Date of installation:

10. Energy and Demand Savings Adjustments

Energy Savings from Tracking Sheet:		kWh/yr	% of Project Completed in 2012:		
Demand Savings from Tracking Sheet:		kW	% of Project Completed in 2011:		
Energy Savings from M&V (ENSC):		kWh/yr	Energy Savings from PDA (for ref.):		kWh/yr
Demand Savings from M&V (ENSC):		kW	Demand Savings from PDA (for ref.):		kW
Diversity Factor Used by ENSC:					

Adjustment from the Evaluator

Adjustment - M&V Energy Savings:	
Adjustment - M&V Demand Savings:	
Diversity Factor Used by Econoler:	

Final Project Impacts at the Meter

Evaluated Energy Savings:		kWh/yr
Evaluated Demand Savings:		kW

11. Additionnal Notes (if required)

CUSTOM NEW CONSTRUCTION IMPACT EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 5, 2013



ECONOLER

ACRONYMS

ABI	Advanced Building Institute
BNI	Business, Non-Profit and Institutional
CPG	Core Performance Guide
DSMDS	Demand-Side Management Data System
EM	Energy Modelling
ENSC	Efficiency Nova Scotia Corporation
FS	Feasibility Study
HVAC	Heating, Ventilation and Air-Conditioning
LEED	Leadership in Energy and Environmental Design
M&V	Measurement and Verification
MNECB	Model National Energy Code for Buildings
NC	New Construction
NCEM	New Construction Energy Modeling
NTGR	Net-to-Gross Ratio
PM	Program Manager

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Diversity factor	The ratio of the sum of the individual maximum demands of the various subsystems to the maximum demand of the whole system.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings

Spillover (internal)	Percentage of savings attributable to participants who continue to implement the energy efficiency measures introduced by a program after participating in it once, without participating in the program a second time.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 impact evaluation of Custom New Construction (NC), which is a component of the Custom program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM), as well as 10 on-site visits.

PROGRAM OVERVIEW

As part of the Custom program, NC was launched by Efficiency Nova Scotia Corporation (ENSC) on October 1, 2010. It provides technical assistance and financial incentives to help business, non-profit and institutional (BNI) customers build more energy-efficient facilities and reduce their electricity consumption and demand. NC provides eligible customers with incentives to help them achieve significant and predictable electricity savings in new commercial or industrial buildings, as well as in additions and major renovations.

NC offers two paths of participation: New Construction Energy Modeling (NCEM) and Prescriptive Rebates (Refer to the Business Energy Rebates – BER – report for further information on prescriptive rebates.). The NCEM path uses energy modeling to examine all possible energy savings within the building systems as a whole.

The Custom program is comprised of two components, with one targeting retrofit projects (Custom Retrofit) and the other targeting new construction or major renovations to the existing buildings (NC). In 2012, the Custom Retrofit and NC components were evaluated separately.

NC aimed at achieving net electricity savings of 6.1 GWh and demand savings of 1.1 MW for the year of 2012.

KEY FINDINGS

As the evaluation of NC showed, the program saw a total of 8 projects implemented for the year of 2012, which is similar to the number of projects in 2011 (9). In terms of net energy savings, NC generated 4.644 GWh, which represents a considerable increase in comparison with the net savings in 2011 (2.607 GWh). Unlike 2011, NC also claimed peak demand savings as part of the 2012 evaluation. Econoler's verification revealed that NC achieved net peak demand savings of 0.525 MW in 2012.

Program Energy Savings

To calculate the net savings of NC in 2012, the Evaluator first made on-site visits to all the projects and conducted in-depth participant interviews during these on-site visits. The Evaluator calculated the gross energy and peak demand savings for all the 2012 projects according to the specific characteristics of each project type.

Afterwards, the Evaluator determined the appropriate net-to-gross ratios (NTGRs) to be applied by assessing the free-ridership. With this approach, a free-ridership level of 26 percent was established, which represents a significant increase compared with the Custom free-ridership in 2011 (2012 is the first year in which the NC free-ridership is evaluated separately from that of Custom). The NTGRs, which directly determined the calculation of the net energy savings of NC for 2012, are presented in the following table.

Table 1: Distortion Effects and Net-to-Gross Ratio

Distortion Factors	2012
Free-Ridership Level	26%
Net-to-Gross Ratio	0.74

The current evaluation revealed that NC generated net energy savings of 4.644 GWh at the generator in 2012. As for electricity demand reduction, the program achieved 0.525 MW in net peak demand savings at the generator in 2012. The following table presents the NC final savings, along with the savings tracked by ENSC for 2012.

Table 2: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Adjusted Gross Savings	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	6.381 GWh	6.381 GWh	0.93	5.934 GWh
Evaluation Results	6.381 GWh	6.276 GWh	0.74	4.644 GWh
Demand Savings				
Tracked Savings from ENSC	0.840 MW	0.840 MW	0.93	0.781 MW
Evaluation Results	0.840 MW	0.710 MW	0.74	0.525 MW

As shown in the table above, the net energy savings at the generator calculated by Econoler are approximately 22 percent lower than those tracked by ENSC. This difference is mainly due to the NTGR ratio established as part of this year's evaluation. Actually, the gross energy savings tracked by ENSC were adjusted by only 1.6 percent, which was mainly due to Econoler finding two small discrepancies between the energy savings figures presented in the feasibility studies and those tracked by ENSC.

The difference between net peak demand savings from Econoler and ENSC (almost 33 percent) is higher than for net energy savings because of the significant adjustments made by the Evaluator to the gross peak demand savings tracked under the program tracking sheet. In fact, it was found that the peak demand savings claimed for two projects were either inapplicable or not detailed enough by engineering calculations to allow for an accurate claim in 2012. However, Econoler adjusted upward one of the projects' peak demand savings values since ENSC's estimate of the diversity factor was

considered too conservative in light of the information available, which translated into an increase of the peak demand savings by more than 50 percent for this project.

As part of the gross savings evaluation, Econoler also slightly modified the line loss factors used by ENSC for all NC projects in accordance with up-to-date values from NSPI. It is, however, worth noting that this modification had no impact on the final evaluated savings results, Econoler's average line loss factors for energy and peak demand savings being respectively 0.07 percent and 0.06 percent lower than ENSC's.

Finally, the relatively high free-ridership percentage established following the in-depth interviews (conducted during the on-site visits) is probably due to a variety of factors. The review of the 2012 NC projects showed that a significant proportion of program participants had decided to implement energy efficiency measures not only to obtain ENSC's technical and financial support, but also to obtain a green building certification (e.g. LEED) or to comply with a corporate policy. Additionally, it should be noted that similar programs in other jurisdictions have shown a comparable level of free-ridership.

RECOMMENDATIONS

Econoler has found that overall the program works well with satisfactory results. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

NC-R1. Ensure that program participants provide appropriate peak savings calculations: As was the case with the 2011 evaluation, the feasibility studies and building simulation reports made available by program participants in 2012 featured no or very limited information on potential demand savings to be achieved by their new construction projects. It was therefore very difficult for ENSC to track such savings and for Econoler to evaluate them. ENSC should also ensure that program participants provide not only estimated peak demand savings, but also sufficient information to establish an appropriate diversity factor for the project. Such information could include the simulated hourly peak load curve of the new building or at least the proportion of the demand savings achieved by the energy-efficient electrical systems (lighting, HVAC, etc.) along with their respective operation schedules. Finally, ENSC should also record in the program tracking sheet the peak demand savings of each project with some details on how they were calculated as well as the diversity factor used for each project.

- NC-R2. Improve tracking and monitoring of project status and savings:** The Evaluator ran into a number of difficulties when investigating the status of each project as part of the 2012 in-depth assessment. The NC tracking sheet presented very limited information on the details and status of each project. Most of the project folders made available included only the project development agreement and the feasibility study with a few related documents, but no status or verification report from ENSC. Such a report would have allowed Econoler to understand how ENSC estimated the claimed savings (which were sometimes very different than those in the feasibility study) and what was actually constructed on site. Furthermore, two out of the 10 on-site visits performed revealed that the status of the construction process did not allow claiming any savings (even partially) in 2012. Therefore, Econoler recommends that ENSC improve tracking and monitoring of NC projects' status and, if possible, develop tools (e.g. status reports) to help internal and external users (e.g. the Evaluator) better understand the progress of each project.
- NC-R3. Collect energy billing data from program participants:** Once the new construction is complete, it would be a good practice for ENSC to start collecting the energy billing data of the new building from the program participant for at least four to six months after building commissioning. This information would allow making a comparison between the proposed consumption simulated by the consultant and the actual consumption. The results and analyses of such a comparison could help ENSC identify potential issues with building simulation accuracy as well as the gaps between the list of energy efficiency measures planned in the feasibility and those actually implemented on site, thus strengthening ENSC's quality control over NC projects.
- NC-R4. Conduct a literature review to validate whether the baseline design being used in NC reflects the state-of-the-art construction practices:** In most of the feasibility studies reviewed by Econoler, the potential energy and peak demand savings were estimated with a baseline facility built to the 1997 MNECB as the basis for comparison. In a few cases, the original building design (also defined in the study) was more energy-efficient than the MNECB 1997 reference building. Moreover, eligible projects must achieve at least a 30-percent increase in energy efficiency over the MNECB, which suggests that the MNECB minimal requirements are not stringent enough. In light of this, the Evaluator believes the 1997 MNECB may not be the most suitable baseline for comparison in such a program. Similar new construction programs in other Canadian jurisdictions fine-tuned the 1997 MNECB baseline design to better reflect the state-of-the-art construction practices. Therefore, Econoler recommends that ENSC conduct a literature review of the other new construction programs in place elsewhere in Canada to optimize the baseline construction design to be used under NC for energy and demand savings calculations.

1 PROGRAM DESCRIPTION

The Custom program is comprised of two components, with one targeting retrofit projects and the other targeting new construction or major renovations to the existing buildings. As part of the Custom program, Custom New Construction (NC) was launched by Efficiency Nova Scotia Corporation (ENSC) on October 1, 2010. NC provides technical assistance and financial incentives to help business, non-profit and institutional (BNI) customers build more energy-efficient facilities and reduce their electricity consumption and demand. In 2012, the Custom Retrofit and NC components were evaluated separately.

The program's rationale is that most new construction projects today are still managed and measured on a separate capital budget for construction with almost no available incentives for incorporating energy-efficiency technology into the ongoing operating budget or the total ownership cost. As capital budgets come under pressure, the high efficiency measures that tend to have a higher initial cost are compromised.

NC provides eligible customers with incentives to help them achieve significant and predictable electricity savings in new commercial or industrial buildings, as well as in additions and major renovations. Program delivery has been constructed in such a way as to get the customer involved from the preliminary design stage to effectively implement the program measures and realize maximum energy savings. Marketing is done through direct consultations with builders and architects, as well as through the building permit offices across the province.

NC offers two paths of participation: New Construction Energy Modeling (NCEM) and Prescriptive Rebates (Refer to the Business Energy Rebates report for further information on prescriptive rebates.). The NCEM path uses energy modeling to examine all possible energy savings within the building systems as a whole.

Furthermore, there may be a limited number of projects conducted under another program path, which is no longer supported by ENSC unless the new construction project was submitted for approval before 2012. This former program path (called the "New Construction Core Performance path") was designed in compliance with the Advanced Building Institute's (ABI) Core Performance Guide (CPG). The CPG has defined a set of simple, discrete strategies and building features that must be integrated into building design and construction to achieve energy savings. In early 2012, ENSC elected not to support this NC program path anymore due to the high complexity in assessing projects' compliance with the CPG.

Depending on the program path selected, incentives are awarded based on:

- a) a set rate of \$0.20/kWh saved based on the energy savings between standard efficiency equipment and high-performance equipment as developed by the customer and the

administrator on a measure-by-measure basis in the Energy Modeling approach, up to 50% of the installed equipment cost;

- b) a schedule of established incentives for a predetermined list of common high-efficiency measures (“prescriptive”); or
- c) a combination of (a) and (b) above.

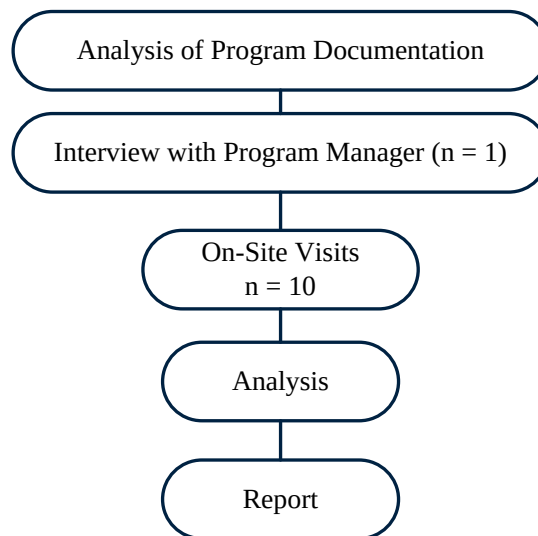
NC aimed to achieve net electricity savings of 6.1 GWh and demand savings of 1.1 MW for 2012. Savings generated by NC are accounted for under the Custom program as outlined in the 2012 Demand-Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

The figure below illustrates the research strategy and the data collection activities used for the 2012 evaluation.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the evaluation for NC. At this stage, all of the available program information was reviewed. The Evaluator consulted the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interview with Program Manager

Econoler staff met the Program Manager (PM) in July 2012. The discussion allowed the Evaluator to gain an overall understanding of various program elements, such as program background, mechanisms and delivery.

2.2.3 On-Site Visits

In November 2012, 10 on-site visits were conducted at facilities that had participated in NC¹. These on-site visits were conducted by Econoler's subcontractor, Equilibrium Engineering. These site visits helped to validate the technical specifications of the new energy-efficient equipment as well as its operation schedule. In addition, the Evaluator collected information on the facility characteristics.

In-depth interviews were also conducted with participants during on-site visits to collect information on free-ridership.

Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocols is included in Appendix II.

¹ Of the 10 on-site visits, eight were conducted on projects completed in 2012 and two on projects expected to be completed in 2013.

3 TRACKING SHEET

As part of the program evaluation process, Econoler reviewed the structure and contents of the NC tracking sheet. This tracking sheet is actually an extract from the online Demand-Side Management Data System (DSMDS). The Evaluator did not review the complete contents of the DSMDS, but did make an in-depth analysis of the NC tracking sheet and the technical documentation provided by the PM.

All in all, the tracking sheet is quite simple and only presents basic information on each project. The minimal details required for program administration are generally available in the tracking sheet, although it does not provide any means for project process monitoring.

Econoler compared the 2012 tracking sheet with that of 2011 (submitted for the 2011 program evaluation) and found no significant differences between the two versions. The only changes noted are listed below:

- > DSMDS numbers and NSPI rate codes have been added for each project in the 2012 tracking sheet;
- > tentative demand and peak demand savings have been written for all the projects claimed in 2012;
- > the 2012 tracking sheet does not provide building size figures (in square meters/feet) while the 2011 version did; and
- > the 2011 version indicated project status and whether verification was already performed by ENSC, while the 2012 tracking sheet does not provide such information and only includes projects completed in 2012.

Like the 2011 version, the 2012 tracking sheet shows minimal reference information on the project, presenting only the project identification number, name, location, contact person name and expected finish year (2012 for all the projects), as well as the program path followed by each project. In the tracking sheet, the PM has divided the NCEM path into two categories. The first category, Energy Modelling (EM), is used to classify projects for which the building simulations assess all the possible aspects of new buildings and their potential interactive effects. The second category, Feasibility Study (FS), includes projects whose pre-construction feasibility study focuses mainly on a few specific systems or elements of the building without considering all the potential energy efficiency improvements and their interactive effects. These two unofficial categories have been defined by ENSC for reference purposes only. A third path, the CPG, is also mentioned in the tracking sheet, but ENSC removed it from its offerings earlier in 2012.

Finally, the tracking sheet presents the potential energy and peak demand savings for each project and the potential financial incentive, but does not give relevant information on how all these figures about the savings and incentives are calculated (there are no reference document, size of the building, list of energy efficiency measures, diversity factor for peak demand calculations, etc.).

Following the tracking sheet review, the Evaluator identified a number of potential adjustments that could be made to improve its consistency and effectiveness and facilitate program monitoring and evaluation. Knowing that ENSC is currently working on such improvements on the DSMDS, the Evaluator makes the following recommendations that should be followed in developing the reporting option for the DSMDS in 2013.

- > **Track the market sector of each customer:** The PM should add a column to indicate the customer's market sector (e.g. "Commercial," "Industrial," "Institutional," etc.) for tracking purposes. This additional information could also allow quickly identifying which market sectors contribute the most to the program and adapting the marketing strategy accordingly.
- > **Add customer contact details in the tracking sheet:** The Evaluator recommends adding customer contact details (phone number, email, etc.) in the same tracking tool as the one used to follow up on project progress and program impacts. This information can be entered either in the same sheet as the energy savings data or in a separate sheet of the same spreadsheet.
- > **Break down the address information:** Currently, the address information (the "Location" column) for each customer is contained in one cell. This prevents making quick site selection based on locations for field activities. Breaking down address information into three cells (street address, city and postal code) will greatly facilitate this process.
- > **Provide additional information on proposed energy efficiency measures:** The 2012 tracking sheet included the expected gross savings of each project, but there was no information on how these figures were arrived at (feasibility study, building simulation results, ENSC verification, etc.) or the energy efficiency measures or design features implemented. In some of the NCEM projects, the newly constructed buildings featured a limited number of tailored energy efficiency measures while other NCEM projects included a sound whole-building design assessment, which typically led to the installation of many energy-efficient elements throughout the building envelope and equipment. To facilitate project tracking, Econoler thus recommends that NC tracking sheet include at least a minimum amount of information on the key energy efficiency measures proposed.

4 IMPACT EVALUATION

This section describes the work that the Evaluator completed to assess the actual impact (energy and peak demand savings) of NC in 2012. Apart from a short overview of the methodology used for program impact evaluation, this section presents a detailed assessment of NC gross and net savings for 2012, along with explanations on how the net-to-gross ratios (NTGRs) were determined for net savings calculations.

4.1 OBJECTIVES AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation for NC is aimed at determining the gross and net savings of this program for 2012. Both energy and demand savings were examined in this evaluation. To do so, Econoler analyzed the following key documents in relation with each project:

- > feasibility studies, new building simulations and any other pertinent technical reports prepared to evaluate the expected energy savings of the building design prior to starting construction;
- > ENSC's reports on the design validation and measurement and verification (M&V) activities undertaken before, during and after the construction of each new building; and
- > results of the in-depth interviews conducted with program participants during on-site visits.

As mentioned in Section 2 (Methodology), the approach used by the Evaluator involved conducting on-site visits for all the projects as well as in-depth interviews with program participants. More precisely, these interviews were intended to collect information on free-ridership. Then, the Evaluator calculated the gross savings for all the projects completed in 2012 according to the specific values, parameters and equations of each project type. The calculations helped identify the appropriate adjustment factors to be used for estimating the overall gross savings for 2012.

The Evaluator determined the appropriate NTGR to be applied based on the data collected through the free-ridership assessment interviews conducted during on-site visits. For this year's evaluation, internal spillover was not taken into account. Finally, the net savings for 2012 were calculated using the NTGR established.

4.2 ON-SITE VISIT SAMPLING AND PROTOCOL

Considering the relative proportion of expected NC savings in comparison with other ENSC programs, Econoler decided that the number of in-depth project verifications and on-site visits undertaken in 2011² was inadequate and did not provide sufficient information to allow properly adjusting (if necessary) the program savings. Consequently, the Evaluator increased the number of on-site visits from two to ten in its 2012 Evaluation Plan developed during summer 2012.

The 10 NC on-site visits aimed mainly at confirming the proper installation of energy-efficient equipment and building envelope components and verifying the assumptions made for energy and demand savings calculations (hours of operation, occupancy level, etc.). The expected outcome of these on-site visits was the validation of the actual program impacts in terms of energy and demand savings.

The next two subsections respectively outline the sampling methodology applied to the selection of the 10 on-site visits out of all the projects to be claimed in 2012 and the customized visit protocols used by the auditors.

Sampling Methodology

In October 2012, 10 projects were expected to be completed and approved under NC by the end of the year, which concurred with the number of on-site visits planned for this year's evaluation. There was therefore no need for sampling to establish a list of projects for on-site visits.

Most of the 2012 projects were conducted under an NCEM program path while only one project was undertaken following the CPG requirements. The following table presents the number of 2012 NC projects by program path and expected savings.

Table 3: Total Number of Projects and Tracked Savings Used for On-Site Visit Sampling³

#	Number of Participants	Expected Savings (GWh/year)	Percentage of Expected Savings
New Construction Energy Modelling (NCEM)⁴	9	6.803	97%
- Energy Modelling	7	5.613	80%
- Feasibility Study	2	1.189	17%
Core Performance Guide (CPG)	1	0.182	3%
Total	10	6.985	

² For reference purposes, the Evaluator conducted on-site visits for two of the nine NC projects claimed in 2011.

³ As of October 2012.

⁴ In this table, the PM divided the NCEM path into two approaches, namely "Energy Modelling" and "Feasibility Study". Section 3 provides further information on this classification of NC projects.

For this year's evaluation, the Evaluator planned to conduct a review of the 10 project files followed by an on-site visit to validate the information found in the documentation and collect additional data. For the NCEM path, Econoler analyzed the input data of the building simulation model and validated these data with information collected during the on-site visit. For the CPG program path, Econoler analyzed the content of the project file and validated compliance with the CPG by collecting the necessary information during the on-site visit. In addition to the verification of project impacts, the on-site visits also allowed the Evaluator to collect information on free-ridership level associated with the program. The Evaluator performed in-depth interviews with participants during the on-site visits to validate what actions would have been taken by the participant for the new construction in the absence of the program. The results of this assessment were then used to calculate the free-ridership of NC for 2012.

On-Site Visit Protocol

The Evaluator used two different documents when conducting the on-site visits of the projects conducted through the NCEM path. The first three-page protocol showed the project's general information such as the project name and contact details and allowed for the collection of general details on building space heating and cooling systems. In addition, this document defined the facility operation schedules, which included daily time of use (8 am to 5 pm) and the number of operating hours per day. Finally, the protocol aimed to collect information on actual electricity consumption and demand from utility bills (if any). These actual data were compared to the simulated electricity consumption and demand, which allowed making an adjustment of simulated savings. This protocol is included in Appendix II of this report.

During the NCEM on-site visits, the Evaluator also used copies of the feasibility studies and M&V reporting files (if any) that ENSC had provided. These files were used to validate technical information, such as the number and type of installed pieces of equipment (e.g. lighting fixtures) along with their respective efficiency. As each NCEM project is different, the Evaluator contends that using ENSC files would be more time-effective than developing several specific on-site visit protocols.

Moreover, the Evaluator developed a tailored questionnaire based on CPG requirements for the on-site visit of the project undertaken under this approach. This on-site visit questionnaire verified the seven design process strategies and the 14 technical requirements included in the CPG. In addition to the six-page questionnaire provided to the auditors, seven pages of minimum requirements tables (taken from the CPG) were attached for reference purposes. This questionnaire and its appendices were the main documents that the auditors consulted when conducting the on-site visit for the project conducted under the CPG approach. This questionnaire is presented in Appendix II.

4.3 GROSS SAVINGS

The 2012 sample included all the 10 new-construction buildings that participated in the program for this year. Nine of these projects were conducted under the NCEM path while only one project was undertaken through the CPG path. The next two subsections describe the approach followed by the Evaluator to assess the gross savings of each project in accordance with its respective path.

4.3.1 NCEM Project Gross Savings Evaluation

The gross savings estimation of NCEM projects was computed based on the information available in the program tracking sheet and project folders submitted by ENSC, as well as based on the data collected and observations made during on-site visits. Because of the customized approach used for each NCEM project, the Evaluator conducted different gross savings analyses for each project, tailored to its project specificities, such as the type of technical evaluation performed by the program participant (entire building simulation, feasibility study, etc.) or the sort of energy efficiency measures implemented through the project.

The Evaluator conducted 9 on-site visits with the aim of calculating the actual savings from the measures implemented at each site. These on-site visits provided opportunities to verify the installation and technical specifications of energy-efficient equipment and building envelope components (when possible), as well as the context in which the M&V activities had been conducted. The Evaluator collected the information required to estimate equipment operation hours and the appropriate diversity factors for all the energy efficiency measures.

Verification of the Baseline

When simulating energy efficiency measures installed in a new building, the building simulation software typically compares the proposed energy-efficient components with the equivalent standard practices in the sector. Accordingly, one key step of the NCEM project gross savings evaluation was for Econoler to review the baseline assumptions made by the building designer to calculate energy savings. To evaluate these assumptions, the Evaluator verified whether the key baseline design assumptions used in the simulations were at least compliant with the minimal requirements of the Model National Energy Code for Buildings (MNECB) of 1997.⁵

When discrepancies arose between the simulated baseline and the basis of comparison (standard practices, codes, etc.), Econoler evaluated how the simulated savings would have been affected if appropriate assumptions had been made in building simulations instead of those that had been used.

⁵ There was one exception in this year's evaluation: it was a major retrofit project, whose baseline assumptions were actually the existing building, and therefore it was not compared to MNECB 1997.

Econoler then adjusted the savings by increasing or decreasing the input values concerned according to the new baseline data collected.

Nominal Specifications

The first kind of on-site verification conducted was to determine whether the nominal specifications of the energy-efficient equipment installed in the new building corresponded to the feasibility study and/or building simulation report. The main technical specifications validated on site included the make, model, nominal capacity and nominal efficiency. When discrepancies arose between the project documentation and nameplate data collected on site, Econoler consulted with the participants to understand the rationale underlying the change in design technical specifications. If these modifications were relevant, Econoler then calculated appropriate adjustment factors to account for the modifications in the initial building design.

Installation Rate

Where possible, the Evaluator conducted a survey on the new energy efficiency measures installed in the new construction (e.g. lighting unit count). Should the facility be too large and the number of energy efficiency measures too high, the Evaluator inspected a sample considered representative of the entire population where possible. Where applicable, the Evaluator also prioritized the inspection of energy efficiency measures expected to generate more energy savings than other energy efficiency measures implemented within the facility.

Hours of Operation

To estimate the hours of operation, the Evaluator first examined the feasibility studies to find the operating schedules of the energy-efficient equipment incentivized under NC. The Evaluator then confirmed these schedules with the customer during the on-site visit.

Diversity Factor

During the on-site visits, the Evaluator consulted with the customer to verify the annual operating schedules of the new building and its new energy-efficient systems, such as heating, ventilation and air-conditioning (HVAC) systems. This assessment allowed Econoler to estimate the diversity factor to be used for the calculation of coincident peak demand savings.

As with the 2011 evaluation, Econoler elected to use the 5:00 pm to 7:00 pm timeframe on non-holiday weekdays of December, January or February, as the peak load period for this year's evaluation.

Review of the M&V

For the validation of the energy savings claimed by each NCEM project, a comprehensive M&V process must be developed and carried out, either by each program participant or by ENSC (or one of its consultants). This M&V aims at validating the actual energy savings generated by the project. As a key step, the Evaluator reviewed the M&V undertaken for each project to identify areas of potential improvement. Whenever Econoler found significant omissions or issues in the M&V conducted, they verified the missing information on site with program participants and tried to determine whether it might have an impact on the claimed energy savings. Where there was indeed such an impact, the Evaluator developed tailored recommendations for improving M&V in the coming years.

The best M&V practice in new energy efficiency building management involves comparing the simulated consumption with the actual energy bills. To conduct such an analysis, Econoler planned to collect energy bills as part of the on-site visits. However, since most of the projects were completed in the last few months of 2012, Econoler was not able to collect a sufficient number of energy bills to perform the analysis on most of the NC projects.

4.3.2 CPG Project Gross Savings Evaluation

There were three steps involved in the evaluation of the major impacts of the only 2012 NC project conducted under the CPG path. As part of the NCEM project impact evaluation, the first step was for the Evaluator to perform the remote collection of information and documentation from ENSC on the project. With this data-gathering process, an initial verification was made on the new building's compliance with relevant CPG requirements. Then, the Evaluator was able to establish a preliminary list of criteria with which the project was in compliance. Based on this preliminary assessment, the Evaluator prepared a short list of key queries to be confirmed on site with the program participant.

The second step was the on-site visit, during which the Evaluator used the CPG assessment protocol to conduct the interview with the customer. The 2012 CPG protocol was developed in 2011 and did not show significant changes compared with last year's version. The Evaluator discussed the CPG criteria of the protocol with the customer and verified the technical specifications of the building's equipment when possible.

The third step involved analyzing all the documents received in light of the information collected on site. This analysis allowed Econoler to evaluate the actual compliance of the projects with the CPG requirements. When applicable, the Evaluator collected new documentation from either ENSC or the program participant.

To verify the actual project impacts, the Evaluator had initially planned to adjust the savings of each project based on the building's level of compliance with the CPG. However, the sole CPG on-site visit revealed that the participants had a poor understanding about how to demonstrate compliance with the CPG. Much of the technical documentation required evaluating CPG compliance was missing and

many energy-efficient building features required by the CPG were inaccessible during the short on-site visit conducted following completion of the construction of the new building.

In fact, one of the main reasons why ENSC decided to cancel the CPG in 2012 was the difficulty that both the participant and ENSC had in demonstrating the compliance of the project with CPG requirements. Considering that there was only one CPG project in 2012 accounting for less than 3 percent of the overall expected program savings and that the CPG approach is no longer supported by the NC incentives, Econoler decided to accept the energy and demand savings calculated and verified by ENSC for 2012 without making any adjustment.

Econoler has no recommendations for improving the impact of CPG project since this path was discontinued in 2012.

4.3.3 Adjusted Gross Savings

The 2012 gross energy savings detailed in the ENSC tracking sheet were revised to include the adjustments calculated by the Evaluator following a comparison of the project savings computed by Econoler against those presented in the tracking sheet. To improve accuracy of the adjustments, the savings adjustment calculation was divided into two categories depending on the NC program paths undertaken to implement the project, namely the NCEM and CPG paths.

Adjustments to NC Projects Conducted under the NCEM Approach

Each NCEM project was given an adjustment factor established on the basis of the findings and observations from the project document analyses and on-site visits performed. Since the Evaluator reviewed all the NCEM projects claimed in 2012, every project was adjusted using its own adjustment factor and no general adjustment factors were calculated for the whole program.

For most projects, the on-site visits did not reveal significant discrepancies between the installed measures and the ones included in the simulations. The operation schedules, the number of equipment installed and their technical specifications, as well as the facilities' purposes observed during the on-site visits generally matched with the findings from the projects' documentation review.

As part of the evaluation, Econoler also consulted ENSC to seek its confirmation on the status of a number of projects, which allowed collecting more information on each project and confirming whether most energy efficiency measures had actually been installed and were in proper operation. Following this, it was found during the on-site visits that the implementation status of two projects (approximately 11 percent of expected savings) did not allow achieving significant verifiable energy savings in 2012. As for the larger project (9.7 percent of savings), the program participant met during the on-site visit informed Econoler that the building construction was not expected to be completed before March 2013. On site, Econoler confirmed that the construction progress did not allow for calculating any savings for 2012. As for the other project considered ineligible in 2012 (1.5 percent of total program savings), the major part of its insulation work (which was actually its only energy efficiency measure

for which savings was claimed in 2012) was not yet completed.⁶ All things considered, Econoler concluded that all the energy and demand savings for these two projects should be claimed in 2013 and therefore removed all their savings from both the tracked and evaluated savings from this year's evaluation.

Furthermore, Econoler found three small discrepancies between the energy savings figures of the feasibility studies and those tracked by ENSC. After verification, an adjustment of approximately 2.7 percent of the overall program savings at the meter was made for these three projects. For all other projects, Econoler did not find any technical concerns that would justify any energy savings adjustments. All in all, the adjustment ratio used by Econoler for NC energy savings at the meter was 0.984.

In contrast with the 2011 NC evaluation, the final tracking sheet provided by ENSC for this year's evaluation included peak demand savings. Tracking and then evaluating demand savings for NC projects was, however, rather difficult because many of the building simulation reports and feasibility studies made available by program participants gave very limited information on the assumptions and formulae used to estimate potential demand savings to be achieved. In addition, it was not always possible to accurately estimate the diversity factor to be used for calculating the coincidence between demand savings and the peak demand period in Nova Scotia. In the absence of the hourly peak load curve data, Econoler relied on the buildings' operation schedules collected during the on-site visits for most projects to estimate the diversity factors.

By verifying the tracked peak demand savings, Econoler reviewed the information available for ENSC to estimate the savings claimed for each project. As mentioned above, it was found that there were very few or no simulation results in the project folders. When demand savings figures were available (i.e. for four of the seven NCEM), ENSC used these values and applied very conservative diversity factors to account for the coincidence with the peak demand period.

For at least one of these projects, Econoler considered that the diversity factor should be higher to better reflect the actual operation schedule of the new building. Accordingly, the diversity factor was increased by Econoler, resulting in adjusting the project's peak demand savings upward by more than 50 percent. By contrast, Econoler found out that peak demand savings were claimed for a facility which only operated from mid-spring to mid-autumn with no electricity consumption during the peak demand period. Consequently, Econoler removed all peak demand savings for this project. The Evaluator also noted that the building simulation report of another of the four projects did not allow accurately estimating peak demand savings, which ENSC assumed to be as high as 10 percent of total savings. Therefore, Econoler recommended that the PM claim 100 percent of the demand

⁶ There were three buildings being retrofitted through this project. By the time of the on-site visit (at the beginning of December 2012), even in the building in the most advanced state of construction, not half of its interior partitions had been completed and the roof retrofit had not begun yet.

savings in 2013 when a more detailed and up-to-date simulation report is drafted by the program participant, and therefore removed all the peak demand savings for this project. The last one of the three projects had quite low peak demand savings and Econoler saw no reason for adjusting ENSC's claim, so it left the peak demand savings unchanged.

As for the other three NCEM projects which had no demand savings calculation results available in their feasibility studies or simulation reports, ENSC estimated their peak demand savings by using the project energy savings figures and the percentage of the building operation time per year. ENSC did not show the Evaluator the details of such calculations. Nevertheless, this approach resulted in very conservative peak demand savings with a figure of less than 5 percent of total program demand savings. Considering the lack of information and the comparatively small size of these three NCEM projects, Econoler decided to accept ENSC's conservative approach by approving its original peak demand savings figures for 2012.

All things considered, the peak demand savings assessment resulted in adjusting the tracking sheet demand savings by a factor of 0.846.

Adjustments to NC Projects Conducted under the CPG Approach

As mentioned in Section 4.3.2, the Evaluator decided to accept the energy and peak demand savings tracked by ENSC without making any adjustment for the sole NC project undertaken under the CPG. Econoler decided to use this approach because many assumptions regarding the participants' compliance with the CPG were difficult to properly verify through the on-site visits. Specifically, for the peak demand savings calculation, ENSC used the kWh/kW ratio calculated by ABI for its building simulations along with a very conservative diversity factor. In absence of sufficient information to corroborate this approach, Econoler accepted the conservative estimate made by ENSC and left the peak demand savings at the meter unchanged for 2012.

Calculation of Adjusted Gross Savings

The following table shows the adjustment factors used by the Evaluator for the gross energy savings calculations.

Table 4: Adjustment Factors for Gross Energy Savings Calculations

Program Path	Adjustment Ratios	
	Gross Energy Savings	Gross Peak Demand Savings
NCEM Path	0.984	0.836
CPG Path	1.000	1.000

The adjustment factors in the table above are presented for reference purposes only. Since the Evaluator analyzed all the 2012 NC projects, each project was adjusted on the basis of its own adjustment factor, calculated using the findings from the project documentation review as well as the

on-site visit's observations. It is also worth noting that all the gross impact assessments described by Econoler so far in the report have already taken into account the interactive effects on space heating and cooling systems as well as the diversity factor. There is no need for additional calculations regarding these aspects of project impact calculations.

The details of the energy and peak demand savings calculated for the two program paths above are presented in the following table, which indicates the savings at the meter as well as at the generator. Savings at the generator level were calculated using the line loss factor of each participant based on the transmission and distribution losses on the grid. The line loss factor values used were provided by Nova Scotia Power and differed a little from those used by the PM. For reference purposes, the weighted average line loss factors of each project category are presented in Table 5.

The 2012 overall gross energy savings for NC are estimated at 5.918 GWh at the meter and at 6.276 GWh at the generator. Moreover, the total gross peak demand savings are respectively estimated at 0.669 MW at the meter and 0.710 MW at the generator.

Table 5: Evaluation Results – Revised Savings in Tracking Sheet

Program Path	NCEM Projects	CPG Projects	Total for all NC Projects
Number of Projects	7	1	8
Program Tracking Sheets			
Total Tracked Energy Savings – at the Meter (GWh) *	5.831	0.182	6.014
Total Tracked Demand Savings – at the Meter (MW) *	0.742	0.050	0.791
Evaluated Energy Savings			
Adjustment Ratio on Energy Savings	0.984	1.000	0.984
Total Gross Energy Savings – at the Meter (GWh)	5.735	0.182	5.918
Average Line Loss Factor**	1.060	1.064	1.060
Total Gross Energy Savings – at the Generator (GWh)	6.081	0.194	6.276
Evaluated Demand Savings			
Adjustment Ratio on Demand Savings	0.836	1.000	0.846
Total Gross Peak Demand Savings – at the Meter (MW)***	0.620	0.050	0.669
Average Line Loss Factor**	1.061	1.064	1.061
Total Gross Peak Demand Savings – at the Generator (MW)	0.657	0.053	0.710

Notes:

* The program tracking savings values (energy and demand) already included the interactive effects of energy efficiency measures on existing electrical heating or cooling systems. Accordingly, the adjustment factors calculated by Econoler also took into account any potential interactive effects on space heating and cooling systems.

** The line loss factors shown in this table are weighted averages calculated using the unitary line loss factor of each participant pertaining to each project category, on the basis of the gross savings (energy or demand) of each participant.

*** The adjustment factors used on tracked demand savings have already taken into account the weighted average diversity factor of each project category.

4.4 NET-TO-GROSS RATIO

The NTGR evaluation of the program is based on a self-report approach which relies on a series of questions designed to measure the influence of the program on participants' decision to implement program-eligible energy efficiency design component within the newly constructed building. These questions were included in the in-depth participant interviews conducted during the on-site visits.

This section presents the methodology used to transform responses to NTGR questions into an NTGR. For the program, the NTGR includes the assessment of only one distortion effect, namely the free-ridership. Once this effect is quantified, the NTGR is calculated based on the following equation:

$$\text{Net-to-gross ratio} = (1 - \% \text{ free-ridership}).$$

4.4.1 Free-Ridership

In NC, free-ridership occurs when participants declare they would still have implemented the energy efficiency measures within their new building design in the absence of the program. Econoler evaluated the free-ridership of NC through in-depth interviews with all the program participants. The free-ridership assessment section of the in-depth interview questionnaire (Appendix II) attempted to measure the following through eight standardized free-ridership questions divided into four groups:

- > the probability that the customer would have implemented the same energy efficiency measures in the absence of the program and, if yes, the likelihood that the program encouraged the customer to implement the measures earlier than they would have otherwise;
- > the probability that the participant would have paid the full incremental cost of the energy efficiency project in the absence of the program incentives and/or on-bill financing;
- > the probability that the customer would have installed a piece of standard equipment instead of the energy-efficient equivalent model;
- > the factors other than the program that might have affected the customer's decision; and
- > the temporal sequence of the program and the customer's decision.

Each group of questions was transposed into a level of program attribution which was used to calculate the overall free-ridership level for each participant. The algorithm behind this calculation is presented in Appendix III.

Using this approach, based on the on-site visit and interview results, a free-ridership level of 26 percent was established for the program.

Without understating ENSC's contribution towards promoting energy-efficient practices in the new construction market, it seemed that several factors played a role in the relatively high percentage of free-ridership for NC in 2012. Namely, it has been observed that many new buildings were seeking Leadership in Energy and Environmental Design (LEED) certification, which is becoming increasingly

common for new institutional and large commercial buildings. Therefore, a number of NC participants seeking a green building label would have probably implemented, at least partly, their energy efficiency project without ENSC's financial and technical support. This seemed to be a very common motivation contributing to the free-ridership level of some new construction projects.

Throughout the project review process, the Evaluator also found several pieces of evidence indicating the existence of free-ridership. For example, one participant's feasibility study specifically stated: "To determine the estimated incentive amounts for the NSP [ENSC] program, we [...] also included the following eligible measures that were already part of the original design". In this case, more than 70 percent of the total project savings were attributable to energy efficiency measures that were already part of the initial design. These measures were added to the building simulation only to obtain a greater incentive from ENSC and would have been implemented in the absence of the program.

Finally, it should be noted that it was the first time that the NC free-ridership was evaluated separately from that of Custom. Therefore, there was no basis of comparison against which to evaluate the progress of this value. Nevertheless, it should be mentioned that similar programs by other jurisdictions have shown a comparable level of free-ridership (e.g. specifically, the free-ridership level of Hydro-Québec building optimization program was estimated at 27 percent in its last evaluation of new construction projects⁷).

⁷ Hydro-Québec, Rapport d'évaluation du Programme : Appui aux Initiatives – Optimisation Énergétique des Bâtiments (AI-OEB), Année 2009, December 9, 2011, page 21.

4.5 NET SAVINGS

The net savings for the program were estimated using the NTGR calculated in the previous section. The equation below was used to calculate the net savings.

$$\text{Net savings} = \text{Gross Evaluation Savings} \times \text{NTGR}$$

The previous equation was used for both demand and energy savings. The results obtained using the above equation are presented in the following table.

Table 6: 2012 Net Energy Savings for NC at the Generator

	Energy Savings – at the Meter (GWh)	Energy Savings – at the Generator (GWh)	Demand Savings – at the Meter (MW)	Demand Savings – at the Generator (MW)
Evaluation Results – Gross Savings	5.918	6.276	0.669	0.710
NTGR	0.74	0.74	0.74	0.74
Evaluation Results – Net Savings	4.379	4.644	0.495	0.525

The following table compares the net energy savings values calculated in the previous table and the program tracked net savings for 2012.

Table 7: Comparison of Tracked and Evaluated Savings at the Generator

	Initial Gross Savings	Adjusted Gross Savings	NTGR	Net Savings
Energy Savings				
Tracked Savings from ENSC	6.381 GWh	6.381 GWh	0.93	5.934 GWh
Evaluation Results	6.381 GWh	6.276 GWh	0.74	4.644 GWh
Demand Savings				
Tracked Savings from ENSC	0.840 MW	0.840 MW	0.93	0.781 MW
Evaluation Results	0.840 MW	0.710 MW	0.74	0.525 MW

As shown in the table above, the net energy savings at the generator evaluated by Econoler are approximately 22 percent lower than those tracked by ENSC. This difference is mainly due to the NTGR ratio established in this year's evaluation. In fact, the gross energy savings tracked by ENSC were adjusted by only 1.6 percent, which was mainly due to Econoler finding two small discrepancies between the energy savings figures presented in the feasibility studies and those tracked by ENSC.

The difference between Econoler's and ENSC's net peak demand savings figures (almost 33 percent) was higher than for net energy savings because of the significant adjustments made by the Evaluator

to the gross peak demand savings tracked in the program tracking sheet. In fact, it was found that the peak demand savings claimed for two projects were either inapplicable or not detailed enough in engineering calculations to allow for an accurate claim in 2012. However, Econoler adjusted upward one of the projects' peak demand savings values because ENSC's estimate of the diversity factor was considered too conservative in light of the information available and represented an increase of the peak demand savings by more than 50 percent for this very project.

As part of the gross savings evaluation, Econoler also slightly modified the line loss factors used by ENSC for all NC projects in accordance with up-to-date values from NSPI. It is, however, worth noting that this modification had no impact on the final evaluated savings results, Econoler's average line loss factors for energy and peak demand savings being respectively 0.07 percent and 0.06 percent lower than those of ENSC.

As mentioned in Section 4.4.1, the high free-ridership percentage established through the in-depth interviews conducted as part of the on-site visits is probably due to various factors. First, the review of the NC projects of 2012 showed that a significant proportion of the program participants had decided to implement energy efficiency measures not only to obtain ENSC's technical and financial support, but also to obtain a green building certification (e.g. LEED) or to comply with a corporate policy. Moreover, energy efficiency measure costs usually account for a relatively small increment when compared with the total new construction cost. Thus, the financial barriers may not be as strong with NC as they are with other BNI programs. In addition, it should be noted that similar programs in other jurisdictions have shown a comparable level of free-ridership.

CONCLUSION

The program saw a total of 8 projects implemented for the year of 2012, which is similar to the number of projects in 2011 (9). This year's evaluation also revealed that NC generated net energy savings of 4.644 GWh at the generator in 2012, compared to 2.607 GWh in 2011. Unlike 2011, NC claimed peak demand savings as part of this year's evaluation along with energy savings, for each of the projects included in the tracking sheet. Econoler's verification revealed that NC achieved net peak demand savings of 0.525 MW in 2012.

To calculate the gross energy and peak demand savings of NC in 2012, the Evaluator used an approach that involved conducting on-site visits of all projects and in-depth participant interviews during these on-site visits. This process allowed the Evaluator to calculate the gross impacts for all the 2012 projects by considering the specific characteristics of each project type. Moreover, Econoler took into consideration the free-ridership measured through the participant interviews to establish an appropriate NTGR for this year and thereby calculate the net energy and peak demand savings NC achieved in 2012.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Ensure that program participants provide appropriate peak savings calculations: As was the case with the 2011 evaluation, the feasibility studies and building simulation reports made available by program participants in 2012 featured no or very limited information on potential demand savings to be achieved by their new construction projects. It was therefore very difficult for ENSC to track such savings and for Econoler to evaluate them. ENSC should also ensure that program participants provide not only estimated peak demand savings, but also sufficient information to establish an appropriate diversity factor for the project. Such information could include the simulated hourly peak load curve of the new building or at least the proportion of the demand savings achieved by the energy-efficient electrical systems (lighting, HVAC, etc.) along with their respective operation schedules. Finally, ENSC should also record in the program tracking sheet the peak demand savings of each project with some details on how they were calculated as well as the diversity factor used for each project.
	2. Improve tracking and monitoring of project status and savings: The Evaluator ran into a number of difficulties when investigating the status of each project as part of the 2012 in-depth assessment. The NC tracking sheet presented very limited information on the details and status of each project. Most of the project folders made available included only the project development agreement and the feasibility study with a few related documents, but no status or verification report from ENSC. Such a report would have allowed Econoler to understand how ENSC estimated the claimed savings (which were sometimes very different than those in the feasibility study) and what was actually constructed on site. Furthermore, two out of the 10 on-site visits performed revealed that the status of the construction process did not allow claiming any savings (even partially) in 2012. Therefore, Econoler recommends that ENSC improve tracking and monitoring of NC projects' status and, if possible, develop tools (e.g. status reports) to help internal and external users (e.g. the Evaluator) better understand the progress of each project.

Sections	Recommendations
Executive Summary	3. Collect energy billing data from program participants: Once the new construction is complete, it would be a good practice for ENSC to start collecting the energy billing data of the new building from the program participant for at least four to six months after building commissioning. This information would allow making a comparison between the proposed consumption simulated by the consultant and the actual consumption. The results and analyses of such a comparison could help ENSC identify potential issues with building simulation accuracy as well as the gaps between the list of energy efficiency measures planned in the feasibility and those actually implemented on site, thus strengthening ENSC's quality control over NC projects.
	4. Conduct a literature review to validate whether the baseline design being used in NC reflects the state-of-the-art construction practices: In most of the feasibility studies reviewed by Econoler, the potential energy and peak demand savings were estimated with a baseline facility built to the 1997 MNECB as the basis for comparison. In a few cases, the original building design (also defined in the study) was more energy-efficient than the MNECB 1997 reference building. Moreover, eligible projects must achieve at least a 30-percent increase in energy efficiency over the MNECB, which suggests that the MNECB minimal requirements are not stringent enough. In light of this, the Evaluator believes the 1997 MNECB may not be the most suitable baseline for comparison in such a program. Similar new construction programs in other Canadian jurisdictions fine-tuned the 1997 MNECB baseline design to better reflect the state-of-the-art construction practices. Therefore, Econoler recommends that ENSC conduct a literature review of the other new construction programs in place elsewhere in Canada to optimize the baseline construction design to be used under NC for energy and demand savings calculations.
Tracking Sheet	5. Track the market sector of each customer: The PM should add a column to indicate the customer's market sector (e.g. "Commercial," "Industrial," "Institutional," etc.) for tracking purposes. This additional information could also allow quickly identifying which market sectors contribute the most to the program and adapting the marketing strategy accordingly.

Sections	Recommendations
Tracking Sheet	6. Add customer contact details in the tracking sheet: The Evaluator recommends adding customer contact details (phone number, email, etc.) in the same tracking tool as the one used to follow up on project progress and program impacts. This information can be entered either in the same sheet as the energy savings data or in a separate sheet of the same spreadsheet.
	7. Break down the address information: Currently, the address information (the “Location” column) for each customer is contained in one cell. This prevents making quick site selection based on locations for field activities. Breaking down address information into three cells (street address, city and postal code) will greatly facilitate this process.
	8. Provide additional information on proposed energy efficiency measures: The 2012 tracking sheet included the expected gross savings of each project, but there was no information on how these figures were arrived at (feasibility study, building simulation results, ENSC verification, etc.) or the energy efficiency measures or design features implemented. In some of the NCEM projects, the newly constructed buildings featured a limited number of tailored energy efficiency measures while other NCEM projects included a sound whole-building design assessment, which typically led to the installation of many energy-efficient elements throughout the building envelope and equipment. To facilitate project tracking, Econoler thus recommends that NC tracking sheet include at least a minimum amount of information on the key energy efficiency measures proposed.

APPENDIX II – ON-SITE VISIT PROTOCOL

The others on-site visit protocols for New Construction are attached in PDF format to this report.

In-Depth Interviews

In general, this in-depth questionnaire aims to discuss with the participants their decision to participate in the program. More specifically, it would help validate the influence of the New Construction Program on the participant's decision to implement the energy efficiency measures when designing and building the new facility. In addition, this questionnaire should help shed light on the participant's satisfaction in the program process and outcomes.

These questions must be asked during the on-site visits of New Construction Program's participants, in November and December 2012.

Project Identification and Date

Project ID:	_____	Project Name:	_____
Person Interviewed:	_____	Date of the Visit:	_____
Telephone:	_____	Auditor Name:	_____

Questions on the Participant's Decision to Participate in the Program

- A1. Why did your company or organisation choose to participate in the New Construction Program? Was it for the program incentives? For the green concepts (reducing energy consumption and carbon footprint, helping protect environment, etc.)? Please explain.

- A2. If applicable, who recommended you to participate in this program?

A3. Before participating in the New Construction Program, did your company or organisation plan to include, in the new building design, all the energy efficiency elements that were identified/recommended through the New Construction Program?

- ☐ Yes
☐ No
☐ Don't know / Refuse

A4. (Only if yes to A3) I just want to make sure I understand you well - Before you decided to participate in the New Construction Program, could you confirm that you had already made the decision to implement the energy efficiency measures you implemented through the program?

- ☐ Yes
☐ No
☐ Don't know / Refuse

For the next two questions (A5 to A6), I would like you to consider what actions you would have been taken in the absence of the New Construction Program. Please answer on a **scale of 0 to 10**, with a 0 indicating that you "Definitely **Would Not Have** Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action."

A5. In the absence of the Program, would you have implemented exactly the same energy efficiency measures in your new building as that you implemented through the program?

- Reminder: 0 – We definitely **would not have** implemented exactly the same measures
10 – We definitely **would have** implemented exactly the same measures
☐ Response (0 to 10)
☐ Don't know / Refuse

A6. In the absence of the Program, would you have installed industry standard equipment instead of energy-efficient equipment?

- Reminder: 0 - Definitely **would not have** installed standard equipment
10 - Definitely **would have** installed standard equipment
☐ Response (0 to 10)
☐ Don't know / Refuse

- A7. As part of its New Construction Program, Efficiency Nova Scotia offers financial incentives to help the implementation of energy-saving projects. If your company or organisation had not received the financial incentives from Efficiency Nova Scotia, would you have paid the full cost of the project you implemented? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not Have Paid**” and a 10 indicating that you “Definitely **Would Have Paid**.”

_____ Response (0 to 10)
_____ Don't know / Refuse

- A8. Through its New Construction Program, Efficiency Nova Scotia also offers financing to foster the implementation of energy-saving projects. Did your company or organisation receive financing from Efficiency Nova Scotia for the implementation of your energy efficiency project?

_____ Yes
_____ No
_____ Don't know / Refuse

- A9. (Only if yes to A8) If your company or organisation had not received the financing offered by Efficiency Nova Scotia, would you have paid and/or financed the full cost of the project you implemented? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not Have Paid and/or Financed**” and a 10 indicating that you “Definitely **Would Have Paid and/or Financed**.”

_____ Response (0 to 10)
_____ Don't know / Refuse

A10. Next, I'm going to ask you to rate the importance of factors that might have influenced your decision to implement the energy efficiency project you implemented through the program. Using a scale from 0 to 10, where 0 means "**Not at all important**" and 10 means "**Extremely important**", please rate the importance of each of the following in your decision to implement the energy efficiency project you implemented through the Program.

Factor	Response (scale of 0 to 10)
a. The program financial incentives and/or financing	___Response ___N/A
b. The technical assistance provided by the program during the design development	___Response ___N/A
c. The technical assistance offered by the program during the project implementation	___Response ___N/A
d. Your company or organisation's corporate policy or guidelines regarding the new construction design	___Response ___N/A
e. The existing building code	___Response ___N/A
f. Previous experience with the New Construction Program or a similar program either from Efficiency Nova Scotia or Nova Scotia Power	___Response ___N/A

Satisfaction Questions

- B1. In general, how was your company or organization's experience with the New Construction Program? Please explain.

- B2. More precisely, could you comment on the following aspects of the program support offered to participants?

Interaction and communication with staff: _____

Availability of staff: _____

Interaction and communication with contractors/consultants: _____

The rebate and/or incentive amounts granted: _____

Paperwork and procedures required to receive rebate or incentives: _____

- B3. What have been the challenges and/or barriers you faced in developing and implementing the energy efficiency measures in your new construction?

B4. Do you have any suggestions on how to improve the New Construction Program?
Consider all aspects and phases of the program previously mentioned.

B5. Anything else to add (or additional notes)?

Thank you very much for your time and kind cooperation!

APPENDIX III – ALGORITHM FOR FREE-RIDERSHIP CALCULATION

A5. In the absence of the program, what is the likelihood that you would have implemented exactly the same energy efficiency measures in your new building that you implemented through the program? (Scale 0 to 10)	$A5 = \text{Answer} \times 10\%$
A6. In the absence of the program, what is the likelihood that you would have installed industry standard equipment instead of energy-efficient equipment? (Scale 0 to 10)	$A6 = (10 - \text{Answer}) \times 10\%$
PA1 Score:	MEAN VALUE OF: (A5 ; A6)
A3. Before participating in the program, did your company plan to include, in the new building design, all the energy efficiency elements that were identified/recommended through the program?	IF 1. Yes: Use A4 IF 2 OR 9 : A3 = 0%
A4. I just want to make sure - Before you decided to participate in the program, you had already made the decision to implement the energy efficiency measures that you implemented through the program?	IF 1. Yes: A3 = 100% IF 2 OR 9 : A3 = 0%
A7. If your company had not received the financial incentives from ENSC, would you have paid the full cost of the project you implemented? (Scale 0 to 10)	$A7 = \text{Answer} \times 10\%$
A9. If your company had not received the financing offered by ENSC, would you have paid and/or financed the full cost of the project you implemented? (Scale 0 to 10)	$A9 = \text{Answer} \times 10\%$
PA2 Score:	IF A3 = 0% : $\text{MEAN}(A7; A9) / 2$ IF A3 = 100% : $\text{MEAN}(A7; A9)$
A10. Level of influence (Scale 0 to 10) Factors a, b, c, and f = Program factors Factors d and e = Non Program factors	$A10\_P = \text{SUM}(a; b; c; f)$ $A10\_NP = \text{SUM}(d; e)$
PA3 Score:	100% - [A10_P / (A10_P + A10_NP)]
Final Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3)
Inconsistency Test #1	IF $\text{ABS}(A5 - A6) \geq 30\%$: $PA1 = \text{MIN}(A5 ; A6)$
Inconsistency Test #2	IF $\text{ABS}(A7 - A9) \geq 30\%$: IF A3 = 0% : $PA2 = \text{MIN}(A7; A9) / 2$ IF A3 = 100% : $PA2 = \text{MIN}(A7; A9)$
Inconsistency Test #3	IF $PA2 \geq 70\%$ AND IF $(A5 \text{ OR } A6) < 70\%$: $PA2 = \text{EMPTY}$
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3)



1. General Information

Site Visit Date: _____
Project ID: _____ Contact Name: _____
Project type: _____ Contact Phone: _____
Company name: _____ Contact Email: _____
Address: _____

List of people met during the visit: _____

Type of building:

Commercial/institutional	☐	Industrial/manufacturing	☐
Municipal	☐	Other (specify)	☐

Specify: _____

2. Facility Operation Schedules

Facility annual schedule: Please fill the table below for each occupancy schedule reported by the site contact as occupancy could vary for each section of the facility. Use additional sheets if necessary.

Description	1 - Normal Schedule		2 - Specify:		3 - Specify:	
	Weekdays	Weekends	Weekdays	Weekends	Weekdays	Weekends
Number of day with regular schedule per year						
Number of day with regular holidays schedule per year						
Number of days with no occupancy per year (For example: seasonal closure)						
Total number of day per year						

Facility daily schedule: Please fill the table below for each occupancy schedule reported by the site contact as occupancy could vary for each section of the facility. Use additional sheets if necessary.

Schedules		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Holidays
Schedule 1: Normal	Time of use (e.g. 8:00 am to 5:00 pm)								
	Hours per day								
Schedule 2 (specified above)	Time of use								
	Hours per day								
Schedule 3 (specified above)	Time of use								
	Hours per day								

3. Building Heating/Cooling System Description

Heating Systems

Please fill the table below for each heating system at the site

Description	Heating system 1	Heating system 2	Heating system 3	Heating system 4
Energy source (electricity, natural gas, oil, etc.)				
Heating system type (electric resistance, furnace, heat pump...)				
Nominal capacity (indicate the unit – kW, Mbtu/h...)				
Heating system efficiency or COP				
If any, changes in building set points (occ./ unocc. temp., % hum)				

Cooling Systems

Please fill the table below for each cooling system at the site

Description	Cooling system 1	Cooling system 2	Cooling system 3	Cooling system 4
Energy source (electricity, natural gas, oil, etc.)				
Cooling system type (compressor, absorption...)				
Nominal capacity (indicate the unit – kW, tons, etc.)				
Cooling system SEER or COP				
If any, changes in building set points (occ./ unocc. temp., % hum)				

4. Electricity Consumption

Electric company: _____ Electricity Rate: _____ Electricity Tariff: _____

Month	Number of Days	Energy (kWh)	Peak Demand (kW)	Total Cost (\$)
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				

5. Additional Notes

0. Project Details

Site Visit Date:	_____	Contact Name:	_____
Project ID:	_____	Contact Phone:	_____
Project name:	_____	Contact Email:	_____
Company name:	_____		
Address:	_____		
List of people met during the visit:	_____	_____	_____
	_____	_____	_____

1. Section One: Design Process Strategies

1.1 Identify Design Intent

Conduct a team meeting to identify key energy goals for the project and to coordinate subsequent efforts among team members.

1.1.1	Did the project team conduct this meeting? Discuss...	☐ Yes ☐ No	Notes:
1.1.2	Collect a statement (if any) that the training was performed (minutes of meeting)?	☐ Check ☐ N/A	Notes:

1.2 Communicating Design Intent

Develop key information about project performance requirements to insure that design goals are translated forward through the design process. Project goals are converted into documentation incorporated into each phase to guide design, sequence of operation, specifications, bid submittals, construction, acceptance testing and building operation.

1.2.1	Did the project team clearly communicate the design intent? Discuss...	☐ Yes ☐ No	Notes:
1.2.2	Ensure that the following documents exist: 1-Design Intent Meeting Summary, 2-Operational Performance Requirements, 3-Acceptance Testing Requirements, and 4-Construction Documents.	☐ Check ☐ N/A	Notes:
1.2.3	Look at project documentation (specifications, bid submittals, etc.) to verify that project goals and performance requirements have been communicated through design process.	☐ Check ☐ N/A	Notes:

1.3 Building Configuration

Consider the implication of alternate building configurations to maximize building energy performance, functionality and daylighting. Identify the pros and cons of several alternate building configurations using existing analysis tools, consultants, reference material or other resources.

1.3.1	Verify that at least three alternate building configuration designs have been developed and analyze (could be included in the Design Intent Document).	☐ Check ☐ N/A	Notes:

1.4 Mechanical System Design

Use project-specific load calculations based on Core Performance requirements including coincident load conditions to properly size mechanical equipment, rather than relying on generic rule-of-thumb sizing Criteria.

1.4.1	Ensure that load calculations for sizing mechanical systems are compliant with ASHRAE Standard 55. Collect documentation if any.	☐ Check ☐ N/A	Notes:
1.4.2	Discuss and ensure that documentation exists on the list of design process actions described in Criteria 1.4 .	☐ Check ☐ N/A	Notes:



Implement an Acceptance Testing protocol to test the operational characteristics of installed systems. Document that installed systems are operating as intended prior to occupancy. It is up to the project team to identify the key systems to be tested and verified to insure that the project meets the performance goals identified by the owner and design team. Specific guidance on test protocols are provided in Appendix A.

Collect a full set of construction documents and specifications, systems manuals, maintenance and calibration requirements, control protocols, etc. for use by the building operations team. Conduct an operator training session to make sure the building operators understand the systems and operation of the building. Information should be collected in a set of manuals designed to facilitate building operation and future communication of this information to new operating staff. Work with the building owner to identify the best way to collect, store and distribute this information.

Install digital utility meters capable of collecting hourly utility use data. Implement a data collection protocol on-site, with the local utility or a third party to collect this data. A summary of the information should be reviewed quarterly by building performance trends and identify potential system performance issues. Some building managers may choose to review this data more frequently to support ongoing operational improvements and maintenance.

2.1 Section Two: Core Performance Requirements

2.1 Energy Code Compliance

In addition to implementing the requirements of the Core Performance program, projects using the program must meet all local energy code requirements of the prescriptive requirements of ASHRAE 90.1-2004 or the MNECB (1997), whichever is more stringent.

2.1.1	All buildings meet or exceed ASHRAE 90.1-2004 and MNECB 1997, and features not covered by CPG meet or exceed ASHRAE 90.1-2004 or IECC 2006.	☐ Yes ☐ No	Notes:
2.1.2	Provide a signed statement that mechanical equipment is compliant with ASHRAE 90.1-2004 and/or MNECB 1997.	☐ Check ☐ N/A	Notes:

2.2 Air Barrier Performance

During design and construction, develop and implement air sealing details and protocols to reduce uncontrolled air movement through the building envelope and duct systems.

2.2.1	Ensure a full and continuous air barrier is installed, with attention to details at parapet, windows/doors and foundation connections. Provide documents.	☐ Check ☐ N/A	Notes:
2.2.2	Interior separations: Is there an air barrier system between conditioned space and space designed to maintain air conditions (temp.+hum.) 50% different? If yes, provide documentation.	☐ Yes ☐ No	Notes:
2.2.3	Provide specifications of air barrier materials, testifying compliance with ASTM E 2178 (air permeability < 0.004 cfm/ft ² @ 0.3" of water).	☐ Check ☐ N/A	Notes:

2.3 Minimum IAQ Performance

Implement protocols to insure acceptable indoor air quality, including meeting or exceeding ASHRAE Standard 62-2001, developing and implementing air quality management plans for construction and operation, and conducting a building flush-out prior to occupancy.

2.3.1	Ensure outdoor air control technique is compliant with ASHRAE Standard 62. Provide documentation.	☐ Check ☐ N/A	Notes:
2.3.2	Ensure the IAQ Construction Management Plan has been developed and implemented to control IAQ during construction. Provide documentation.	☐ Check ☐ N/A	Notes:
2.3.3	Ensure the building has been flush with 100% of the scheduled quantity of outdoor air prior to occupancy. Provide flush-out plan.	☐ Check ☐ N/A	Notes:
2.3.4	Ensure the IAQ Operations Management Plan for building operation has been developed and implemented. Provide documentation.	☐ Check ☐ N/A	Notes:

2.4 Opaque Envelope Performance

Meet specific insulation Criteria for each building envelope assembly.

2.4.1	If window and glazed door area > 40%: Ensure all walls, roof assemblies, floor and slabs-on-grade meet Criteria of Table 2.4.1 . Provide documentation.	☐ Check ☐ N/A	Notes:
2.4.2	If window and glazed door area < 40%: Ensure energy performance modelling demonstration has been completed. Provide documents.	☐ Check ☐ N/A	Notes:

2.5 Fenestration Performance

Meet specific window performance Criteria for u-value and solar heat gain coefficient, based on CSA A440.2/NFRC ratings. Performance requirements are based on entire window assembly, not glazing alone.

2.5.1	If window and glazed door area > 40%: Ensure all vertical windows meet Criteria of Table 2.5.1 . Provide documentation.	☐ Check ☐ N/A	Notes:
2.5.2	Ensure that skylight area is no greater than 5% of the roof area and that it meets Criteria of Table 2.5.2 . Provide documentation.	☐ Check ☐ N/A	Notes:
2.5.3	Ensure all fenestration (windows, skylights, doors) is rated according to Std. CSA A440.2 or the National Fenestration Council (NFRC).	☐ Check ☐ N/A	Notes:

2.6 Lighting Controls

Install control systems throughout the building, including occupancy sensors and time clock controls. Daylit areas are encouraged to incorporate daylight controls, but at a minimum these areas must be provided with separate switching to facilitate future incorporation of daylight control systems.

2.6.1	Ensure all occupied areas allow occupants to reduce illumination pattern by at least 50% (or 40% for HID lamps).	☐ Check ☐ N/A	Notes:
2.6.2	Ensure all daylit areas are separately controlled from non-daylit areas, with either automatic daylight controls or manual switching allowing 50% and 100% reduction of illumination level.	☐ Check ☐ N/A	Notes:
2.6.3	Automatic controls: Occupancy sensors must be installed in almost all small public areas. Automatic turn-off after 30 minutes.	☐ Check ☐ N/A	Notes:
2.6.4	Automatic controls: Note if automatic daylight controls are installed (not mandatory).	☐ Check ☐ N/A	Notes:
2.6.4	Automatic controls: Note if time clock controls are installed in areas not requiring occupancy sensors (not mandatory).	☐ Check ☐ N/A	Notes:

2.7 Lighting Power Density (LPD)

Projects may not exceed the lighting power density limits indicated in this Criterion.

2.6.1	Ensure installed lighting equipment power density does not exceed the allowed lighting power density (LPD), as shown in Table 2.7.1 . Provide documentation.	☐ Check ☐ N/A	Notes:

Additional Notes:

2.8 Mechanical Equipment Efficiency Requirements

Mechanical equipment must meet the performance Criteria developed by the Consortium for Energy Efficiency (CEE) labeled as Tier 2 performance requirements.

2.8.1	Package unitary equipment must meet requirements of Tables 2.8.1 and 2.8.2 and must be Energy Star labeled.	☐ Check ☐ N/A	Notes:
2.8.2	Gas Unit Heaters must have intermittent ignition device+power venting or flue damper. Gas Furnaces<66kW (225 kBtu/hr) have AFUE rating>90. Gas Furnaces in rooftop equipment have AFUE>80.	☐ Check ☐ N/A	Notes:
2.8.3	Package Terminal AC and Heat Pumps must meet requirements of Table 2.8.3 .	☐ Check ☐ N/A	Notes:
2.8.4	Boilers must meet requirements of Table 2.8.4 .	☐ Check ☐ N/A	Notes:
2.8.5	Electric chillers must meet Table 2.8.5 .	☐ Check ☐ N/A	Notes:
2.8.6	Absorption chillers must meet Table 2.8.6 .	☐ Check ☐ N/A	Notes:
2.8.7	Equipment not listed above must meet Energy Star if applicable.	☐ Check ☐ N/A	Notes:

2.9 Dedicated Mechanical Systems

Spaces in the building with specific process loads or that require conditioning significantly different for the main building spaces must be provided with a separate, dedicated mechanical system designed specifically for these loads.

2.9.1	Zones with special temperature/humidity requirements should be served by separate air distribution systems.	☐ Check ☐ N/A	Notes:
2.9.2	Areas with significantly different load profiles than main building should be served by a separate, dedicated system.	☐ Check ☐ N/A	Notes:

2.10 Demand Control Ventilation

Outside airflow should be controlled by a system which measures CO2 and provides airflow based on occupant density, as measured by the CO2 sensor.

2.10.1	Demand Control Ventilation must be installed, controlled by CO2 sensors. Ensure that CO2 sensors are installed.	☐ Check ☐ N/A	Notes:
2.10.2	When cooling by economizer is required, air damper control must respond to economize settings rather than CO2 sensors.	☐ Check ☐ N/A	Notes:
2.10.2	CO2 settings: Increase ventilation at 800 ppm, maximum ventilation at 950 ppm. Differential settings: max differential between outside and inside: 530 ppm.	☐ Check ☐ N/A	Notes:

Additional Notes:



2.11 Domestic Hot Water System Efficiency		

<i>Domestic hot water demand should be met by either demand hot water heaters or high-efficiency condensing appliances.</i>		

2.11.1	Domestic hot water loads: served by gas demand hot water heating systems, high efficiency tank water heaters, or sealed combustion hot water heaters.	☐ Check ☐ N/A	Notes:
2.11.1	High efficiency tank water heating systems: should include RSI-2.5 (R-14) tank insulation, and heat traps to prevent thermosiphoning.	☐ Check ☐ N/A	Notes:
2.11.1	Fossil-fuel fired systems that have not sealed combustion should include flue control damper.	☐ Check ☐ N/A	Notes:
2.11.3	Verify that water conserving aerators and shower heads are installed in lavatories and staff areas.	☐ Check ☐ N/A	Notes:

2.12 Fundamental Economizer Performance		

<i>This Criterion includes a list of features and performance verification strategies to insure proper and effective economizer operation.</i>		

2.12.1	Installed economizers should incorporate features as of Criteria 2.12.	☐ Check ☐ N/A	Notes:
2.12.1	Verify that all units larger than 33,000 Btu/hr (9.7 kW) have an economizer installed.	☐ Check ☐ N/A	Notes:

2.13 Heat Recovery		

<i>Incorporate a heat recovery system in the ventilation air exhaust stream for spaces with high occupancy or high outdoor air ventilation requirements.</i>		

2.13.1	Energy recovery ventilation system should be installed and should include latent heat recovery with effectiveness of min. 70%. If any, air-air sensible heat recovery systems must be 50% efficient.	☐ Check ☐ N/A	Notes:

2.14 Supply Air Temperature Reset (VAV)		

<i>VAV systems should include control capabilities to reset supply air temperature to the warmest setting that will meet cooling load in all zones.</i>		

2.14.1	In shoulder and cool weather seasons, VAV control strategy must use the warmest setting that meet cooling load in all zones.	☐ Check ☐ N/A	Notes:

Additional Notes:	

BUSINESS ENERGY SOLUTIONS

IMPACT AND PROCESS EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 11, 2013



ECONOLER

ACRONYMS

BER	Business Energy Rebates
BES	Business Energy Solutions
CATI	Computer-Assisted Telephone Interviewing
CDI	Commercial Direct Install
CFL	Compact Fluorescent Lamp
CRA	Corporate Research Associates
DA	Delivery Agent
DHW	Domestic Hot Water
ECM	Electronically Commutated Motor
ENSC	Efficiency Nova Scotia Corporation
EP-DI	Efficient Products – Direct Install
HVAC	Heating, Ventilation and Air Conditioning
LED	Light Emitting Diode
MURB	Multi-Unit Residential Buildings
NRCan	Natural Resources Canada
NSPI	Nova Scotia Power Inc.
NTGR	Net-to-Gross Ratio
OPA	Ontario Power Authority
PM	Program Manager
SBES	Small Business Energy Solutions

DEFINITIONS

Base case	A base case details the information on how assumed gross savings used in the tracking sheet have been established. Usually, these savings are calculated with a series of variables such as hours of operation, wattage or base consumption.
Demand savings	Savings occurring at specific peak hours of energy demand.
Distortion effects	A variety of effects that affect the energy savings generated by a program. Distortion effects may be of different natures, e.g., behavioral or market-related. The most frequently considered distortion effects are free-ridership and spillover.
Diversity factor	The ratio of the sum of the individual maximum demands of the various subsystems to the maximum demand of the whole system.
Demand-to-energy ratio	A ratio obtained by dividing the target peak demand savings by the target energy savings of a given program for a given year.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Evaluation plan	The evaluation plan summarizes the program description, objectives, base cases, documentation, evaluation methodology, budget and schedule.
Free-ridership	Percentage of savings attributable to participants who would have implemented the same or similar energy efficiency measures, with no change in timing, in the absence of the program.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Interactive effects	Interactive effects occur when the installation of an energy efficiency measure has an impact on the energy consumption of other elements in the facility such as heating and cooling.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.
Net energy savings	Energy savings generated by energy efficiency measures after applying interactive effects and distortion effects.
Net-to-gross ratio	The ratio between the net energy savings and gross energy savings.

Sampling error	The amount of inaccuracy in estimating some value that is caused by examining only a portion of a population (i.e. a <i>sample</i>) rather than the whole population.
Sample size	The number of observations or replicates included in a statistical sample.
Spillover (internal)	Percentage of savings attributable to participants who continue to implement the energy efficiency measures introduced by a program after participating in it once, without participating in the program a second time.
Tracked savings	Gross and net savings calculated by ENSC in the program tracking sheet, using the current participation data and parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) from the most recent evaluation.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 process and impact evaluation of Business Energy Solutions (BES), also known as the Small Business Direct Install program. The 2012 evaluation was based on in-depth interviews with the Program Manager (PM) as well as on 80 on-site visits and a telephone survey of 151 participants.

PROGRAM OVERVIEW

BES provides energy conservation measures to eligible participants. It comprises two components: Small Business Energy Solutions (SBES) and Commercial Direct Install (CDI).

Small Business Energy Solutions

SBES provides implementation of energy-efficient lighting and non-lighting measures to small businesses all across Nova Scotia. The eligible businesses pay as low as 20 percent of the installation and materials costs and the remaining portion, up to 80 percent, is paid by Efficiency Nova Scotia Corporation (ENSC).

SBES offers a wide variety of lighting measures that are customized to each business. It also promoted heat pumps towards the end of 2012.

SBES also included three pilot programs in 2012. Very Small Business targeted any small business with a net proposed energy savings of less than 5,000 kWh, such as charitable and non-profit organizations, and provided the implementation of SBES-eligible measures for a 100 percent incentive. Retail LED offered the installation of Light Emitting Diode (LED) lamps to retail facilities, for example restaurants and retail stores, at no cost. Finally, LED Blitz (also known as Swift Switch) targeted malls and common areas in hotels and aimed at replacing incandescent and halogen light bulbs with LEDs.

Commercial Direct Install

CDI provides direct installation of energy-efficient lighting and non-lighting products free of charge to small businesses in Nova Scotia.

CDI features the following products:

- > a variety of compact fluorescent lamps (CFLs) including hard glass, twist, mini-twist, and dimmable, as well as specialty CFLs;
- > LED exit signs;
- > efficient MR16, PAR30, and PAR38 LED lamps;
- > hot water tank wrap;
- > pre-rinse spray valves;
- > pipe insulation; and
- > faucet aerators.

BES aimed to achieve net electricity savings of 28.8 GWh (19.2 GWh for SBES and 9.6 GWh for CDI) and demand savings of 4.2 MW (3.3 MW for SBES and 0.9 MW for CDI) in 2012.

KEY FINDINGS

The 2012 evaluation of BES demonstrated that the program is well designed. The program totalled 4,208 participants for the year 2012. SBES accounted for 1,239 of those participants (including participants from the Very Small Business and Retail LED pilots), while CDI covered 2,730 of them (including 84 participants from Multi-Unit Residential Buildings (MURB)). The remaining 239 participants took part in the LED Blitz pilot in December 2012. In terms of net energy savings, the program generated 30.152 GWh.

Awareness

The evaluation revealed that ENSC is successful at communicating about the program. Indeed, it was the main way participants learned about the program, although more likely for CDI participants (77 %) than for SBES participants (37 %). ENSC sources included ENSC staff, newspapers or other media sources, bill inserts, literature in the mail, the ENSC website, or a phone call from an ENSC representative.

Contractors or vendors also contributed to program awareness, especially among SBES participants, as 21 percent of SBES participants and 7 percent of CDI participants learned about the program from them. Word of mouth was also very beneficial to program awareness, once again more so among SBES participants, which also constitutes a good indicator of program satisfaction.

Satisfaction

Satisfaction with the program is high among SBES and CDI participants. Indeed, most of them expressed their satisfaction with the overall program and with the length of time between when they applied for the program and when measures were implemented in their facilities. Considering the participants' high level of satisfaction with the program, it is not surprising that most participants did not face any barriers during their involvement in the program.

Participants offered recommendations to improve the program that mainly revolved around communication. Indeed, participants spoke of their wish to have more advertising and marketing, better communication and more information on the program in general. They also suggested providing a quicker participation process.

Program Energy Savings

To calculate the net savings of BES in 2012, Econoler reviewed the gross savings estimated by ENSC and included interactive effects for all products. More particularly, on-site visit results were used to estimate a self-declaration ratio and installation rates for SBES measures and the unitary savings values used for CDI were reviewed based on information found in the literature. Moreover, Econoler took into consideration the free-ridership, for both SBES and CDI, and internal spillover, for SBES only, measured through the participant survey. A free-ridership level of 17 percent was captured for SBES, while no spillover effect was identified. The evaluation of CDI revealed a free-ridership level of 13 percent.

Table 1: Distortion Effects and Net-to-Gross Ratio

	SBES	CDI
Free-Ridership Level	17%	13%
Spillover Level	0%	--
Net-to-Gross Ratio	0.83	0.87

The evaluation revealed that BES had generated net energy savings of 30.152 GWh and demand savings of 5.244 MW at the generator in 2012.

Table 2: Overall Comparison of Tracked and Evaluated Savings at the Generator for BES

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR*	Net Savings
Energy Savings					
Tracked Savings from ENSC	41.504 GWh	37.512 GWh	34.624 GWh	0.88	30.612 GWh
Evaluation Results	41.825 GWh	40.422 GWh	34.467 GWh	0.87	30.152 GWh
Demand Savings					
Tracked Savings from ENSC	8.636 MW	8.061 MW	7.441 MW	0.86	6.430 MW
Evaluation Results	8.679 MW	7.148 MW	6.081 MW	0.86	5.244 MW

* NTGRs were different for each component. The NTGRs presented in this table correspond to the rounded averages obtained by dividing the net savings by the installed gross savings (with interactive effects).

Overall, the net energy savings evaluated for BES fell short of those tracked by ENSC by 2 percent. This result can be explained by the adjustments applied in the SBES gross savings calculation, namely the installation rates and the self-declaration ratio on the hours of operation. Moreover, for all components, ENSC used an interactive effects factor of -7.7 percent on lighting products, but this factor was established at -15.3 percent for this year's evaluation.

For demand savings, the difference between the tracked and the evaluation results mainly comes from the fact that, for SBES, Econoler applied a diversity factor of 80 percent on the gross demand savings.

RECOMMENDATIONS

Econoler finds that the program works well overall and generates important electric savings. In addition to the general recommendations presented for all ENSC programs in the overall executive summary of the 2012 demand-side management (DSM) programs, the Evaluator made specific recommendations at various places in the present report, which are aimed at optimizing the program. Based on the evaluation results, the most important recommendations that Econoler has for this program are as follows:

- BES-R1. Improve the tracking sheet to allow for a better validation of savings:** Both SBES and CDI tracking sheets show some improvements on last year's version. In 2013, the information will be gathered in one main tracking sheet, using the SBES tracking sheet model. With that in mind, the Evaluator highlighted some potential adjustments that could be made to improve the content of the future tracking sheet and allow for a better validation of savings:

- > Specify the detailed characteristics of each type of lighting product installed, namely the number of lamps per fixture, the wattage of the lamps and the ballast factor;
- > Track the quantity of CFLs and LED lamps installed based on the type and wattage of the lamps replaced to facilitate the validation of the displaced wattage values used in the unitary savings calculations;
- > Calculate gross and net energy savings directly in the tracking sheet;
- > Make savings calculations automatic to ensure that the savings recorded in the tracking sheet correspond to those calculated using the parameters filled out for each measure (quantity, unitary wattage value, hours of operation, etc.);
- > Add a field to indicate the heating energy source, if air conditioning is used in the building and if the lighting products were installed inside or outside the building; this would allow for a more precise evaluation of interactive effects factor; and
- > Collect the specific length (in feet) of insulated pipe installed in each participating facility to calculate the savings accordingly and limit the length to the first 15 feet.

BES-R2. Include a ballast factor in the unitary wattage calculation of hardwired CFLs, metal halide fixtures and high pressure sodium fixtures: The impact evaluation of SBES revealed some inconsistencies in the approach used to calculate the unitary wattage values of the following products: hardwired CFLs, metal halide fixtures and high pressure sodium fixtures. For these products, ENSC only considers a ballast factor for the old product that was replaced. For the new product installed, a ballast factor of 1 is applied, which is not appropriate. These types of products include a ballast that consumes a certain wattage. Therefore, Econoler recommends modifying the approach in the future to include a ballast factor in the unitary wattage calculation of hardwired CFLs, metal halide fixtures and high pressure sodium fixtures installed through the program.

BES-R3. Develop a validation process for product removals: Some inconsistencies related to product removal were noted in the CDI tracking sheet by the Evaluator. In some cases, an installer had to come back to replace lamps initially installed with another type of energy-efficient lamp, but no deductions were made to subtract the quantities of lamp that were removed. For this year's evaluation, Econoler made some spot checks in the tracking sheet and, when noticing that such situations occurred, adjusted the quantities of products installed accordingly. However, the Evaluator could not go through all the projects recorded in the tracking sheet. Therefore, it is essential for ENSC to develop a validation process to ensure the accuracy of the quantities of product entered in the tracking sheet and that deductions are made when some products are removed or replaced by other energy-efficient products.

1 PROGRAM DESCRIPTION

Efficiency Nova Scotia Corporation (ENSC) Business Energy Solutions (BES) provides energy conservation measures to eligible participants. The program comprises two components: Small Business Energy Solutions (SBES) and Commercial Direct Install (CDI). SBES carries the same objectives as its initial version implemented from 2008 to 2011. As for CDI, it pursues the same goals as those targeted by Efficient Products – Direct Install (EP-DI) in 2011. The following is a description of each of the two BES components.

Small Business Energy Solutions

SBES provides implementation of energy-efficient lighting and non-lighting measures to small businesses all across Nova Scotia. For the purpose of this program, a small business is defined as any non-residential participant with an average total annual electricity use of less than 350,000 kWh (except for multi-unit residential buildings) and an average monthly demand less than 100 kW. The eligible businesses pay as low as 20 percent of the installation and materials costs and the remaining portion up to 80 percent is paid by ENSC. In certain cases, participants can pay their portion of the costs in monthly installments through their Nova Scotia Power Incorporated (NSPI) power bills for up to a 24-month period at an interest rate of 0 percent. If participants do not use financing from NSPI, they pay their portion of the project cost before any materials are shipped.

SBES offers a wide variety of lighting measures that are customized to each business. It also promoted heat pumps towards the end of 2012.

SBES also included two pilot programs, which were offered for a limited time in 2012. The first pilot, Very Small Business, targeted any small business with a net proposed energy savings of less than 5,000 kWh, such as charitable and non-profit organizations, and provided the implementation of SBES eligible measures for a 100 percent incentive. The second pilot, Retail LED, offered the installation of LED lamps to retail facilities, for example restaurants and retail stores, for no cost. Finally, LED Blitz (also known as Swift Switch) targeted malls and common areas in hotels and aimed at replacing incandescent and halogen light bulbs with LEDs.

Commercial Direct Install

CDI provides direct installation of energy-efficient lighting and non-lighting products free of charge to participants. This program also targets small businesses in Nova Scotia and follows the same eligibility criteria as described above regarding SBES.

The program features the following products:

- > a variety of Compact Fluorescent Lamps (CFLs) including hard glass, twist, mini-twist, and dimmable, as well as specialty CFLs;
- > Light-Emitting Diode (LED) exit signs;

- > efficient MR16, PAR30, and PAR38 LED lamps;
- > hot water tank wrap;
- > pre-rinse spray valves;
- > pipe insulation; and
- > faucet aerators.

Both BES components are implemented through delivery agents (DAs). The DAs are responsible for all aspects related to the marketing, administration, ordering, delivery and installation of the materials, as well as for proper recycling of old materials. For SBES, the province of Nova Scotia was divided into six (6) designated areas with a DA assigned to each one. As for CDI, one DA is responsible for the whole province with no territorial division.

The program involves inspecting a number of completed projects. Where applicable, the amount paid by ENSC is adjusted according to the information validated during on-site visits.

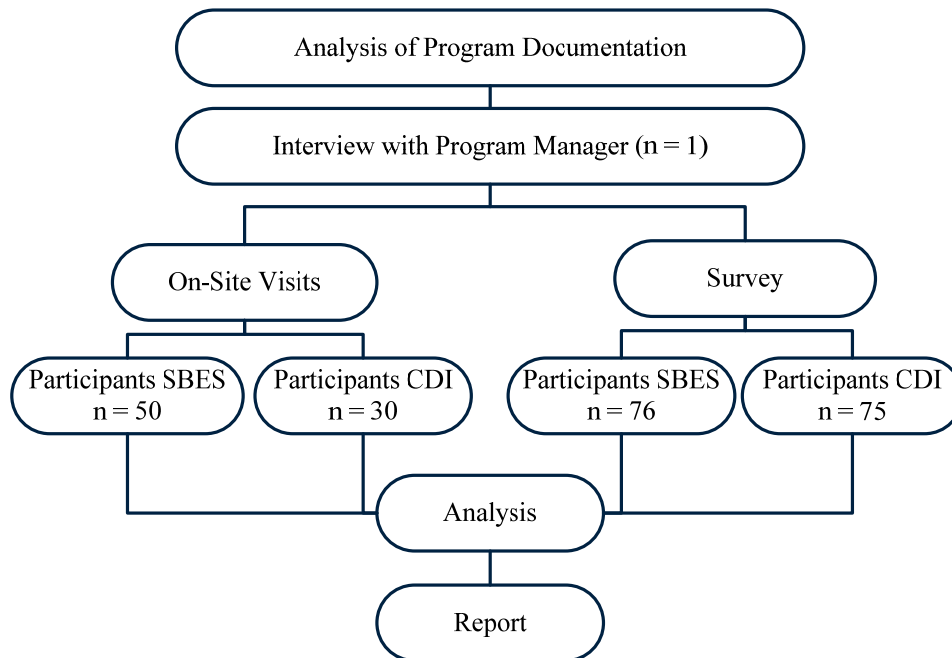
BES aimed to achieve net energy savings of 28.8 GWh (19.2 GWh for SBES and 9.6 GWh for CDI) and net demand savings of 4.2 MW (3.3 MW for SBES and 0.9 MW for CDI) in 2012. Electricity savings generated by BES are accounted for under the Small Business Direct Install program as outlined in the 2012 Demand Side Management Plan.

2 METHODOLOGY

2.1 METHODOLOGICAL MODEL

Figure 1 below illustrates the research strategy and the data collection activities used for the 2012 evaluation. Copies of the different data collection tools used are included in the Appendices.

Figure 1: Methodological Model



2.2 METHODOLOGY DESCRIPTION

2.2.1 Analyzing Existing Program Information

Analyzing program documentation was the first task in the process evaluation for BES. At this stage, all of the available program information was reviewed.

The information used to conduct this analysis was primarily obtained from the following sources:

- > ENSC website;
- > Program Manual; and
- > Tracking Sheet.

2.2.2 Interviews with Program Manager

Econoler staff conducted two interviews, respectively in July and August 2012, with the Program Manager (PM). These interviews were intended to understand the major changes that occurred in program delivery in 2012. Based on the information obtained in these interviews, a list of questions and topics to include in the data collection tools for the evaluation was prepared.

2.2.3 On-Site Visits

On-site visits were conducted in October and November 2012 for both SBES and CDI by Equilibrium Engineering, one of Econoler's subcontractors.

For SBES, 50 on-site visits were conducted to verify the installation of lighting products according to the data found in the tracking sheet. In addition, hours of operation were metered for two weeks in selected areas of the facilities visited.

For CDI, 30 on-site visits were conducted in facilities where energy-efficient products had been installed by the DAs. The purpose of these visits was to verify whether the products were properly installed according to the information contained in the tracking sheet. In addition, technical information such as lamp wattages was collected during the on-site visits and participant interviews to validate the unitary savings assumptions used for each category of product.

Further explanations of the methodology used for the on-site visits are available in the Impact Evaluation section of this report. A copy of the on-site visit protocol is included in Appendix II.

2.2.4 Participant Survey

A telephone survey with a total of 151 program participants was conducted by Econoler's subcontractor, Corporate Research Associates, Inc. (CRA), from its offices in Halifax. The interviews were conducted in November 2012 using computer-assisted telephone interviewing (CATI) technology. The average length of the survey was 11 minutes.

The participant survey was used to gain a better understanding of the following program features:

- > spillover and free-ridership;
- > program awareness;
- > participant motivations and barriers;
- > satisfaction with the program; and
- > recommendations for improvements.

The profile of the organizations interviewed through the survey and the survey questionnaire are shown in Appendices III and IV respectively. The following table shows the population and sample sizes, as well as the corresponding sampling error at a 90 percent confidence level for the 2011 and 2012 telephone surveys. In 2012, there were two components of BES: SBES and CDI. The survey results for 2012 are presented in two separate rows, one for each component.

Table 3: Sample Size and Sampling Error

Survey	Population	Sample Size (n)	Sampling Error at 90% Confidence Interval
2011 Participants	1,468	61	±10.4%
2012 Participants – Overall		151	
2012 Participants – SBES	1,239 ¹	76	±9.1%
2012 Participants – CDI	2,646 ²	75	±9.4%

¹ The population of SBES participants for the 2012 survey was 746 at the time the survey was being conducted.

² The population of CDI participants for the 2012 survey was 1,446 at the time the survey was being conducted.

3 PROCESS EVALUATION

3.1 OBJECTIVE AND APPROACH OF THE PROCESS EVALUATION

A full-scale process evaluation was not required for BES for the year of 2012. However, a participant survey was conducted as part of the data gathering activities for the evaluation. In addition to the questions designed for impact evaluation purposes (free-ridership and spillover), survey participants were asked questions related to program awareness, barriers and overall satisfaction. The following sections present the survey results and an analysis of the program tracking sheet.

3.2 TRACKING SHEET

The information regarding BES is tracked in two separate tracking sheets, one for the SBES component and one for the CDI component. For this year's evaluation, Econoler reviewed the content of both SBES and CDI tracking sheets. It is important to note that, from 2013, the information will be combined in one main tracking sheet, using the SBES tracking sheet model. Therefore, this should solve some of the issues mentioned in this review.

3.2.1 SBES

The SBES tracking sheet presents information on the participating facilities and the achieved savings in one tab. Another tab was included to present detailed information on the projects implemented. In this tab, each installation, which consists of a group of similar products installed in a specific location of the facility, is recorded in one line. To associate these installations with the facility where they were implemented, ENSC uses a unique project identification number. Since each project implemented has a unique identification number, it is easy to find the total number of projects implemented within a year and this allows easy monitoring of the participation level of the program.

As for the information on participants, the tracking sheet includes all the fields on facility and contact information necessary to conduct surveys and on-site visits. The contact names and phone numbers were filled out for almost all participants (all contact names were filled in and only 7 percent of phone numbers were missing). Moreover, the email addresses, even if this field is not mandatory, were available for several participants. This field was useful for on-site visits planning.

Information on the total project cost with details on the utility and customer contributions is also included in the tracking sheet. Econoler verified if the total project cost corresponded to the combined sum of the utility and the customer contributions.

As for savings, the tracking sheet presents the gross savings. It includes the key parameters required to validate the energy savings calculations: the quantity installed, the unitary wattage values and the hours of operation for the old and new lighting products. This is an improvement on last year's tracking

sheet, which included neither the unitary wattage values nor the hours of operation. Separate fields have now been created for the main parameters used in the savings calculations and were filled out based on the information collected on site and on the new products selected for installation. The hours of operation are based on the information provided by participants for each location where lighting products were installed. For the measures equipped with an occupancy sensor and resulting in reduced hours of operation, the new hours of operation are also based on information provided by participants following the product installation.

The tracking sheet still lacks several sorts of detailed information to allow easy validating of the savings calculations. Firstly, the unitary wattage value indicated for the old products covers the whole system without specifying the wattages of its components. For instance, the unitary wattage value defined for a “T12 Fluorescent 4FT - 2x34 W - 0.88” fixture is 77 watts ($2 \text{ lamps} \times 34\text{W/lamp} \times 1/0.88$). The fact that the number of lamps per fixture, the lamp wattage and the ballast factor of the old lighting products are not specified in separate fields makes it really difficult to validate the unitary wattage values and the number of new units used in the savings calculations. For the new lighting products, the information is a little bit easier to identify and validate. The ballast factor is presented in a separate field. The fact that it is not directly integrated into the unitary wattage values allows for a better validation of the unitary wattage values used in the savings calculations. Secondly, the tracking sheet cannot provide any information on the use of occupancy sensors since it is not entered as a measure in the DSMDS. In the tracking sheet, the only way to find this information is to compare the old and new hours of operation. The data revealed that two percent of the installations included occupancy sensors. Finally, the location where a specific group of lighting measures was implemented is recorded in the tracking sheet. Since all buildings are different, this location can be entered differently from one group to another. Therefore, information to indicate if the measures were implemented indoors or outdoors is not provided in a standardized format, which would allow for a more precise evaluation of the interactive effects factor.

In addition to the fields identifying the categories and types of the old and new products, the tracking sheet contains a field specifying the type of installation. For the installation of lighting fixtures, there are eleven different types of installation since the type of fixture installed is also included in the field. The reason that explains such categorization is that each installation type is linked to a different labour price.

Net savings are not presented in the tracking sheet. They are calculated on a monthly basis, for all BES components, in a monthly reporting sheet.

The Evaluator found some inconsistencies in the tracking sheet. For 672 entries out of the total 10,611, the savings recorded differ from those calculated by the Evaluator using the parameters entered in the tracking sheet. The old and new numbers of units differed in 3 percent of the cases, but this is probably due to a replacement with fixtures having a different number of lamps per unit, which is hard to validate without having this information entered in a separate field of the tracking sheet. Inconsistencies were also observed in the unitary wattage value used for some categories of product.

For example, the “T12 Fluorescent 4FT - 2x34 W - 0.88” category presents two other different unitary wattage values, which is inconsistent since it is for the exact same products. This situation happens for some of the old and new lighting products (27 cases out of 999 categories of product). In a few cases where new lighting products were installed, new hours of operation were entered as 0.

Nonetheless, the Evaluator noticed that improvements were made from last year. For the hours of operation, all the values were below 8,760 hours per year, which is the maximum amount of time for a year. As well, the fields required for savings calculations were now filled out systematically without any blank entries.

In conclusion, the tracking sheet shows some improvements on last year's version. Some potential adjustments could still be made to the 2012 tracking sheet to allow validating savings calculations, improve data consistency and facilitate program evaluation. Therefore, the Evaluator recommends that ENSC:

- > **Specify the detailed characteristics of each lighting product:** The current tracking sheet does not specify some of the characteristics of the old or new lighting products. In fact, such details as the number of lamps per fixture, the wattage of the lamps and the ballast factor are all squeezed into one field with the name of the product. Information presented in this way does not allow the Evaluator to differentiate two similar lighting products yet including different key components such as ballasts, or to validate the unitary wattage values used in the savings calculations. Therefore, the Evaluator recommends adding fields in the tracking sheet to specify the characteristics of the old and new lighting products separately.
- > **Develop a validation process for savings calculations:** To ensure that the savings recorded in the tracking sheet correspond to those calculated using the parameters filled out for each measure (quantity, unitary wattage value, hours of operation, etc.), ENSC should develop a validation process using a formula that would automatically calculate the savings using the parameters entered in the tracking sheet. This would ensure the consistency of the energy savings recorded for each measure. In this year's tracking sheet, for 7 percent of the measures, the savings recorded differ from those calculated by the Evaluator using the parameters entered in the tracking sheet. Moreover, other fields should be added to the tracking sheet in order to also keep track of the net savings calculations. These calculations should be linked to a table which presents self-declaration ratios, installation rates, NTGR and interactive effects.
- > **Investigate the possibility of better identifying installations with lighting controls:** The way the installation of occupancy sensors are filled out in the DSMDS does not allow, at this time, for indicating in the tracking sheet whether occupancy sensors were installed with the lighting products. The only way to identify and confirm this measure is to compare the old and new hours of operation. A reduction in hours of operation would indicate that an occupancy sensor was installed. It is therefore recommended that ENSC investigates the possibility of developing a new

mechanism that would allow for easier identification of the installation of lighting controls on each measure implemented and eliminate entry errors in the hours of operation.

- > **Add a field to indicate if the measures were installed inside or outside the building:** The tracking sheet already includes a field with the specific location of each group of lighting measures implemented. Since all buildings are different, locations can be entered differently from one group to another, which precludes easily identifying if the measures were installed indoors or outdoors. Therefore, Econoler recommends including a field, in addition to the location, to simply identify if the measures were installed indoors or outdoors. This would facilitate the evaluation of the interactive effects factor.

3.2.2 CDI

The CDI tracking sheet presents information in one main sheet with fields on the participating facilities, products installed and achieved energy savings. Each project has a unique identification number, which facilitates participant identification for field activities.

Overall, the tracking sheet is clear and concise. It contains the necessary fields required for program evaluation and provides the PM with a way to continuously monitor the number of products installed and the number of participating facilities.

First, it provides all the necessary information on the participating building including the company name, building address, and the contact name and phone number, which allowed the Evaluator to conduct the telephone survey and on-site visits. However, in some cases, neither the contact name nor the phone number was entered. Some other elements needed for the impact evaluation were also missing. For instance, some participants' rate codes were missing and the business type in many cases was identified as "Other". This should change in the future since ENSC has recently made the rate code field mandatory and has diversified the choices in the business type pull-down menu. Other fields, such as the Domestic Hot Water (DHW) heating type (only necessary when DHW products are installed), were left blank in smaller numbers. The tracking sheet does not include fields about the heating source or air conditioning.

The tracking sheet also records the quantity of products installed in each category. Each type of product associated with a specific unitary savings value is tracked under a separate column, which facilitates savings calculations. Since the CDI tracking system is shared with Multi-Unit Residential Buildings (MURB), some of the columns are left empty since they refer to products only eligible in MURB. The Evaluator also noticed that, with certain categories of product, the tracking sheet presents a mix of 0 values and blank entries to indicate that no product was installed.

The Evaluator noted some inconsistencies while reviewing the quantities of products recorded in the tracking sheet. A number of participants complained about the lighting products installed in their facility, saying that the types of light were not adequate for their needs. In these cases, the installer came back to replace the lamps with another type of energy-efficient lamp and a new project

identification number was created to enter these new quantities of product installed. However, deductions were not made in the tracking sheet to subtract the lamps removed. Econoler made some spot checks to identify such situations and, when they occurred, adjusted the quantities of products installed.

As for savings, the tracking sheet includes a column where a certain sort of energy savings is presented. However, these savings are calculated by the DAs using old energy savings values and only serve to evaluate their targeted performance. Apart from that, no energy or demand savings are directly calculated in the tracking sheet. The PM calculates the program savings in a separate table by multiplying the number of products installed by the unitary savings values from the base cases presented in the Evaluation Plan.

In the light of these observations, the Evaluator makes the following recommendations to facilitate program monitoring and evaluation in the future:

- > **Develop a validation process for product removals:** Some inconsistencies related to product removal were noted in the CDI tracking sheet by the Evaluator. In some cases, an installer had to come back to replace lamps initially installed with another type of energy-efficient lamp, but no deductions were made to subtract the quantities of lamp that were removed. For this year's evaluation, Econoler made some spot checks in the tracking sheet and, when noticing that such situations occurred, adjusted the quantities of products installed accordingly. However, the Evaluator could not go through all the projects recorded in the tracking sheet. Therefore, it is essential for ENSC to develop a validation process to ensure the accuracy of the quantities of product entered in the tracking sheet and that deductions are made when some products are removed or replaced by other energy-efficient products.
- > **Calculate energy savings directly in the tracking sheet:** The real tracked energy and demand savings calculations are not included in the tracking sheet. They are calculated separately by the PM. Consequently, it is difficult for the PM and the Evaluator to monitor savings generated by the program and to identify the parameters used to calculate these savings. Therefore, Econoler recommends adding fields to the tracking sheet in order to keep track of the gross and net savings calculations. These calculations should be linked to a table which presents unitary savings values, installation rates, NTGR and interactive effects.
- > **Make sure that all the fields are systematically filled out:** The Evaluator noted that some fields were left blank:
 - Business type: This field could be useful for evaluating some unitary savings values, which vary depending on the business type, such as DHW tank wrap. In 39 percent of the cases, it was entered as "Other" or missing.
 - Contact information: Some contact information entries were not filled out, such as the first and last names (11%) and phone number (12%). Also, the tracking sheet does not have a field to

enter the postal code of the participating facility, which would facilitate grouping participants by region for on-site visit sampling.

- Rate code: This field is used to determine the line loss factor. It was left empty in 17 percent of the records.
- Water heating type: This field needs to be filled out to distinguish between electricity and non-electricity savings when DHW products are installed. It was left blank for 3 percent of the participating facilities where DHW tank wrap, pipe insulation, faucet aerator and/or low-flow showerhead were installed.

All this information is useful for field activities (on-site visits and telephone survey) and is often essential for impact evaluation. Therefore, it is recommended to limit the number of blank entries in these fields to the maximum extent possible. For business type, ENSC is already considering expanding the list of business types to prevent participants from always choosing "Other". Regarding the fields for rate codes and contact information, these fields are mandatory since the end of 2012, which should correct the situation rapidly.

- > **Collect information on the heating energy source and air conditioning:** The tracking sheet should include information on the energy source used for space heating and indicate if air conditioning is used. This information would be useful for the interactive effects factor calculations.
- > **Set limitations for entries:** To ensure the validity of the values entered in the tracking sheet, Econoler recommends that ENSC set some limitations to standardize information collection, facilitate the identification of blank entries and limit errors. For instance, under each category of eligible products, a "0" value should be entered when no installation is done. Currently, the tracking sheet presents a mix of 0 values and blank entries.

3.3 PARTICIPANT PERSPECTIVES

Since BES is comprised of two components (SBES and CDI), the 2012 participant survey was conducted with participants from both SBES (n=76) and CDI (n=75). Participants who took part in both components were asked to answer questions about only one of the components.

3.3.1 Program Awareness

ENSC is successfully communicating about the BES program in a variety of ways. Both SBES and CDI participants primarily found out about the program from various ENSC sources, although this was much more likely for CDI participants (77% for CDI participants compared with 37% for SBES participants). These sources included ENSC staff, newspapers or other media sources, bill inserts, literature in the mail, the ENSC website, or a phone call from an ENSC representative. It was more likely for SBES participants (33%) to hear about the program through word of mouth than CDI participants (17%). This high percentage of participants who found out about the program through word of mouth is evidence that the program is viewed positively. Finally, more than two in ten SBES

participants found out about the program from a contractor or vendor (21%), compared with just 7 percent for CDI participants.

Table 4: Program Awareness

Sources of Program Awareness	2011* SBES (%)	2012*	
		SBES (%)	CDI (%)
<i>Sample Size</i>	61	76	75
TOTAL ENSC SOURCES	--	37%	77%
ENSC staff/presentation	34%	14%	43%
Newspaper/media	3%	8%	7%
Bill insert	3%	7%	5%
Literature received through mail	28%	4%	3%
ENSC website	11%	4%	--
Phone call from SBES/ENSC/CDI representative/Cold call	10%	1%	23%
Friend or business associate (word of mouth)	51%	33%	17%
Contractor or vendor	28%	21%	7%
Another/previous participant	30%	3%	--
Others	3%	16%	1%
Don't know	--	1%	1%
*Multiple responses ³			

3.3.2 Motivations and Barriers to Participation

Businesses and organizations chose to participate in the program for a number of reasons. Among these, saving on energy costs was the primary motivation for both SBES (66%) and CDI (49%) participants. For fewer participants, the primary reason was taking advantage of program incentives (9% for SBES and 11% for CDI). Several motivators were not related to cost savings. More than one in ten participants mentioned improved lighting conditions (13% for both SBES and CDI), while almost two in ten CDI participants (19%) mentioned energy efficiency in general. In addition, environmental protection (3% for SBES and 1% for CDI) was mentioned by a smaller number.

³ To identify the source of program awareness, participants had historically been allowed to indicate only one response representing the source of first contact with the program. In 2011, the survey started allowing multiple responses to include sources of contact that might have occurred simultaneously.

Table 5: Reasons for Participating

Motivations	2012			
	SBES (%)		CDI (%)	
	Most Important Motivation	Second Most Important Motivation	Most Important Motivation	Second Most Important Motivation
<i>Sample Size</i>	76	76	75	74*
Save on energy costs/bills	66%	24%	49%	23%
Improve existing lighting conditions	13%	22%	13%	11%
Take advantage of program incentives	9%	9%	11%	15%
To improve building	4%	--	--	--
Energy efficiency	3%	12%	19%	8%
Help protect the environment	3%	8%	1%	18%
Reduce maintenance costs	3%	1%	1%	1%
Others	--	3%	4%	3%
None/No other reasons	--	20%	--	20%
Don't know	--	1%	1%	1%
*Base: Respondents who did not say 'Don't know' for most important motivation				

Most SBES participants did not experience any barriers to program participation (just 3% reported barriers), while 15 percent of the CDI participants did so.

Table 6: Barriers to Program Participation

Any Barriers	2011 SBES (%)	2012	
		SBES (%)	CDI (%)
<i>Sample Size</i>	61	76	75
No	77%	97%	85%
Yes	20%	3%	15%
Don't know	3%	--	--

Only two SBES participants mentioned barriers to the program, which makes them very minimal impediments. These barriers included too much work required to obtain the funding. Barriers mentioned by CDI participants were mainly related to problems with product installation, unavailability of some products, or energy-efficient equipment not meeting payback requirements.

Table 7: Specific Barriers to Program Participation

Specific Barriers	2012			
	SBES (#)		CDI (#)	
	Most Important Barrier	Second Most Important Barrier	Most Important Barrier	Second Most Important Barrier
<i>Sample Size*</i>	2	2	11	11
Too much work required to obtain funding	1	--	1	--
Problems implementing/installing measures/products	--	--	3	--
Unavailability of measures/products	--	--	2	2
Energy-efficient equipment does not meet payback requirements	--	--	1	--
Others	1	--	3	--
None/No other barriers	--	2	--	8
Don't know	--	--	1	1
*Base: Respondents who said there were barriers to participating in the program				

3.3.3 Program Influence

Participants were asked to rate the importance of various factors in their decision to participate in the program. For SBES participants, the financial assistance provided by ENSC was considered the most important factor (with a mean score of 9.3 on a '0' to '10' scale with '10' indicating "extremely important"), followed by the information received during the initial contact with the program representative (mean 8.7). Other factors considered important included recycling or removal of lamps and fixtures (mean 7.9), the lighting audit (mean 7.8), the existing energy efficiency code (mean 7.0), or because it was standard practice in the industry (mean 6.4). Previous experience with the program or similar programs was considered less important (mean 4.6). Meanwhile, for CDI participants, the free installation of energy efficient products was considered important (mean 9.1), as was the information or advice provided by program staff (mean 7.9). The funded lighting audit was considered less important (mean 4.8).

Table 8: Influence of Program Elements on Participation

Program Elements	2011 SBES		2012			
			SBES		CDI	
Average rating: 0 is "Not at all important", 10 is "Extremely important"	Sample Size*	Mean Score	Sample Size*	Mean Score	Sample Size*	Mean Score
ENSC financial assistance	61	8.9	76	9.3	n/a	n/a
Information received during the initial contact by a program representative	60	7.4	76	8.7	n/a	n/a
Recycling of removed lamps and fixtures	61	7.2	75	7.9	n/a	n/a
ENSC funded lighting audit	57	7.6	73	7.8	63	4.8
Existing energy efficiency code	51	5.4	63	7.0	n/a	n/a
Standard practice in industry	54	4.3	58	6.4	n/a	n/a
Previous experience with the SBES program, or a similar program either from ENSC or NSP	54	3.4	63	4.6	n/a	n/a
The free installation of energy-efficient products offered by the program	n/a	n/a	n/a	n/a	72	9.1
Information or advice provided by program staff through the process.	n/a	n/a	n/a	n/a	70	7.9
*Don't know/Refused excluded from calculations						

3.3.4 Satisfaction with the Program

Both CDI and SBES achieved a high level of participant satisfaction with a higher satisfaction level among SBES participants. Actually, 95 percent of SBES participants and 85 percent of CDI participants reported satisfaction with the program.

Table 9: Satisfaction with Program Overall

Satisfaction with Program*	2011 SBES (%)	2012	
		SBES (%)	CDI (%)
<i>Sample Size**</i>	61	76	74
Overall program	87%	95%	85%
*Base: Percentage of respondents who were very satisfied / satisfied			
**Don't know/refused removed from calculations			

As for the reasons for dissatisfaction, two SBES participants indicated that they had expected more savings, while one mentioned that the products installed did not suit their needs. Meanwhile, the majority of the CDI participants who were dissatisfied mentioned that the installed products did not suit their needs, indicating an area that may require further attention. The quality assurance plan put in place by ENSC in 2013 should address more of these issues. Other reasons mentioned by CDI participants included that they did not like the evaluator, or that the energy evaluation took too long.

Table 10: Reasons for Dissatisfaction with the Program

Reasons for Dissatisfaction*	2012			
	SBES (#)		CDI (#)	
	Most Important Reason	Second Most Important Reason	Most Important Reason	Second Most Important Reason
<i>Sample Size</i>	4	4	11	11
I expected more savings	2	--	--	--
Measures/products implemented/ installed don't suit my needs	1	--	8	2
I did not like the evaluator who visited the building	--	--	1	--
The energy evaluation took too long	--	--	1	--
Others	1	--	1	1
None/No other reasons	--	3	--	8
Don't know	--	1	--	--
*Base: Respondents who were dissatisfied with program				

The majority of participants were satisfied with the length of time between when they applied for the program, and when measures were implemented in their facilities with 86 percent among both the SBES and the CDI participants giving a rating of '4' or '5' (with '5' representing "very satisfied").

Table 11: Satisfaction with Time Interval between Program Application and Implementation

Satisfaction with Time Interval*	2012	
	SBES (%)	CDI (%)
<i>Sample Size</i>	76	71
5 "Very satisfied"	62%	68%
4	24%	18%
3	7%	8%
2	4%	1%
1 "Not at all satisfied"	4%	4%
*Don't know/Refused excluded		

3.3.5 Recommendations for Improvements

While one-half of the participants did not offer any suggestions on program improvement (51% for SBES and 55% for CDI), those who did suggested the following: increasing advertising (9% for SBES and 4% for CDI), better communication (7% for SBES and 11% for CDI), more information in general (5% for SBES and CDI), and a quicker process (5% for SBES and 1% for CDI participants).

Table 12: Recommendations for Improvements

Suggestions*	2011 SBES (%)	2012	
		SBES (%)	CDI (%)
<i>Sample Size</i>	61	76	75
Increase advertising/marketing	18%	9%	4%
Better communication/Hard to get in contact with	7%	7%	11%
More information/Found process confusing	11%	5%	5%
Quicker process	5%	5%	1%
Satisfied with program	5%	4%	4%
Others	10%	8%	9%
No recommendations	--	11%	12%
Don't know	52%	51%	55%
Refused	--	3%	1%
*Multiple responses			

4 IMPACT EVALUATION FOR SBES

4.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

The impact evaluation for SBES aims at determining the gross and net savings of this component for 2012. Both energy and demand savings were considered in this evaluation. To do so, the following parameters were analyzed by Econoler:

- > unitary wattage values of the lighting products;
- > hours of operation;
- > installation rate;
- > diversity factor;
- > interactive effects;
- > free-ridership; and
- > internal spillover.

The impact evaluation of SBES consisted of a review of the tracking sheet, 50 on-site visits with time-of-use metering and the participant survey.

The review of the tracking sheet involved an analysis of the unitary wattage values established for each lighting product and an assessment of how the savings were calculated.

The on-site visits were used to validate the installation of products in participant facilities and to establish the installation rates where inconsistencies arose. The on-site visits also included a metering activity, for which time-of-use meters were installed for two weeks. The purpose of this activity was to collect information on the hours of operation and to compare it to the hours of operation declared by the participants to establish a self-declaration ratio. Information on the space heating source and heating, ventilation and air conditioning (HVAC) equipment installed at each site was also obtained during the on-site visits. This information was useful to calculating the interactive effects factor and the diversity factor.

The participant survey provided information for calculating the net-to-gross ratio (NTGR) for this component, including free-ridership and internal spillover. The NTGR established was used to calculate the net savings.

As previously mentioned in the program description, the SBES offer was expanded to non-lighting measures towards the end of 2012. A few projects, including heat pump installations, were completed this year. The savings calculations used by ENSC for these measures will be reviewed during this impact evaluation.

The impact evaluation of SBES also includes the assessment of the savings associated with the two pilots conducted through SBES: Very Small Business and Retail LED.

4.1.1 On-Site Visit Sampling and Protocol

Sampling Methodology

A total of 50 on-site visits were conducted for the impact evaluation of SBES. The sampling was completed in September 2012 based on the participant list in the tracking sheet. At that time, the tracking sheet included 746 completed projects.⁴

In order to cover the main lighting products installed, projects were sorted by category of new product and total tracked energy savings. This made it possible to identify the products that generate more savings within the program. The weight of each category in terms of savings is presented in the table below.

Table 13: Tracked Energy Savings for Each Category of New Product Installed⁵

New Lighting Product	T8	Custom Lighting	CFLs	Exit Signs	Metal Halide	T5 HO	Halogen PAR	HP Sodium	Total
Total Savings (MWh)	8,773	2,667	1,673	177	46	31	7	0	13,374
% of Total Savings	<u>65.6%</u>	<u>20.0%</u>	<u>12.5%</u>	1.3%	0.3%	0.2%	0.1%	0.0%	100%

The table shows that T8 lamps, custom lighting products and CFLs together represent 98 percent of the total tracked savings. Therefore, for the on-site visit sampling, businesses were selected if they had at least T8 lamps, custom lighting products or CFLs installed.

Once the screening was done by applying this criterion to the initial list of participants, the final selection was done in such a way that projects in all ranges of savings were represented. Of the 746 completed projects, 57 generate energy savings of up to 50,000 kWh and represent 35 percent of total program savings. Based on this analysis, 18 sites (35% x 50) with energy savings of up to 50,000 kWh and 32 sites with energy savings of above 50,000 kWh were selected.

On-Site Visit Protocol

The on-site visits were used to calculate the following parameters:

- > installation rates, by comparing the quantity and type of lighting products installed on-site with the data recorded in the tracking sheet;
- > a self-declaration ratio, to adjust the hours of operation declared by the participants according to the hours of operation metered for two whole weeks at the selected facilities;

⁴ Projects considered as completed are projects with closed, approved or installed statuses.

⁵ As of September 2012.

- > the interactive effects factor, using the information collected on the space heating source and HVAC equipment installed in each facility; and
- > the diversity factor, by investigating the percentage of the total demand savings occurring during the peak demand period based on contact declaration.

4.2 GROSS SAVINGS

The gross savings evaluation was computed based on the information available in the program tracking sheet. For 2012, 1,239 projects were implemented, totalling 12,526 installations.

4.2.1 Unitary Savings for Lighting Measures

Unitary Wattage

A review of the unitary wattage values used in the gross savings calculations was conducted for each category of product identified in the tracking sheet.

Three types of replacement can be done through this program:

- > lamp replacements;
- > lamp and ballast replacements; and
- > fixture and lamp replacements.

Occupancy sensors can also be installed in combination with a replacement of lighting system. For this measure, the energy impact is quantified as a reduction in the hours of operation and is directly incorporated in every lighting system replacement.

For each type of old or new lighting product, the unitary wattage value is established based on the characteristics of each component of the system. The information in the tracking sheet only includes the unitary wattage value of the whole lighting products. It does not specify the detailed characteristics of the products (number of lamps per fixture, lamp wattage and ballast factor) in separate fields; these details, if provided, could have allowed the Evaluator to easily validate the unitary wattage value of each product.

To validate unitary wattage values, the limited amount of information available in the tracking sheet was used to re-engineer how the savings were calculated and to understand the different systems encountered. This re-engineering of the savings calculation showed that in most cases, the unitary wattage calculation is adequate.

Econoler mainly focuses on validating the unitary wattage values used for T8 fluorescents, since this measure covers 52 percent of the gross savings generated by the program. For T8 measures with lamp and ballast replacements or fixture and lamp replacements, the unitary wattage is a combination of ballast characteristics and lamp wattage, which is the right approach. However, when only the lamp was replaced ("Relamp" installation type), no ballast factor was considered for the newly-installed

lamp, but one was included in the unitary wattage values of the old lamp that was replaced. Since it is solely a lamp replacement, only the lamp wattage should be used for both products. Therefore, Econoler made an adjustment to all savings calculations in this category to only take into account the lamp wattage of the old lamp that was replaced. It resulted in a positive adjustment of 1.122 for that category.

For incandescent, halogen and LED products, ENSC always uses a ballast factor of 1. This is the adequate value for these products.

Finally, for the installation of hardwired CFLs, metal halide fixtures and high pressure sodium fixtures, ENSC only considers a ballast factor for the old product that was replaced. For the new product installed, a ballast factor of 1 is applied, which is not appropriate. These types of products include a ballast that consumes a certain wattage. However, since these categories of product represent less than 3 percent of the gross savings and due to the difficulty of adjusting savings calculations in the tracking sheet, no adjustment was made for this year's evaluation. Still, Econoler recommends modifying the approach in the future to include a ballast factor in the unitary wattage calculation for hardwired CFLs, metal halide fixtures and high pressure sodium fixtures installed through the program.

As mentioned in the SBES tracking sheet review, Econoler calculated the total savings for each installation using the parameters entered in the tracking sheet and found 672 incorrect entries out of the total 10,611 by comparing them with the savings recorded by ENSC. These savings were also adjusted in the gross savings calculations, resulting in a small decrease of -1.6 percent.

Hours of Operation

Currently, the hours of operation in the program tracking sheet are obtained through information provided by participants. During the 2011 evaluation, time-of-use loggers were installed in 15 participating facilities to measure these hours of operation and compare them to the values declared by the participants. The results revealed that participants seem to overestimate the hours of operation of the lighting products installed through the program. However, with only 15 sites visited and 90 loggers installed, the error margin was too big to allow calculating a self-declaration ratio that would be applied on all the savings achieved by the program. Therefore, for future evaluations, it was recommended to increase the number of sites on which data loggers would be installed to allow for establishing a more reliable self-declaration ratio.

Econoler followed this recommendation in 2012. The number of on-site visits was increased to 50. During these visits, a total of 260 time-of-use loggers were installed. Using these loggers installed on a total of 1,914 lamps, the hours of operation were recorded for two whole weeks.

For most sites, the hours of operation were monitored for each section of the facility where lighting products were installed through SBES. However, a few sites had numerous sections with lighting products installed, which did not allow the installation of loggers in each of them. A maximum of 10

loggers were installed at each site and the location of their installation was selected according to the type of products installed and its similarity to other sections; the objective in so doing was to monitor the time-of-use for as many lighting products as possible and for as many diverse sections as possible.

Once all the metering was completed, the hours of operation collected by the loggers were compared to the values declared by the participants. For each type of product installed, the ratio between the metering data and the declared hours of operation was calculated. Then, a weighted average of these ratios was used to establish a self-declaration ratio of 0.98. This self-declaration ratio is applied on all lighting products installed through SBES, except for exit signs, which are always turned on 24 hours per day. The self-declaration ratio is also applied to adjust the savings from the Retail LED pilot since it is assumed that a similar overestimation occurs for these products also.

Overall, this result shows that the hours of operation declared by participants are close to reality.

Installation Rate

For the evaluation of SBES in 2011, 15 on-site visits were conducted primarily for quality assurance purposes. For each site, the number of products installed was validated. In several instances, that number was different from the information provided in the tracking sheet. However, the number of on-site visits conducted during this evaluation was not sufficient to allow the adjustment of tracked savings with reliable adjustment values. This is the reason why Econoler decided to increase the number of on-site visits to 50 for this year's evaluation.

For each site visited, the number of products installed was recorded and compared to the quantities provided in the tracking sheet. The difference between on-site values and the tracking sheet was used to establish an installation rate when the error margin was acceptable. The table below presents the percentages of installation and the installation rates established for each category of product.

Table 14: Percentages of Products Installed and Installation Rate

Category of Product	Number of Sites Visited	Quantity Installed – From Tracking Sheet	Percentage of Products Installed On-Site	Installation Rate	Error Margin ⁶
T8	48	4,135	97%	97%	2%
T5	1	57	100%	100%	0%
CFL	32	635	90%	90%	7%
Exit Sign	13	71	97%	97%	3%
Other	26	969	93%	100%	10%

Installation rates were established for all product categories, except for the “Other” category, which includes various types of lighting products such as metal halide lamps and induction wall packs. For

⁶ Calculated for a confidence interval of 90%.

the latter, the error margin was too high (10%) to justify the application of an installation rate on all lighting products of this category. For all the other products, the on-site results showed high installation rates. For the T8 category, which is by far the most important category of SBES in terms of quantity installed and savings, the installation rate was established at 97 percent. For CFLs, one of the reasons that could explain the installation rate of 90 percent is that some participants did not like the luminosity and removed them to put back the lamp type they had before.

For the LED fixtures installed through the Retail LED pilot, an installation rate of 100 percent is used.

4.2.2 Unitary Savings for Non-Lighting Measures

Non-lighting measures were added to the program at the end of 2012. For this year, three heat pumps were implemented in participating facilities. For each different model, the savings were calculated using the following equations:

$$Annual\ Energy\ Savings\ \left[\frac{kWh}{year}\right] = Capacity \times \left(\frac{1}{HSPF_{Base}} - \frac{1}{HSPF_{EE}} \right) \times Full\ Load\ Hours$$

$$Annual\ Demand\ Savings\ \left[\frac{kWh}{year}\right] = Capacity \times \left(\frac{1}{HSPF_{Base}} - \frac{1}{HSPF_{EE}} \right)$$

Where:

- > the capacity represents the real capacity of the heat pump installed;
- > the Heating Seasonal Performance Factors (HSPF) of the base measure is estimated at 3.412, considering electric baseboard heating as the baseline;
- > the HSPF for the new energy-efficient heat pump installed is based on the information provided on the specification sheet and adjusted for the Nova Scotia region; and
- > the annual full load hours are estimated at 2,200 hours.

This approach is based on the one used under Business Energy Rebate (BER) for similar products. The baseline corresponds to a facility with electric heating and no air conditioning. Therefore, the savings calculations only take into account savings in heating, which is conservative since ENSC does not have any information on the use of air conditioning in the facility before the installation of the heat pump. The HSPF of the new heat pump, as indicated in the specifications sheet, is adjusted for region V (the region which Nova Scotia is part of). The annual full load hours in heating correspond to an average value sourced from the Efficiency Vermont Technical Reference Manual (TRM)⁷.

Thus, for the first year of the program with non-lighting measures, the assumptions based on the methodology developed under BER are appropriate. If heat pump measures gain in popularity in the

⁷ Efficiency Vermont, Technical Reference User Manual (TRM) – Measure Savings Algorithms and Cost Assumptions, September 20, 2011.

future, Econoler recommends collecting information on the use of air-conditioning in the facility before the installation of the heat pump and calculating savings on cooling also.

4.2.3 Diversity Factor

Based on the information received from ENSC, the peak period for electricity demand in Nova Scotia occurs in December, January and February between 7 a.m. and 12 p.m., as well as between 4 p.m. and 11 p.m. on a weekday that is not a holiday⁸. As in the 2011 evaluation, Econoler elected to use the 5 p.m. to 7 p.m. timeframe as the peak load period for this year's evaluation.

To evaluate the peak demand coincident with the NSPI system peak, hours of operation and the facility schedule were investigated for all the sites visited during the evaluation process. For each site, the percentage of the total demand savings occurring during the peak demand period was established based on contact declaration. A diversity factor of 80 percent was obtained by calculating the weighted average of all the values obtained from the 50 on-site visits according to the total savings for all the lighting products considered for diversity factor calculations. This value was used for all types of lighting product excluding LED exit signs, which were set to 100 percent.

For heat pumps, Econoler used the diversity factor obtained from the 2012 BER evaluation for HVAC systems. This value was estimated at 100 percent, based on 22 on-site visits conducted at participating facilities where mainly air- and ground-source heat pumps were implemented.

4.2.4 Revised Gross Savings

Econoler revised the gross energy and demand savings calculated in the tracking sheet based on the following adjustments:

- > revised unitary wattage values for some lighting products;
- > self-declaration ratio on hours of operation; and
- > installation rates.

Savings at the generator level were calculated using a line loss factor of 1.076 between the meter and the generator. This value was calculated using the weighted average of the line loss factor values obtained from rate codes of each participating facility in the tracking sheet according to the energy savings. The line loss factors were provided by Nova Scotia Power for each rate code.

The total revised savings obtained for each category of measure implemented are presented in Table 15. The total gross energy savings for SBES are estimated at 21.019 GWh at the meter and at 22.616 GWh at the generator. The total gross demand savings are estimated at 5.088 MW at the meter and at 5.474 MW at the generator.

⁸ Nova Scotia Power, Domestic Service Time-Of-Day Tariff, www.nspower.ca.
<http://www.nspower.ca/en/home/aboutnspi/ratesandregulations/electricityrates/domesticservicetimeofdaytarrifoptional.aspx>.

Table 15: Evaluation Results – Gross Energy and Demand Savings – SBES

Category of Product	Fluorescent T8		Fluorescent T5	CFL	Exit Sign	Other SBES Lighting Products	LED (Retail Pilot)	Heat Pump	Total
	Relamp	Other							
Tracking sheet									
Initial Tracked Savings (GWh)	0.149	11.225	0.059	2.025	0.256	4.739	3.783	0.085	22.322
Calculated Tracked Savings (GWh)	0.149	11.179	0.059	2.019	0.256	4.739	3.487	0.085	21.973
Calculated Tracked Demand Savings (MW)	0.046	3.712	0.030	0.602	0.030	1.278	0.774	0.039	6.511
Evaluated Energy Savings									
Adjustment for Wattage	1.122	-	-	-	-	-	-	-	-
Self-Declaration Ratio on Hours of Operation	0.98	0.98	0.98	0.98	1.00	0.98	0.98	-	-
Installation Rate	97%	97%	100%	90%	97%	100%	100%	-	-
Total Gross Energy Savings - at Meter (GWh)	0.158	10.627	0.058	1.780	0.249	4.645	3.417	0.085	21.019
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-
Total Gross Energy Savings - at Generator (GWh)	0.170	11.434	0.062	1.916	0.268	4.998	3.677	0.092	22.616
Evaluated Demand Savings									
Adjustment for Wattage	1.122	-	-	-	-	-	-	-	-
Installation Rate	97%	97%	100%	90%	97%	100%	100%	-	-
Total Gross Demand Savings - at Meter (MW)	0.050	3.601	0.030	0.541	0.029	1.278	0.774	0.039	6.342
Diversity Factor	80%	80%	80%	80%	100%	80%	80%	100%	-
Total Gross Peak Demand Savings - at Meter (MW)	0.040	2.880	0.024	0.433	0.029	1.022	0.619	0.039	5.088
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-
Total Gross Peak Demand Savings - at Generator (MW)	0.043	3.099	0.026	0.466	0.032	1.100	0.666	0.042	5.474

4.3 INTERACTIVE EFFECTS

Interactive effects occur when the implementation of energy efficiency measures has an impact on the energy consumption of other elements such as heating and cooling systems. In the case of SBES, replacement of standard lighting products with energy-efficient lighting products causes an increase in the heating load during winter and a decrease in the cooling load during summer.

Therefore, interactive effects of -15.5 percent were established in this evaluation for lighting products that were installed inside the facility. This factor is based on a study conducted by ADS in 1992 for Hydro-Québec. The work conducted in this study modified certain parameters in building simulations of commercial buildings in Quebec to determine the impact of these changes on heating and cooling systems. The simulations were performed with the DOE2 software and only focused on buildings heated entirely by electricity.

The following table presents the calculation details for these interactive effects. This calculation takes into account the proportions of participating facilities that are electrically heated and air-conditioned. These proportions were obtained from the 80 on-site visits conducted for BES.

Table 16: Interactive Effects Calculation for Indoor Lighting Products

Parameters	% of Facilities	Interactive Effects ⁹
Electric heating with air conditioning	17%	-43.4%
Electric heating without air conditioning	20%	-49.0%
No electric heating with air conditioning	29%	5.7%
No electric heating without air conditioning	34%	0.0%
Weighted Interactive Effects	100%	-15.5%

These interactive effects are only applicable on lighting products that have an impact on the heating and cooling consumption of the facility, i.e. on lighting products that are installed inside. Therefore, Econoler calculated an average interactive effects factor that takes into account the proportion of lighting products installed under SBES for outdoor usage. To do so, the Evaluator identified the locations where lamps were installed from the information presented in the tracking sheet by searching using key words such as exterior, outside and parking. This analysis revealed that 1 percent of lighting products were installed outside, which resulted in an average interactive effects factor of -15.3 percent. This average interactive effects factor is applicable on all lighting products except for LED exit signs, which are solely installed inside.

⁹ ADS ASSOCIÉS, "Évaluations des effets énergétiques combinés des mesures d'économies d'énergie – secteur commercial," report presented to Hydro-Québec, 1992.

Table 17: Average Interactive Effects Factors for Lighting Products

Category of Product	% Indoor	% Outdoor	Interactive Effects Factor
Exit Signs	100%	0%	$(100\% \times -15.5\%) + (0\% \times 0\%) = -15.5\%$
All Other Lighting Products	99%	1%	$(99\% \times -15.5\%) + (1\% \times 0\%) = -15.3\%$

As mentioned in the tracking sheet review, the Evaluator recommends adding a specific field in the tracking sheet to facilitate the identification of lighting products installed inside or outside. This field could also indicate if some lighting products were installed in refrigerated spaces, which would result in significant positive interactive effects. This would allow for a better evaluation of the net savings of the program.

4.4 NET-TO-GROSS RATIO

The NTGR evaluation of SBES is based on a self-report approach, which relies on a series of questions designed to measure the influence of the program on participants' decisions to install energy-efficient lighting products in their facilities. These questions were included in the participant survey for the portion of participants who took part in SBES.

This section presents the methodology used to transform responses to the NTGR survey questions into an NTGR. For SBES, the NTGR includes the assessment of two distortion effects: free-ridership and internal spillover. Once each effect is quantified, the NTGR is calculated based on this equation:

$$\text{NTGR} = (1 - \% \text{ free-ridership} + \% \text{ internal spillover}).$$

4.4.1 Free-Ridership

In SBES, free-ridership occurs when participants declare they would still have installed the energy-efficient lighting products in the absence of the program. The telephone survey included a number of free-ridership questions that attempted to measure the following variables:

- > if participants had any plans to install energy-efficient lighting products before participating in the program;
- > the probability that participants would have installed the same energy-efficient lighting products if they had not participated in the program;
- > the probability that participants would have installed the standard lighting products instead of energy-efficient ones if they had not participated in the program;
- > the probability that participants would have paid the full cost of the energy-efficient lighting products if the program had not been in place;
- > the level of importance of different factors on the participants' decision to take part in the program; and

- > the probability that participants would have installed the energy-efficient lighting products but at a later date if they had not participated in the program.

Each question was then transposed into a level of program attribution which was used to calculate the global free-ridership level of the participants. The algorithm behind this calculation is presented in Appendix V.

Using this approach, the survey results revealed a free-ridership level of 17 percent for SBES. This value is slightly higher than the 13 percent and 14 percent free-ridership levels obtained for the 2011 and 2010 evaluations respectively.

Lighting measures such as CFLs and T8s are now widely available and business owners tend to purchase them on their own, which increases free-ridership. On the other hand, products installed during retrofits conducted under SBES now include non-lighting measures. Indeed, the program began promoting non-lighting measures towards the end of 2012, such as heat pumps. The addition of these non-lighting measures, which business owners are not inclined to install on their own, should help lower the free-ridership level. Unfortunately, since their implementation only started late in 2012, it was impossible to include most of those participants in this year's analysis.

4.4.2 Spillover

The internal spillover effects of SBES were measured through the participant survey. Internal spillover occurs when participants purchase eligible energy-efficient lighting products following their previous participation in the program due to its influence, thereby demonstrating the advantages of such products.

During the telephone survey, SBES participants were asked if they had bought and installed additional energy-efficient lighting products following their previous participation in the program. To verify the eligibility of the additional purchases, other questions were asked about the following:

- > the date of the purchase to ensure it was made after participating in the program; and
- > if they benefited from any other incentive program for these additional purchases, or if they planned to submit an incentive request for these purchases in the future.

Subsequently, other questions were asked to verify the level of influence the program had on the purchases. Depending on the level of influence obtained during the survey, a portion of these savings was attributed to the program. The level of internal spillover was calculated for each participant according to the following equation.

$$\%SO = \frac{kWh \text{ associated with the additional purchase} \times \text{attribution level}}{kWh \text{ associated with the lighting products installed under the SBES component}}$$

Past evaluation revealed an extremely low level of internal spillover. In 2011, using the same approach, the spillover represented 0.8 percent of the total energy savings achieved through SBES.

This year, the level of internal spillover remains low. Only two SBES participants out of the 76 surveyed were flagged for spillover. They confirmed having purchased additional energy-efficient lighting products following their participation in the program. However, the additional energy savings attributable to the program generated by these additional purchases were extremely low in comparison to the energy savings achieved by these participants through the program. Therefore, the spillover level for SBES in 2012 is considered negligible.

4.4.3 NTGR Calculation

Using the free-ridership and spillover levels established, the NTGR value for the program is estimated at 0.83. This NTGR is applied to all lighting products installed through the program.

For the LED products installed through the Retail LED pilot and the non-lighting measures installed at the end of the year, a NTGR of 1.00 is applied.

4.5 NET SAVINGS

The net savings for the program were estimated using the interactive effects factor and the NTGR mentioned above. The following equation was used to calculate the program net savings.

$$\text{Net Savings} = \text{Gross Evaluation Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

This equation was used for both demand and energy savings. The results obtained are presented in the following table. Overall, the total net energy and demand savings amount to 15.294 GWh and 3.677 MW at the meter and 16.456 GWh and 3.957 MW at the generator.

Table 18: Evaluation Results – Net Energy and Demand Savings by Product – SBES

Category of Product	Fluorescent T8		Fluorescent T5	CFL	Exit Sign	Other SBES Lighting Products	LED (Retail Pilot)	Heat Pump	Total
	Relamp	Other							
Energy Savings									
Total Gross Energy Savings – at Meter (GWh)	0.158	10.627	0.058	1.780	0.249	4.645	3.417	0.085	21.019
Interactive Effects Factor	-15.3%	-15.3%	-15.3%	-15.3%	-15.5%	-15.3%	-15.3%	-	-
NTGR	0.83	0.83	0.83	0.83	0.83	0.83	1.00	1.00	-
Total Net Energy Savings (GWh) – at Meter	0.111	7.471	0.040	1.252	0.174	3.265	2.894	0.085	15.294
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-
Total Net Energy Savings (GWh) – at Generator	0.120	8.038	0.044	1.347	0.188	3.513	3.114	0.092	16.456
Demand Savings									
Total Gross Peak Demand Savings – at Meter (MW)	0.040	2.880	0.024	0.433	0.029	1.022	0.619	0.039	5.088
Interactive Effects Factor	-15.3%	-15.3%	-15.3%	-15.3%	-15.5%	-15.3%	-15.3%	-	-
NTGR	0.83	0.83	0.83	0.83	0.83	0.83	1.00	1.00	-
Total Net Peak Demand Savings (MW) – at Meter	0.028	2.025	0.017	0.305	0.021	0.719	0.524	0.039	3.677
Line Loss Factor	1.076	1.076	1.076	1.076	1.076	1.076	1.076	1.076	-
Total Net Peak Demand Savings (MW) – at Generator	0.031	2.179	0.018	0.328	0.022	0.773	0.564	0.042	3.957

The table below presents comparisons between the energy and demand savings established by this evaluation and those calculated in the 2012 tracking sheet.

Table 19: Comparison of Tracked and Evaluated Savings at the Generator – SBES

	Initial Gross Savings*	Adjusted Gross Savings	Adjusted Gross Savings with Interactive Effects	NTGR**	Net Savings
Energy Savings					
Tracked Savings from ENSC	23.952 GWh	22.943 GWh	21.177 GWh	0.85	17.971 GWh
Evaluation Results	24.019 GWh	22.616 GWh	19.170 GWh	0.86	16.456 GWh
Demand Savings					
Tracked Savings from ENSC	6.986 MW	6.692 MW	6.177 MW	0.85	5.242 MW
Evaluation Results	7.005 MW	5.474 MW	4.643 MW	0.85	3.957 MW

*Tracked initial gross savings differ from the evaluation results because of the different line loss factors used in the tracking sheet and for the evaluation.

**The NTGRs were different for the Retail LED pilot and the non-lighting measures. The values presented in this table correspond to the rounded averages obtained by dividing the net savings by the installed gross savings (with interactive effects).

The net energy savings evaluated for SBES fell short on those tracked by ENSC by 8 percent. This result can be explained by the adjustments applied to the initial gross savings, namely the installation rates (an average value of 98.4 percent was used for tracked savings) and the self-declaration ratio on the hours of operation. Moreover, an interactive effects factor of -15.3 percent was used for this year's evaluation, while ENSC used -7.7 percent to calculate tracked savings.

For demand savings, the difference between the tracked and the evaluation results is more important because of the addition of a diversity factor of 80 percent in the calculation.

5 IMPACT EVALUATION FOR CDI

5.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

This Impact Evaluation section aims at determining the gross and net savings of CDI for 2012. Both energy and demand savings are considered in this evaluation. To do so, the following parameters were analyzed by Econoler:

- > unitary savings value used for each type of product;
- > installation rate;
- > interactive effects; and
- > free-ridership.

The impact evaluation was based on a review of the program tracking sheet, a literature review, 30 on-site visits and the participant survey.

The review of the tracking sheet involved a computation of the quantities of products installed in the participating facilities and an analysis of the unitary savings values used to calculate savings mainly based on information found in the literature.

On-site visits were used to establish installation rates by validating if the quantities of products installed in the participants' facilities were consistent with the quantities recorded in the tracking sheet. Technical data on the old and new products installed were also collected to validate the parameters used in the unitary savings calculations.

The participant survey provided information to calculate the net-to-gross ratio (NTGR) for this program. The NTGR is used to calculate the program net savings.

5.1.1 On-Site Visit Sampling and Protocol

Sampling Methodology

A total of 30 on-site visits were conducted for the 2012 evaluation of CDI. The sampling was carried out in September 2012 using the program tracking sheet which contained the list of participants and information about all products installed at that time.

The Evaluator's analysis of the tracking sheet showed that several types of product had been installed in the participating facilities. However, by grouping the various CFL and LED products installed into two generic categories, we observed that they accounted for 92 percent of all the products installed and 94 percent of the total tracked savings of the program.

Table 20: Total Quantity Installed and Gross Energy Savings – From Tracking Sheet¹⁰

Product Category	Quantity Installed		Gross Energy Savings (Tracked)	
	Quantity	%	kWh	%
CFL Products	16,904	59%	7,284,848	60%
LED Lighting Products	9,522	33%	4,146,856	34%
Faucet Aerators	1,127	4%	187,082	2%
Low Flow Showerheads	522	2%	80,388	1%
DHW Tank Wraps	273	1%	186,732	2%
Pipe insulation	300	1%	21,000	0%
Spray Valve	108	1%	253,800	1%
Total	28,787	100%	12,160,705	100%

Therefore, it was decided to select businesses that had at least CFL and LED products installed. Once the screening was done by applying this criterion on the initial list of participants, the final selection was done randomly. Afterward, we ensured that all major products were covered in the sample. However, some products installed in small quantities, such as chandelier and R30 CFLs, were not covered in the sample.

On-Site Visit Protocols

The on-site visits were conducted to validate the installation of the products against the data found in the tracking sheet and to establish the percentage of products removed, if any, and the causes for their removal following the installation. Moreover, product information was collected through on-site observations or on-site interviews with contact people to validate the assumptions used to calculate the product unitary savings for:

- > lighting measures (type of lamp replaced and power of lamp replaced);
- > hot water tank wraps (size of tank and type of energy used for water heating);
- > faucet aerators (location of the units and type of energy used for water heating); and
- > low-flow showerheads (type of energy used for water heating).

5.2 GROSS SAVINGS

The quantities of products installed under CDI were computed in the tracking sheet. The CDI tracking sheet provided by ENSC for 2012 contained a total of 2,730 participating facilities¹¹ where different eligible products were installed. In addition, the products installed in the common areas of buildings

¹⁰ As of September 2012.

¹¹ 2,646 participants for CDI and 84 participants from MURB, when products were installed in common areas of buildings.

that participated in MURB in 2012 are also claimed under CDI. The reasoning behind this approach is that the operating conditions for products installed in common areas are more similar and comparable to those found in commercial facilities than to those in residential units. Therefore, it is more appropriate and justifiable to use the unitary savings values estimated for CDI rather than those calculated for residential usage under MURB.

For each category of product contained in the tracking sheet, ENSC uses a unitary savings value based on past evaluation results and various energy savings studies. The following sections describe how these unitary savings values were estimated and present Econoler's review of these values based on the most recent studies and data collected during the on-site visits. In many cases, Econoler based its review on the 2011 Ontario Power Authority (OPA) Quasi-Prescriptive Measures and Assumptions report¹², which is considered as a recent and reliable secondary data source.

5.2.1 Regular CFLs

Two different types of regular CFL can be installed in the participating facilities:

- > 13-watt CFLs; and
- > 23-watt CFLs.

Tracked Savings

In the tracking sheet, ENSC uses a specific unitary savings value for each type of regular CFL based on the following assumptions:

Table 21: Tracked Unitary Savings Values for Each Category of Regular CFL

Category of Regular CFL	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)
13-Watt CFL	61.4	13	48.4	8.53	150.7
23-Watt CFL	94.9	23	71.9	10.29	270.0

All of these parameters come from the 2011 evaluation report of the EP-DI program and were reviewed for this evaluation.

¹² Ontario Power Authority (OPA), "2011 Quasi-Prescriptive Measures and Assumptions," Release Version 1, December 2010.

Revised Savings

Displaced Wattage

To review the displaced wattage values used by ENSC, Econoler consulted the light output equivalency figure presented below.

Figure 2: Light Output Equivalency for Incandescent Lamps to CFLs¹³

LIGHT OUTPUT EQUIVALENCY		
INCANDESCENT BULBS (WATTS)	MINIMUM LIGHT OUTPUT (LUMENS)	COMMON ENERGY STAR QUALIFIED LIGHT BULBS (WATTS)
40	450	9 TO 13
60	800	13 TO 15
75	1,100	18 TO 25
100	1,600	23 TO 30
150	2,600	30 TO 52

For 13-watt CFLs, this table confirms that the displaced wattage value of 48.4 watts (61.4 W – 13 W) is adequate. Moreover, it is in line with the data collected during the on-site visits when participants were asked to indicate the wattage of the old lamps replaced by 13-watt CFLs. Indeed, the majority of participants declared that the 13-watt CFLs replaced old 60-watt incandescent lamps, but some also mentioned that they replaced 100-watt incandescent lamps, or a mix of 60-watt and 100-watt incandescent lamps. On the other hand, two out of fourteen participants indicated that the 13-watt CFLs installed were used to replace 40-watt incandescent lamps. Therefore, Econoler concludes that the displaced wattage of 48.4 watts remains acceptable for this evaluation, but recommends that ENSC starts tracking the quantity of CFLs installed based on the type of lamp replaced, as it is already collected in the Residential Direct Install tracking sheet.

For 23-watt CFLs, the table shows that they produce a light output equivalent to 75-watt or 100-watt incandescent lamps. However, the 2011 EP-DI evaluation report indicated that 23-watt CFLs were mainly used to replace 100-watt incandescent lamps as 75-watt incandescent lamps are rarely used in the Nova Scotia market, resulting in an average wattage of 94.9 watts for the old lamps replaced. The data collected during the on-site visits allowed validating this indication. Nine out of twelve participants declared that the 23-watt CFLs installed through CDI were used to replace 100-watt incandescent lamps. The other three, for their part, indicated that they were used to replace 60-watt incandescent

¹³ ENERGY STAR, “ENERGY STAR Qualified Light Bulbs – 2006 Partner Resource Guide.”

lamps. Therefore, Econoler judges that the displaced wattage value of 71.9 watts (94.9 W – 23 W) remains adequate. As for 13-watt CFLs, it is recommended to start recording the wattage values of the old replaced lamp in the tracking sheet for future evaluations.

Hours of Operation

To estimate the savings of the CFLs installed, ENSC uses hours of operation totalling 8.53 hours per day for 13-watt CFLs and 10.29 hours per day for 23-watt CFLs. These values are based on the hours declared by site contacts during lamp installations through the 2011 EP-DI program.

For this year's evaluation, no information on the hours of operation declared by the participants was collected in the CDI tracking sheet. Therefore, Econoler decided to keep using the hours of operation obtained from contact declaration through the 2011 EP-DI program and apply the self-declaration ratio of 0.98 measured from the on-site visits conducted for SBES. This result revealed that participants seem to overestimate the real hours of operation of the lighting products installed when declaring this information to the installer.

Using the self-declaration ratio of 0.98, the hours of operation for 13-watt and 23-watt CFLs were respectively revised to 8.4 hours per day and 10.1 hours per day.

In 2013, ENSC will track information in one main tracking sheet for both SBES and CDI components. Since this new tracking sheet will be based on the framework already used for SBES, which includes a field to collect the hours of operation declared by the participant of each product installed, Econoler recommends that ENSC starts collecting the hours of operation for the products installed through CDI.

Unitary Savings Calculation

Using the following equation, Econoler calculated the unitary savings values for both types of regular CFL.

$$\text{Annual Unitary Savings} = \frac{\Delta W \times \frac{h}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{W}{kW}} = \frac{kWh}{yr}$$

The results of the unitary savings calculations are presented in the table below. The last column indicates whether the value is different from the one used in the tracking sheet.

Table 22: Revised Unitary Savings Values for Each Category of Regular CFL

Category of Regular CFL	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)	Comparison with Tracked Value
13-Watt CFL	61.4	13	48.4	8.4	148	150.7
23-Watt CFL	94.9	23	71.9	10.1	265	270.0

5.2.2 Chandelier CFLs

Tracked Savings

For chandelier CFLs, ENSC uses a unitary savings value of 118.0 kWh. To estimate this savings value, they considered a displaced wattage value of 34.6 watts (43.6 W – 9 W) and 9.34 hours of operation per day. These parameters come from the 2011 evaluation report of EP-DI and were reviewed for this evaluation.

Revised Savings

Displaced Wattage

The chandelier CFL models installed through CDI have a wattage value of 9 watts. In most cases, the DAs used them to replace old 40-watt incandescent lamps. Such replacement is consistent with the light output equivalency table (Figure 2), which indicates that 40-watt incandescent lamps provide the same level of lumen as 9-watt CFLs.

No other information could be collected to review the displaced wattage value used by ENSC. Since the quantity of chandelier CFLs installed through the program is very small compared to the other lighting products, no site with chandelier CFLs installed were visited during on-site visits. Therefore, Econoler considers it more adequate to use a displaced wattage value of 31 watts, corresponding to the typical replacement case of an old 40-watt incandescent lamp.

Hours of Operation

As for the regular CFLs, the hours of operation estimated at 9.34 hours per day by ENSC, based on the 2011 EP-DI evaluation report, were revised to a value of 9.2 hours per day, using the self-declaration ratio of 0.98.

Unitary Savings Calculation

The following equation presents the unitary savings calculation for chandelier CFLs.

$$Annual\ Unitary\ Savings = \frac{(40\ W - 9\ W) \times 9.2\ \frac{h}{day} \times 365\ \frac{day}{yr}}{1000\ \frac{W}{kW}} = 104\ \frac{kWh}{yr}$$

Econoler revised the unitary savings value by replacing the previous ENSC estimate of 118.0 kWh per year by a new value of 104 kWh per year.

5.2.3 Dimmable CFLs

Three different types of dimmable CFL can be installed under CDI:

- > 8-watt dimmable CFLs;
- > 14-watt dimmable CFLs; and
- > 16-watt dimmable CFLs.

Tracked Savings

In the tracking sheet, ENSC uses a specific unitary savings value for each type of dimmable CFL, based on the following assumptions:

Table 23: Tracked Unitary Savings Values for Each Category of Dimmable CFL

Category of Dimmable CFL	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)
8-Watt Dimmable	33.5	8	25.5	9.9	92.1
14-Watt Dimmable	66.4	14	52.4	9.9	189.3
16-Watt Dimmable	66.4	16	50.4	9.9	182.1

All of these parameters come from the 2011 evaluation report of EP-DI and were reviewed for this evaluation.

Revised Savings

Displaced Wattage

Econoler reviewed the ENSC displaced wattage values by comparing them with the light output equivalency table (Figure 2).

For 14-watt dimmable CFLs, the table shows that 14-watt CFLs produce a light output equivalent to 60-watt incandescent lamps. During the on-site visits, all participants who had 14-watt dimmable CFLs installed indicated that they replaced 60-watt incandescent lamps or sometimes a mix of 60-watt and 100-watt incandescent lamps. Since the equivalent wattage value of a 14-watt CFL corresponds to a 60-watt incandescent lamp, Econoler revised the displaced wattage value of 52.4 watts to 46 watts (60 W – 14 W).

For 16-watt dimmable CFLs, the table shows that 16-watt CFLs produce a light output equivalent to 75-watt incandescent lamps. However, as mentioned above, 75-watt incandescent lamps are rarely used in the Nova Scotia market. Therefore, Econoler instead relied on the data collected during the on-site visits to establish the displaced wattage for 16-watt dimmable CFLs. All 16-watt dimmable CFLs installed in the sites visited were used to replace old 60-watt incandescent lamps, so the displaced wattage value for this product was revised to 44 watts (60 W – 16 W).

8-watt dimmable CFLs do not figure in the light output equivalency table, so Econoler consulted the ENERGY STAR Qualified Lamps Product List¹⁴ to know the typical light output of this technology. The qualified 8-watt dimmable CFLs presented in this list had light output of 430 or 450 lumens, which is close to the light output provided by a 40-watt incandescent lamp. Therefore, Econoler revised the displaced wattage value used for 8-watt dimmable CFLs to 32 watts (40 W – 8 W).

Additionally, considering that old dimmable lamps were replaced by dimmable CFLs, Econoler consulted the available literature to validate if other jurisdictions consider a percentage of wattage reduction to be applied on lamps controlled by a dimmer. It turns out that neither the OPA nor Northeast American organizations (Efficiency Vermont, Mass Save, etc.) applied such a reduction. The only situation where the lamp wattage is reduced is when a daylight dimming control is connected to the lamp. Therefore, Econoler did not apply any additional adjustment to the displaced wattage values.

Hours of Operation

The hours of operation estimated at 9.9 hours per day by ENSC were revised to a value of 9.7 hours per day, using the self-declaration ratio of 0.98.

Unitary Savings Calculation

Using the following equation, Econoler calculated the unitary savings values for both types of dimmable CFLs.

$$\text{Annual Unitary Savings} = \frac{\Delta W \times \frac{h}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{W}{kW}} = \frac{kWh}{yr}$$

The results of the unitary savings calculations are presented in the table below. The last column indicates whether the value is different from the one used in the tracking sheet.

Table 24: Revised Unitary Savings Values for Each Category of Dimmable CFL

Category of Dimmable CFL	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)	Comparison with Tracked Value
8-Watt Dimmable	40	8	32.0	9.7	113	92.1
14-Watt Dimmable	60	14	46	9.7	163	189.3
16-Watt Dimmable	60	16	44.0	9.7	156	182.1

¹⁴ ENERGY STAR, “ENERGY STAR Qualified Lamps Product List”, Posted on January 25, 2013, <www.energystar.gov>.

5.2.4 R30 CFLs

Tracked Savings

R30 CFLs were phased out of the program in 2012. For the few R30 CFLs installed this year, ENSC uses a unitary savings value of 119.2 kWh. To estimate this savings value, a displaced wattage value of 33 watts (48W – 15W) and hours of operation of 9.90 hours per day are considered. These parameters were reviewed for this evaluation.

Revised Savings

Displaced Wattage

The R30 CFLs installed through CDI have a wattage value of 15 watts. According to the light output equivalency table and the ENERGY STAR Qualified Lamps Product List¹⁵, 15-watt R30 CFLs should be used to replace 60-watt bulbs. Therefore, Econoler revised the displaced wattage value to 45 watts (60 W – 15 W).

Hours of Operation

As for the dimmable CFLs, the hours of operation estimated at 9.9 hours per day by ENSC were revised to a value of 9.7 hours per day, using the self-declaration ratio of 0.98.

Unitary Savings Calculation

The following equation presents the unitary savings calculation for R30 CFLs.

$$\text{Annual Unitary Savings} = \frac{(60\text{ W} - 15\text{ W}) \times 9.7 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 159.3 \frac{\text{kWh}}{\text{yr}}$$

Econoler revised the unitary savings value by replacing the previous ENSC estimate of 119.2 kWh per year by a new value of 159.3 kWh per year.

5.2.5 LED Lamps

Different types of LED lamp are installed under CDI:

- > 2.3-watt chandelier LED;
- > 7-watt LED MR16;
- > 14-watt LED PAR30; and
- > 17-watt LED PAR38.

¹⁵ ENERGY STAR, "ENERGY STAR Qualified Lamps Product List", Posted on January 25, 2013, <www.energystar.gov>.

Tracked Savings

In the tracking sheet, ENSC uses a specific unitary savings value for each type of LED lamp, based on the following assumptions:

Table 25: Tracked Unitary Savings Values for Each Category of LED lamp

Category of LED Lamp	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)
2.3-Watt Chandelier	34.5	2.3	32.2	10.95	128.7
7-Watt LED MR16	50	7	43	10.95	171.9
14-Watt PAR30	70	14	56	10.95	223.8
17-Watt PAR38	90	17	73	10.95	291.8

All of these parameters come from the 2011 evaluation report of EP-DI and were reviewed for this evaluation.

Revised Savings

Displaced Wattage

To validate the displaced wattage values used by ENSC, Econoler conducted a literature review, consulted the ENERGY STAR Qualified Lamps Product List¹⁶ and looked up manufacturer specifications for similar LED models as those installed through the program.

Econoler was unable to find credible studies or evaluation reports that provide an estimate of the displaced wattage values for similar LED products. However, the different manufacturer websites consulted and the ENERGY STAR Qualified Lamps Product List provided information on the light output equivalency of these products. This information allowed Econoler to review the displaced wattage values used by ENSC.

For 14-watt PAR30 LED lamps, the old wattage value was adjusted to 75 watts instead of 70 watts, which does not correspond to a typical lamp wattage. The replacement of a 75-watt halogen lamp seems to be much more close to the typical retrofits associated with 14-watt PAR30 LED lamps. For similar reasons, the old wattage value of 2.3-watt chandeliers was adjusted to 25 watts instead of 34.5 watts.

For the other categories, the displaced wattage values remained unchanged. The replacements of a 90-watt halogen lamp by a 17-watt PAR38 LED lamp and of a 50-watt incandescent lamp by a 7-watt MR16 LED lamp are consistent with what was found in the manufacturers' specification sheets.

¹⁶ ENERGY STAR, "ENERGY STAR Qualified Lamps Product List", Posted on January 25, 2013, <www.energystar.gov>.

Hours of Operation

To our best knowledge, no organization has measured and released reliable and trustworthy statistics on the hours of operation of LED lamps installed in commercial facilities. Therefore, Econoler decided to use the hours of operation established in the 2011 EP-DI evaluation report for the Retail LED pilot and revised them using the self-declaration ratio of 0.98. This adjustment resulted in hours of operation totalling 10.7 hours per day.

Unitary Savings Calculation

Using the following equation, Econoler calculated the unitary savings values for each type of LED lamp.

$$\text{Annual Unitary Savings} = \frac{\Delta W \times \frac{h}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{W}{kW}} = \frac{kWh}{yr}$$

The results of the unitary savings calculations are presented in the table below. The last column indicates whether the value is different from the one used in the tracking sheet.

Table 26: Revised Unitary Savings Values for Each Category of LED Lamp

Category of LED Lamp	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)	Comparison with Tracked Value
2.3-Watt Chandelier	25	2.3	22.7	10.7	88.7	128.7
7-Watt MR16	50	7	43	10.7	168	171.9
14-Watt PAR30	75	14	61	10.7	238	223.8
17-Watt PAR38	90	17	73	10.7	285	291.8

5.2.6 LED Exit Signs

Tracked Savings

For LED exit signs, ENSC uses a unitary savings value of 318.9 kWh per year. This value was obtained from the 2011 evaluation report of the EP-DI program using a displaced wattage of 36.4 watts and hours of operation of 24 hours per day. Econoler reviewed these parameters for this evaluation.

Revised Savings

In the 2011 evaluation report of the EP-DI program, the displaced wattage for LED exit signs was established based on the wattage values recorded by the DA in the tracking sheet for the old exit

signs replaced by LED ones. An average of 38.8 watts per kit (19.4 watts per lamp) was obtained with the available data. Using the real wattage value for the LED exit signs installed by the DAs (2.4 watts), the Evaluator established a displaced wattage of 36.4 watts. For this year's CDI evaluation, such information is not available in the tracking sheet.

Therefore, considering that the same LED exit signs were installed in 2012, Econoler kept using the displaced wattage established in 2011.

Since LED exit signs operate 24 hours a day and 7 days a week, the unitary savings value was calculated using the following equation.

$$\text{Annual Unitary Savings} = \frac{36.4 \text{ W} \times 24 \frac{\text{h}}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{\text{W}}{\text{kW}}} = 319 \frac{\text{kWh}}{\text{yr}}$$

Therefore, the unitary savings value used for LED exit signs is 319 kWh per year.

5.2.7 Faucet Aerators

Tracked Savings

For the faucet aerators installed through CDI, ENSC uses an average unitary savings value of 176.3 kWh per year. This value is based on the unitary savings value used for faucet aerators installed through ENSC's residential programs.

Revised Savings

Econoler revised this unitary savings value based on the assumptions for commercial facilities found in the OPA Quasi-Prescriptive Measures and Assumptions report. The table below presents the unitary savings values estimated using the OPA's assumption and a flow-rate improvement of 32 percent (from 2.2 gpm to 1.5 gpm) for different types of commercial facility.

Table 27: Unitary Savings Calculation for Faucet Aerators

Type of Commercial Facility	Proportion in the Tracking Sheet	Unitary Savings (kWh/year)
Hotel	29%	93
Restaurant	12%	1,561
Office	8%	68
Retail	8%	180
School	3%	101
Other	40%	52
Average	100%	261

Based on the proportions of various types of commercial facility where faucet aerators were installed through CDI in 2012, the average unitary savings value was revised to 261 kWh per year. This represents a significant difference in comparison to the residential unitary savings value used by ENSC in the tracking sheet.

5.2.8 Low-Flow Showerheads

Tracked Savings

For the low-flow showerheads installed through CDI, ENSC uses an average unitary savings value of 292 kWh per year.

Revised Savings

Econoler conducted a literature review to validate this unitary savings value. It was found that the unitary savings value estimated by ENSC corresponds to the unitary savings value of a low-flow showerhead installed in a hotel room. Indeed, Econoler obtained a unitary savings value of 292 kWh per year using the OPA's key input parameters associated with low-flow showerheads installed in hotel rooms:

Table 28: Unitary Savings Values Calculations for Low-Flow Showerheads

Parameter	Value
Old Flow-Rate	2.0 gpm
New Flow-Rate	1.5 gpm
Average DHW Usage	59.3 liters/shower/day
Number of Days	365 days/year
Unitary Savings	292 kWh/year

The annual savings associated with the installation of a low-flow showerhead vary depending on the type of facility where the energy-efficient is installed. However, since 67 percent of the low-flow showerheads installed through CDI in 2012 were installed in hotels, Econoler considers that the unitary savings value of 292 kWh per year is adequate.

5.2.9 Pre-Rinse Spray Valves

Tracked Savings

For dishwasher spray valves, ENSC uses a unitary savings value of 2,500 kWh per year. This value is based on two studies conducted by Veritec Consulting for the City of Calgary¹⁷ and for the region of

¹⁷ Veritec Consulting Inc., City of Calgary Pre-Rinse Spray Valve Pilot Study, Final Report, December 2005, Mississauga, Ontario.

Waterloo¹⁸ in 2005. These two studies report savings values of 3,248 kWh per year and 1,762 kWh per year respectively. The savings value used in the tracking sheet corresponds to the average of the savings values from these reports.

Revised Savings

For this year's evaluation, Econoler conducted a literature review to validate the values obtained from the Veritec studies. The OPA Quasi-Prescriptive Measures and Assumptions report¹⁹ presents savings assumptions for pre-rinse spray valves, but upon analysis it was found that the Veritec studies were more relevant since they are based on water usage reduction data collected on sites where efficient dishwasher spray valves were installed. Therefore, Econoler decided to keep using the unitary savings value of 2,500 kWh per year based on on-site data.

5.2.10 Hot Water Tank Wraps

Tracked Savings

ENSC uses a unitary savings value of 684 kWh per year for the hot water tank wraps installed in the CDI participating facilities. This unitary savings value was established during the 2011 impact evaluation of the EP-DI program based on the 2011 OPA Quasi-Prescriptive Measures and Assumptions report²⁰. For the 2012 evaluation, Econoler reviewed the parameters used by the OPA against the information in the tracking sheet and the data collected during the on-site visits.

Revised Savings

Average energy savings according to the type of commercial facility

For the installation of hot water tank wraps, the OPA reports different energy savings values according to the type of commercial facility. The table below presents the values reported by the OPA for various types of commercial facility where hot water tank wraps were installed through CDI.

Table 29: Annual Energy Savings Calculation per Liter of Tank Capacity

Type of Commercial Facility	Proportion in the Tracking Sheet	Annual Savings per Liter of Tank Capacity (kWh/L)
Retail	18%	1.70
Office	15%	1.74

¹⁸ Veritec Consulting Inc., Region of Waterloo, Pre-Rinse Spray Valve Pilot Study, Final Report, January 2005

¹⁹ Ontario Power Authority (OPA), "2011 Quasi-Prescriptive Measures and Assumptions," Release Version 1, December 2010.

²⁰ Ontario Power Authority (OPA), "2011 Quasi Prescriptive Measures and Assumptions," Release Version 1, December 2010.

Lodging	10%	1.74
Restaurant	7%	2.10
School	1%	1.74
Other	49%	1.77
Average	100%	1.77

In 2011, the average annual savings value was established at 1.80 kWh per liter of tank capacity. Based on the proportions of various types of commercial facility where hot water tank wraps were installed in 2012, the average annual savings value was revised to 1.77 kWh per liter of tank capacity for this year's evaluation.

DHW Tank Volume

The data from 5 sites where tank wraps were installed was collected during on-site visits. The average tank size obtained corresponded to 270 liters (71 gallons). However, Econoler considers this sample too small to establish the average DHW tank size of all the participating facilities where hot water tank wraps were installed. As for the savings per liter of tank capacity, Econoler relied on the OPA and the proportion of commercial facilities in the tracking sheet to establish the average tank size. Therefore, a value of 394 liters per tank was used to calculate the unitary savings value of hot water tank wraps for this year's evaluation.

Considering the important difference between the values obtained from the 5 sites visited and the OPA, Econoler recommends that, for the future evaluation, ENSC track the DHW tank size in the tracking sheet for all participating facilities where hot water tank wraps were installed.

Unitary Savings Calculation

Using the two parameters presented above, Econoler calculated a unitary savings value of 697 kWh per year for the hot water tank wraps installed through CDI:

$$\text{Unitary Savings} = 1.77 \frac{\text{kWh}}{\text{liter}} \times 394 \text{ liters} = 697 \frac{\text{kWh}}{\text{yr}}.$$

5.2.11 Pipe Insulation

Tracked Savings

ENSC uses a unitary savings value of 74 kWh per year for each unit of hot water pipe insulated through CDI. This value is based on the unitary savings value used for pipe insulation installed through ENSC's residential programs. The calculation was based on an insulated pipe 10-foot-long and 0.75-inch in diameter, which were considered as common length and size in residential applications.

Revised Savings

In the tracking sheet, the number of “pipe insulation” units was reported in length of pipe insulated by 6-foot intervals. Econoler revised the unitary savings value used by ENSC based on the input assumptions found in the OPA Quasi-Prescriptive Measures and Assumptions report and a unit of pipe insulated of 6 feet. Using the proportions of each type of commercial facilities where pipe insulation was installed in 2012, the average unitary savings value obtained is 179 kWh per year.

Table 30: Unitary Savings Calculation for 6 Feet of Pipe Insulated

Type of Commercial Facility	Proportion in the Tracking Sheet	DHW Usage (hours/year)	Savings (kWh/year)
Hotel	16%	3,931	211
Retail	12%	2,077	112
Office	7%	2,353	126
Restaurant	7%	2,077	112
School/University	3%	2,522	135
Other	55%	3,749	201
Average	100%	-	179

For 2013, Econoler recommends collecting the specific length (in feet) of insulation installed on each site to adjust the savings calculations accordingly. With regard to the maximum length of insulation, Econoler recommends limiting the length to the first 15 feet, since the general equation used to calculate the energy savings cannot be used on an infinite length of insulated pipe. Indeed, the equation is based on the assumptions that the water temperature is uniform through the insulated portion of the pipe and that the pipe insulation is installed immediately downstream of the hot water storage tank, where most of the heat loss would occur.

5.2.12 Occupancy Sensors, Thermostats and Power Bars

Occupancy sensors, programmable thermostats and power bars with integrated timers were part of the 2011 EP-DI program. Occupancy sensors and programmable thermostats were phased out of CDI in 2012 due to high installation costs (an electrician was needed for the installation). Power bars with integrated timers were also removed from CDI in 2012 due to a too-small demand for this product.

For these three categories of product, the units installed through CDI in 2012 were claimed in the savings calculation, using the unitary savings values from the 2011 EP-DI evaluation report.

Table 31: Unitary Savings Values for Occupancy Sensors, Thermostats and Power Bars

Category of Product	Unitary Savings
Occupancy Sensor	391 kWh/year
Programmable Thermostat	25.2 kWh/year
Power Bar with Integrated Timer	53.1 kWh/year

5.2.13 Installation Rate

For this year's evaluation, 30 on-site visits were conducted to mainly validate whether the products were properly installed according to the information contained in the tracking sheet and, if possible, to establish the installation rates with a sufficient level of precision.

For each site visited, the quantity of products installed was recorded and compared to the quantity indicated in the tracking sheet. When the number of products found on-site was different from that in the tracking sheet, the ratio between the two numbers was calculated, and if the error margin was acceptable, it was used to establish the installation rate. The table below shows the percentages of products installed based on the data collected from the on-site visits and the installation rates applied to the quantity of products installed in the gross savings calculation.

Table 32: Percentages of Products Installed and Installation Rate

Category of Product	Number of Sites Visited	Quantity Installed – From Tracking Sheet	Quantity Installed – From On-Site Visits	Percentage of Products Installed	Installation Rate	Error Margin ²¹
Regular CFL	27	363	339	93%	100%	9.1%
Chandelier CFL	0	-	-	-	100%	-
Dimmable CFL	15	177	166	94%	100%	15.1%
R30 CFL	0	-	-	-	100%	-
LED Lamp	30	568	500	88%	100%	12.3%
LED Exit Sign	10	18	17	94%	100%	8.7%
Faucet Aerator	7	25	22	88%	100%	26.4%
Low-Flow Showerhead	4	4	3	75%	100%	54.8%
Pre-Rinse Spray Valve	4	5	5	100%	100%	0%
Hot Water Tank Wrap	5	5	5	100%	100%	0%
Pipe Insulation	1	3	1	33%	100%	-

For all categories of products, the installation rate was established at 100 percent. Due to the variations between the installation rate and the relatively small number of sites visited, the error margins obtained did not justify the application of the percentage of installation calculated for each category of product in the gross savings calculation.

Nonetheless, the results revealed high percentages of installation for the majority of products. Lower installation rates were observed for LED lamps, faucet aerators, low-flow showerheads and pipe

²¹ Calculated with a confidence interval of 90%.

insulation. In the case of LED lamps, one important issue was identified by the Evaluator. Two participants visited said they replaced their LED MR16 lamps with the old bulbs due to the brightness and color. Moreover, one participant mentioned that two of the LED lamps that should have been installed in the facility were left as backups by the installer. In the light of these observations, Econoler encourages ENSC to investigate on these situations in order to prevent them in the future. For faucet aerators, low-flow showerheads and pipe insulation, the sample of sites visited with these products installed was too low to draw any conclusion with the results obtained.

5.2.14 Demand-to-Energy Ratio

Econoler calculated the total demand savings for CDI based on a demand-to-energy ratio of 0.094 MW/GWh. This ratio was obtained from the 2012 CDI targets by dividing the target demand savings by the target energy savings.

5.3 REVISED GROSS SAVINGS

The annual gross savings for each product category installed through CDI are presented in Table 33. They were calculated using the revised unitary savings and the installation rate established in the previous section. Overall, the total gross energy and demand savings amount to 13.173 GWh and 1.238 MW at the meter.

The gross savings at the generator level are also estimated in Table 33 using a line loss factor between the meter and the generator of 1.084. This value was calculated using the weighted average of the participants' rate codes indicated in the tracking sheet on the basis of the energy savings. The appropriate line loss factor values were provided by Nova Scotia Power.

The resulting total gross energy and demand savings are estimated at 14.279 GWh and 1.342 MW at the generator.

Table 33: Evaluation Results – Gross Energy and Demand Savings – CDI (CFLs and LED Lamps)

Category of Product	13-Watt CFL	23-Watt CFL	Chandelier CFLs	8-Watt Dimm. CFL	14-Watt Dimm. CFL	16-Watt Dimm. CFL	R30 CFL	2.3-Watt Chandelier LED	7-Watt LED MR16	14-Watt LED PAR 30	17-Watt LED PAR 38
Tracking Sheet											
Number of Units – CDI	17,705	8,275	903	2,203	2,721	3,067	55	3,834	2,973	7,360	5,317
Number of Units – MURB Common Areas	543	104	12	0	8	67	0	138	135	126	100
Total Number of Units	18,248	8,379	915	2,203	2,729	3,134	55	3,972	3,108	7,486	5,417
Installation Rate	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total Number of Units Installed	18,248	8,379	915	2,203	2,729	3,134	55	3,972	3,108	7,486	5,417
Energy Savings											
Unitary Savings (kWh)	148	265	104	113	163	156	159	88.7	168	238	285
Total Gross Energy Savings – at Meter (GWh)	2.701	2.220	0.095	0.249	0.445	0.489	0.009	0.352	0.522	1.782	1.544
Line Loss Factor	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084
Total Gross Energy Savings – at Generator (GWh)	2.928	2.407	0.103	0.270	0.482	0.530	0.009	0.382	0.566	1.931	1.674
Demand Savings											
Demand-to-Energy Ratio	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094
Total Gross Demand Savings – at Meter (MW)	0.254	0.209	0.009	0.023	0.042	0.046	0.001	0.033	0.049	0.167	0.145
Line Loss Factor	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084
Total Gross Demand Savings – at Generator (MW)	0.275	0.226	0.010	0.025	0.045	0.050	0.001	0.036	0.053	0.182	0.157

Table 34: Evaluation Results – Gross Energy and Demand Savings – CDI (Other Products)

Category of Product	LED Exit Sign	Faucet Aerator	Low-Flow Shower-head	Pre-Rinse Spray Valve	Hot Water Tank Wrap	Pipe Insulation	Occupancy Sensor	Program-mable Thermostat	Power Bar with Timer	Total for All Categories
Tracking Sheet										
Number of Units – CDI	1,333	1,770	1,657	87	864	465	852	1,346	646	63,433
Number of Units – MURB Common Areas	225	0	5	0	24	0	0	0	0	1,487
Total Number of Units	1,558	1,770	1,662	87	888	465	852	1,346	646	64,920
Installation Rate	100%	100%	100%	100%	100%	100%	100%	100%	100%	-
Total Number of Units Installed	1,558	1,770	1,662	87	888	465	852	1,346	646	64,920
Energy Savings										
Unitary Savings (kWh)	319	261	292	2,500	697	179	391	25.2	53.1	-
Total Gross Energy Savings – at Meter (GWh)	0.497	0.462	0.485	0.218	0.619	0.083	0.333	0.034	0.034	13.173
Line Loss Factor	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	-
Total Gross Energy Savings – at Generator (GWh)	0.539	0.501	0.526	0.236	0.671	0.090	0.361	0.037	0.037	14.279
Demand Savings										
Demand-to-Energy Ratio	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	-
Total Gross Demand Savings – at Meter (MW)	0.047	0.043	0.046	0.020	0.058	0.008	0.031	0.003	0.003	1.238
Line Loss Factor	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	-
Total Gross Demand Savings – at Generator (MW)	0.051	0.047	0.049	0.022	0.063	0.008	0.034	0.003	0.003	1.342

5.4 INTERACTIVE EFFECTS

Interactive effects occur when the installation of energy-efficient products has an impact on the energy consumption of other elements such as heating and cooling systems. As far as CDI is concerned, the replacement of regular lighting products with energy-efficient ones and the installation of hot water tank wraps and pipe insulation cause an increase in the heating load during winter and a decrease in the cooling load during summer.

For all the lighting products (all kinds of CFLs, LED lamps and LED exit signs) installed in participating facilities, an overall interactive effects factor of -15.5 percent was used in this evaluation. This factor is based on a study conducted by ADS in 1992 for Hydro-Québec. The work conducted in this study modified certain parameters in building simulations of commercial buildings in Quebec to determine the impact of these changes on heating and cooling systems. The simulations were performed with the DOE2 software and only focused on buildings heated entirely by electricity.

The following table presents the calculation details for the interactive effects factor. The values presented take into account the proportions of participating facilities that are electrically heated and air-conditioned. These proportions were collected during the 80 on-site visits conducted for BES.

Table 35: Interactive Effects Factor for Lighting Products

Parameters	% of Facilities	Interactive Effects ²²
Electric heating with air conditioning	17%	-43.4%
Electric heating without air conditioning	20%	-49.0%
No electric heating with air conditioning	29%	5.7%
No electric heating without air conditioning	34%	0.0%
Weighted Interactive Effects Factor	100%	-15.5%

For hot water tank wraps and pipe insulation, an interactive effects factor of -100 percent is considered for the heating season while an interactive effects factor of +100 percent is considered for the cooling season. This is the case for hot water tanks located in heated rooms. In winter, all the heat released in the room by the non-insulated hot water tank is used for the heating load. Conversely, during the cooling season, this heat release needs to be compensated for in air-conditioned rooms, thus explaining the +100 percent interactive effects factor. Based on the heating and cooling degree-days for the Halifax²³ region, Econoler considered an eight-month heating period and a two-month cooling

²² ADS ASSOCIÉS, "Évaluations des effets énergétiques combinés des mesures d'économies d'énergie – secteur commercial," report presented to Hydro-Québec, 1992.

²³ RETScreen International, Normalized climate data for Halifax International Airport, Natural Resources Canada, 1997-2010.

period in the interactive effects calculation. Table 36 presents the detailed interactive factor calculation for hot water tank wraps installed in participating facilities.

Table 36: Interactive Effects Factor for Hot Water Tank Wraps and Pipe Insulation

Parameters	% of Facilities	Interactive Effects During Heating Period	Interactive Effects During Cooling Period
Electric heating with air conditioning	17%	$-100\% \times 8/12 = -67\%$	$+100\% \times 2/12 = +17\%$
Electric heating without air conditioning	20%	$-100\% \times 8/12 = -67\%$	$0\% \times 2/12 = 0\%$
No electric heating with air conditioning	29%	$0\% \times 8/12 = 0\%$	$+100\% \times 2/12 = +17\%$
No electric heating without air conditioning	34%	$0\% \times 8/12 = 0\%$	$0\% \times 2/12 = 0\%$
Weighted Interactive Effects Factor	100%	-24.8%	+7.8%
		-17.0%	

5.5 NET-TO-GROSS RATIO

The NTGR evaluation of CDI is based on a self-report approach which relies on a series of questions designed to measure the influence of the program on customers' decision to participate in the program. These questions were included in the participant survey.

This section presents the methodology used to transform responses to the net-to-gross questions into a NTGR. For CDI, the NTGR involved the assessment of one distortion effect: free-ridership. Since CDI covers the installation of all major energy-efficient products in small businesses, there is little remaining energy efficiency potential expected. Hence, spillover is expected to be null for this program.

Once the free-ridership level is quantified, the NTGR is calculated based on the following equation.

$$NTGR = 1 - \% \text{ free-ridership}$$

5.5.1 Free-Ridership

Free-ridership occurs when participants declare that they would still have installed the energy-efficient products in the absence of the program. The telephone survey included a number of free-ridership questions that attempted to measure the following variables:

- > if participants had any plans to install energy-efficient products before participating in the program;
- > the probability that participants would have installed the same energy-efficient products if they had not participated in the program;

- > the probability that participants would have installed standard products instead of energy-efficient ones if they had not participated in the program;
- > the probability that participants would have paid the full cost of the energy-efficient products if the program had not been in place;
- > the level of influence that the various factors had on participants' decision to participate in the program; and
- > the probability that participants would have installed the energy-efficient products but at a later date if they had not participated in the program.

Each group of questions were then transposed into a level of program attribution, which was used to calculate the overall free-ridership level of the participants. The algorithm underlying this calculation is presented in Appendix V. Using this approach, the survey results revealed a free-ridership level of 13 percent for CDI in 2012, which is slightly lower than the 15 percent of free-ridership level obtained under the 2011 evaluation of EP-DI. The changes in product mix from EP-DI to CDI may have helped lower the free-ridership level for this program as more high-end products, such as LED lamps, are now offered through commercial direct install. These products are more specific and are not likely installed by business owners, which contributes to decreasing free-ridership.

5.5.2 NTGR Calculation

Using the free-ridership of 13 percent established for this evaluation, the NTGR value for CDI is estimated at 0.87.

5.6 NET SAVINGS

The net savings for CDI were estimated using the interactive effects factors and the NTGR value obtained above. The following equation was used to calculate the net savings.

$$\text{Net Savings} = \text{Gross Evaluation Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

This equation was used for both demand and energy savings. The results obtained are presented in the following table. Overall, the total net energy and demand savings amount to 9.886 GWh and 0.929 MW at the meter and 10.717 GWh and 1.007 MW at the generator.

Table 37: Evaluation Results – Net Energy and Demand Savings by Product – CDI (CFLs and LED Lamps)

Category of Product	13-Watt CFL	23-Watt CFL	Chandelier CFLs	8-Watt Dimm. CFL	14-Watt Dimm. CFL	16-Watt Dimm. CFL	R30 CFL	2.3-Watt Chandelier LED	7-Watt LED MR16	14-Watt LED PAR 30	17-Watt LED PAR 38
Energy Savings											
Total Gross Energy Savings – at Meter (GWh)	2.701	2.220	0.095	0.249	0.445	0.489	0.009	0.352	0.522	1.782	1.544
Interactive Effects Factor	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%
NTGR	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Total Net Energy Savings (GWh) – at Meter	1.986	1.632	0.070	0.183	0.327	0.359	0.006	0.259	0.384	1.310	1.135
Line Loss Factor	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084
Total Net Energy Savings (GWh) – at Generator	2.152	1.769	0.076	0.199	0.354	0.390	0.007	0.281	0.416	1.420	1.230
Demand Savings											
Total Gross Demand Savings – at Meter (MW)	0.254	0.209	0.009	0.023	0.042	0.046	0.001	0.033	0.049	0.167	0.145
Interactive Effects Factor	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%
NTGR	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Total Net Demand Savings (MW) – at Meter	0.187	0.153	0.007	0.017	0.031	0.034	0.001	0.024	0.036	0.123	0.107
Line Loss Factor	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084
Total Net Demand Savings (MW) – at Generator	0.202	0.166	0.007	0.019	0.033	0.037	0.001	0.026	0.039	0.133	0.116

Table 38: Evaluation Results – Net Energy and Demand Savings by Product – CDI (Other Products)

Category of Product	LED Exit Sign	Faucet Aerator	Low-Flow Shower-head	Pre-Rinse Spray Valve	Hot Water Tank Wrap	Pipe Insulation	Occupancy Sensor	Program-mable Thermostat	Power Bar with Timer	Total for All Categories
Energy Savings										
Total gross energy savings – at meter (GWh)	0.497	0.462	0.485	0.218	0.619	0.083	0.333	0.034	0.034	13.173
Interactive effects factor	-15.5%	0%	0%	0%	-17.0%	-17.0%	0%	0%	0%	-
NTGR	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	-
Total Net Energy Savings (GWh) – at Meter	0.365	0.402	0.422	0.189	0.447	0.060	0.290	0.030	0.030	9.886
Line loss factor	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	-
Total Net Energy Savings (GWh) – at Generator	0.396	0.436	0.458	0.205	0.484	0.065	0.314	0.032	0.032	10.717
Demand Savings										
Total gross demand savings – at meter (MW)	0.047	0.043	0.046	0.020	0.058	0.008	0.031	0.003	0.003	1.238
Interactive effects factor	-15.5%	0%	0%	0%	-17.0%	-17.0%	0%	0%	0%	-
NTGR	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	-
Total Net Demand Savings (MW) – at Meter	0.034	0.038	0.040	0.018	0.042	0.006	0.027	0.003	0.003	0.929
Line loss factor	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	1.084	-
Total Net Demand Savings (MW) – at Generator	0.037	0.041	0.043	0.019	0.046	0.006	0.030	0.003	0.003	1.007

The table below presents comparisons between the energy and demand savings established by this evaluation and those calculated in the 2012 tracking sheet.

Table 39: Comparison of Tracked and Evaluated Savings at the Generator – CDI

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	14.242 GWh	11.821 GWh	10.911 GWh	0.94	10.256 GWh
Evaluation Results	14.279 GWh	14.279 GWh	12.318 GWh	0.87	10.717 GWh
Demand Savings					
Tracked Savings from ENSC	1.339 MW	1.111 MW	1.026 MW	0.94	0.964 MW
Evaluation Results	1.342 MW	1.342 MW	1.158 MW	0.87	1.007 MW

The net energy and demand savings calculated for CDI were compared to the tracked savings estimated by ENSC. The results obtained from this evaluation were slightly higher than the savings tracked by ENSC. The fact that ENSC, to remain conservative, used an installation rate of 83 percent for all lighting products installed through CDI helped achieve these results.

6 IMPACT EVALUATION FOR THE LED BLITZ PILOT

6.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

At the end of 2012, ENSC conducted the LED Blitz pilot. This pilot targeted malls and common areas in hotels and aimed to replace incandescent and halogen light bulbs with LEDs. Two different DAs manage these installations.

The impact evaluation of the LED Blitz pilot aims to determine the gross and net savings associated with this initiative. Both energy and demand savings are considered in this evaluation. To do so, Econoler reviewed the unitary savings value used for each type of LED product and used other parameters evaluated for CDI, such as the interactive effects factor and the demand-to-energy ratio.

6.2 GROSS SAVINGS

A total of 239 facilities participated in this pilot initiative. Various LED products were installed. For each category of product, the Evaluator computed the quantity installed and reviewed the unitary savings value used by ENSC for tracked savings.

Some LED products like 14-watt PAR30 and 17-watt PAR38 are similar as those installed under CDI. However, since ENSC wanted to be conservative for this pilot initiative, the tracked savings were estimated differently for these products (with lower displaced wattage values).

The following sections present the unitary savings values estimated by ENSC for each LED product and Econoler's review of these values.

6.2.1 Unitary Savings Values for LED Products

Tracked Savings

The following table describes how ENSC estimated the unitary savings value for each LED product installed through the LED Blitz initiative.

Table 40: Tracked Unitary Savings Values for Each LED Product

LED Product	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)*
3-Watt Chandelier LED	28.85	3	25.85	12.8	121
3.5-Watt LED MR16	50	3.5	46.5	12.8	217.6
5-Watt LED GU10	50	5	45	12.8	210.6
7-Watt LED PAR20	50	7	43	12.8	201.2
8-Watt LED A LAMP	60	8	52	12.8	243.4
13-Watt LED BR30	65	13	52	12.8	243.4
14-Watt LED PAR30	50	14	36	12.8	168.5
17-Watt LED PAR38	75	17	58	12.8	271.4
18-Watt LED BR40	120	18	102	12.8	477.4
LED Exit Sign	25	3	22	24	192.7

**The unitary savings values were calculated based on the values provided by ENSC, including unrounded hours of operation of 12.8219... hours per day.*

The displaced wattage values are based on the real wattage of the LED lamp installed and a typical equivalent lamp wattage for the old replaced lamp. As mentioned in the previous section, for 14-watt PAR30 and 17-watt PAR38 LED lamps, ENSC used conservative values for the equivalent wattage of the old replaced lamp.

For the hours of operation, ENSC uses a different value from the one used for LED lamps installed through CDI. Due to the specific types of business (malls and common areas of hotels) where LED products were installed through the LED Blitz pilot, ENSC estimated hours of operation based on the following assumptions:

- > 12 hours per day from Monday to Saturday, as most retail stores, hotel restaurants, hotel banquet rooms and malls are open 12 hours per day during these days;
- > 6 hours per day on Sunday; and
- > Some lights turned on 24 hours per day, 7 days per week like in hotel hallways.

This resulted in an average daily usage of 90 hours per week or 12.8 hours per day.

Revised Savings

Displaced Wattage

To validate the displaced wattage values used by ENSC, Econoler consulted different websites to ensure that the wattage value used for the old replaced lamp corresponded to the manufacturer specifications for similar LED products, based on the light output equivalency.

Subsequently, Econoler revised some wattage values estimated for the old replaced lamp.

- > For 3-watt chandeliers, Econoler had the specification sheet of the exact product installed on-site. It was indicated that the LED chandelier lamps should be typically used to replace 25-watt incandescent candelabra lamps. Therefore, Econoler reviewed the wattage value estimated at 28.85 watts by ENSC to 25 watts.
- > For 3.5-watt MR16, Econoler consulted different specification sheets for similar products and found out that these lamps have a similar light output to 25-watt incandescent lamps. Therefore, the old wattage value estimated at 50 watts by ENSC was revised to 25 watts.
- > For 8-watt LED A lamps, Econoler found out that these lamps, depending on their lumen level, can replace 40-watt or 60-watt incandescent lamps. Therefore, instead of using an old wattage value of 60 watts, Econoler decided to use the average value of 50 watts.
- > For 14-watt PAR30 and 17-watt PAR 38, Econoler revised the old wattage values upward, based on the values used for CDI, i.e. an old wattage value of 90 watts instead of 75 watts for 14-watt PAR30 and of 90 watts instead of 75 watts for 17-watt PAR 38.
- > For 18-watt BR40, ENSC used an old wattage value estimated at 120 watts. However, Econoler was unable to find a similar model of LED lamp that produces a light output equivalent to a 120-watt. The wattage values fluctuated between 90-watt halogen lamps and 100-watt incandescent lamps and Econoler decided to use an old wattage value of 100 watts.
- > For the all other products, the displaced wattage values remained unchanged. Econoler's findings revealed that the old equivalent wattage values used for these products provided an equivalent light output and were therefore appropriate.

Hours of Operation

For the LED lamps installed under CDI, Econoler used daily hours of operation of 10.7 hours. This value was established for the different types of facilities that participated in CDI. For the LED Blitz pilot, Econoler chose to use the ENSC's value of 12.8 hours per day, since it is more appropriate for the types of businesses who were targeted by this pilot initiative, namely malls and hotel common areas. This value is largely acceptable, as some LED lamps installed probably run 24 hours per day, 7 days per week.

For LED exit signs, hours of operation of 24 hours per day are used.

Unitary Savings Calculation

Using the following equation, Econoler calculated the unitary savings values for each type of LED lamp.

$$\text{Annual Unitary Savings} = \frac{\Delta W \times \frac{h}{\text{day}} \times 365 \frac{\text{day}}{\text{yr}}}{1000 \frac{W}{kW}} = \frac{kWh}{yr}$$

The results of the unitary savings review are presented in the table below. The last column indicates whether the value is different from the one used in the tracking sheet.

Table 41: Revised Unitary Savings Values for Each LED Product

LED Product	Old Wattage (W)	New Wattage (W)	Displaced Wattage (W)	Hours of Operation (h/day)	Unitary Savings Value (kWh/year)	Comparison with Tracked Value*
3-Watt Chandelier LED	25	3	22	12.8	103	121
3.5-Watt LED MR16	25	3.5	21.5	12.8	100	217.6
5-Watt LED GU10	50	5	45	12.8	210	210.6
7-Watt LED PAR20	50	7	43	12.8	201	201.2
8-Watt LED A LAMP	50	8	42	12.8	196	243.4
13-Watt LED BR30	65	13	52	12.8	243	243.4
14-Watt LED PAR30	75	14	61	12.8	285	168.5
17-Watt LED PAR38	90	17	73	12.8	341	271.4
18-Watt LED BR40	100	18	82	12.8	383	477.4
LED Exit Sign	25	3	22	24	193	192.7
*The differences between the revised and the tracked values when no change occurred are due to the rounded value of 12.8 hours per day now used for the hours of operation.						

6.2.2 Demand-to-Energy Ratio

For the LED Blitz pilot, Econoler used the demand-to-energy ratio of 0.094 MW/GWh calculated for CDI. This ratio was obtained from the 2012 CDI targets by dividing the target demand savings by the target energy savings.

6.3 REVISED GROSS SAVINGS

The annual gross savings for each LED product installed through the LED Blitz pilot are presented in Table 42. They were calculated using the revised unitary savings established in the previous section. Overall, the total gross energy and demand savings amount to 3.308 GWh and 0.311 MW at the meter.

The gross savings at the generator level are also estimated in Table 42 using a line loss factor between the meter and the generator of 1.066. This value was calculated using the participants' rate codes indicated in the pilot's reporting sheets and weighted on the basis of the energy savings. The appropriate line loss factor values were provided by Nova Scotia Power. The resulting total gross energy and demand savings are estimated at 3.527 GWh and 0.332 MW at the generator.

Table 42: Evaluation Results – Gross Energy and Demand Savings – LED Blitz Pilot

Category of Product	3-Watt Chandelier LED	3.5-Watt LED MR16	5-Watt LED GU10	7-Watt LED PAR20	8-Watt LED A LAMP	13-Watt LED BR30	14-Watt LED PAR30	17-Watt LED PAR38	18-Watt LED BR40	LED Exit Sign	Total
Energy Savings											
Number of Units Installed	946	1,879	740	1,260	1,413	792	2,352	4,022	262	14	13,680
Unitary Savings (kWh)	103	100	210	201	196	243	285	341	383	193	-
Total Gross Energy Savings – at Meter (GWh)	0.097	0.188	0.155	0.253	0.277	0.192	0.670	1.372	0.100	0.003	3.308
Line Loss Factor	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	-
Total Gross Energy Savings – at Generator (GWh)	0.104	0.200	0.166	0.270	0.295	0.205	0.715	1.462	0.107	0.003	3.527
Demand Savings											
Demand-to-Energy Ratio	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	-
Total Gross Demand Savings – at Meter (MW)	0.009	0.018	0.015	0.024	0.026	0.018	0.063	0.129	0.009	0.000	0.311
Line Loss Factor	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	-
Total Gross Demand Savings – at Generator (MW)	0.010	0.019	0.016	0.025	0.028	0.019	0.067	0.137	0.010	0.000	0.332

6.4 INTERACTIVE EFFECTS

For the LED products installed through the LED Blitz pilot, Econoler applied the overall interactive effects factor of -15.5 percent, calculated for CDI.

6.5 NET-TO-GROSS RATIO

For this year's evaluation, Econoler did not plan any survey to measure distortion effects for the LED Blitz pilot that took place at the end of December. Due to the special nature of this pilot initiative, the NTGR is established at 1.

6.6 NET SAVINGS

The net savings for the LED Blitz pilot were estimated using the interactive effects factors and the NTGR estimated at 1. The following equation was used to calculate the net savings.

$$\text{Net Savings} = \text{Gross Evaluation Savings} \times (1 + \text{Interactive Effects Factor}) \times \text{NTGR}$$

This equation was used for both demand and energy savings. The results obtained are presented in the following table. Overall, the total net energy and demand savings amount to 2.795 GWh and 0.263 MW at the meter and 2.980 GWh and 0.280 MW at the generator.

Table 43: Evaluation Results – Net Energy and Demand Savings by Product – LED Blitz Pilot

Category of Product	3-Watt Chandelier LED	3.5-Watt LED MR16	5-Watt LED GU10	7-Watt LED PAR20	8-Watt LED A LAMP	13-Watt LED BR30	14-Watt LED PAR30	17-Watt LED PAR38	18-Watt LED BR40	LED Exit Sign	Total
Energy Savings											
Total Gross Energy Savings – at Meter (GWh)	0.097	0.188	0.155	0.253	0.277	0.192	0.670	1.372	0.100	0.003	3.308
Interactive Effects Factor	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-
NTGR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-
Total Net Energy Savings (GWh) – at Meter	0.082	0.159	0.131	0.214	0.234	0.163	0.566	1.159	0.085	0.002	2.795
Line Loss Factor	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	-
Total Net Energy Savings (GWh) – at Generator	0.088	0.169	0.140	0.228	0.249	0.173	0.604	1.235	0.090	0.002	2.980
Demand Savings											
Total Gross Demand Savings – at Meter (MW)	0.009	0.018	0.015	0.024	0.026	0.018	0.063	0.129	0.009	0.000	0.311
Interactive Effects Factor	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-15.5%	-
NTGR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-
Total Net Demand Savings (MW) – at Meter	0.008	0.015	0.012	0.020	0.022	0.015	0.053	0.109	0.008	0.000	0.263
Line Loss Factor	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	-
Total Net Demand Savings (MW) – at Generator	0.008	0.016	0.013	0.021	0.023	0.016	0.057	0.116	0.008	0.000	0.280

The table below presents comparisons between the energy and demand savings established by this evaluation and those calculated in the 2012 tracking sheet.

Table 44: Comparison of Tracked and Evaluated Savings at the Generator – LED Blitz Pilot

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR	Net Savings
Energy Savings					
Tracked Savings from ENSC	3.310 GWh	2.748 GWh	2.536 GWh	0.94	2.384 GWh
Evaluation Results	3.527 GWh	3.527 GWh	2.980 GWh	1.00	2.980 GWh
Demand Savings					
Tracked Savings from ENSC	0.311 MW	0.258 MW	0.238 MW	0.94	0.224 MW
Evaluation Results	0.332 MW	0.332 MW	0.280 MW	1.00	0.280 MW

The net evaluated savings exceeded those tracked by ENSC by 25 percent. Two main factors explain this difference. First, the fact that the unitary savings values for the two main products (14-watt PAR30 and 17-watt PAR38) were revised upward resulted in higher gross savings than those tracked by ENSC. Secondly, to be conservative, ENSC calculated net savings using an installation rate of 83 percent and a NTGR of 0.94. These two values were not evaluated for the LED Blitz pilot and were established at 100 percent and 1 respectively.

7 OVERALL BES RESULTS

This section summarizes the overall results of the impact evaluation for BES. When combining the net savings generated from both SBES and CDI, the total energy and demand savings amount to 30.152 GWh and 5.244 MW respectively. The table below presents the total gross and net savings established by the impact evaluation for BES.

Table 45: Overall Comparisons of Tracked and Evaluated Savings at the Generator for BES

	Initial Gross Savings	Installed Gross Savings	Installed Gross Savings with Interactive Effects	NTGR*	Net Savings
Energy Savings					
Tracked Savings from ENSC	41.504 GWh	37.512 GWh	34.624 GWh	0.88	30.612 GWh
Evaluation Results	41.825 GWh	40.422 GWh	34.467 GWh	0.87	30.152 GWh
Demand Savings					
Tracked Savings from ENSC	8.636 MW	8.061 MW	7.441 MW	0.86	6.430 MW
Evaluation Results	8.679 MW	7.148 MW	6.081 MW	0.86	5.244 MW

* NTGRs were different for each component. The NTGRs presented in this table correspond to the rounded averages obtained by dividing the net savings by the installed gross savings (with interactive effects).

CONCLUSION

The 2012 evaluation of BES demonstrated that the program is well-designed and generates important electric savings. The program underwent structural changes in 2012. Indeed, BES is now comprised of two components: SBES and CDI. SBES carries the same objectives as its initial version implemented from 2008 to 2011. As for CDI, it pursues the same goals as those targeted by EP-DI in 2011. These changes allowed for the program to offer both lighting and non-lighting measures to eligible small businesses across Nova Scotia for a payment of as low as 20 percent of the installation and materials costs through SBES, and for no cost through CDI.

The evaluation revealed that ENSC is successful at communicating about the program, as it was the main way participants learned of it. It is noteworthy, though, that this was much more likely for CDI participants. Contacts with contractors or vendors were also an important source of program awareness, especially for SBES participants, showing the importance of these actors in program promotion. Moreover, word of mouth was an important source of program awareness, more likely among SBES participants, as well as a good indicator of program satisfaction.

Both CDI and SBES achieved a high level of participant satisfaction, with a higher satisfaction level among SBES participants. The majority of participants were also satisfied with the length of time between their application for the program and the implementation of measures in their facilities. Participants offered recommendations to improve the program that went from increasing advertising and improving communication to providing a quicker participation process.

The program totalled 4,208 participants for the year 2012. SBES accounted for 1,239 of those participants (including participants from the Very Small Business and Retail LED pilots), while CDI covered 2,730 of them (including 84 participants from MURB). The remaining 239 participants took part in the LED Blitz pilot in December 2012.

The impact evaluation revealed that BES generated net energy savings of 30.152 GWh and demand savings of 5.244 MW at the generator in 2012. To calculate the net savings of BES in 2012, Econoler reviewed the gross savings estimated by ENSC and included interactive effects for lighting products. Moreover, Econoler took into consideration the free-ridership levels for each program component and spillover for SBES.

APPENDIX I – RECOMMENDATIONS

This Appendix presents all recommendations made by the Evaluator throughout the report as well as the sections where the recommendations originated.

Sections	Recommendations
Executive Summary	1. Improve the tracking sheet to allow for a better validation of savings: Both SBES and CDI tracking sheets show some improvements on last year's version. In 2013, the information will be gathered in one main tracking sheet, using the SBES tracking sheet model. With that in mind, the Evaluator highlighted some potential adjustments that could be made to improve the content of the future tracking sheet and allow for a better validation of savings: > Specify the detailed characteristics of each type of lighting product installed, namely the number of lamps per fixture, the wattage of the lamps and the ballast factor; > Track the quantity of CFLs and LED lamps installed based on the type and wattage of the lamps replaced to facilitate the validation of the displaced wattage values used in the unitary savings calculations; > Calculate gross and net energy savings directly in the tracking sheet; > Make savings calculations automatic to ensure that the savings recorded in the tracking sheet correspond to those calculated using the parameters filled out for each measure (quantity, unitary wattage value, hours of operation, etc.); > Add a field to indicate the heating energy source, if air conditioning is used in the building and if the lighting products were installed inside or outside the building; this would allow for a more precise evaluation of interactive effects factor; and > Collect the specific length (in feet) of insulated pipe installed in each participating facility to calculate the savings accordingly and limit the length to the first 15 feet.

Executive Summary	2. Include a ballast factor in the unitary wattage calculation of hardwired CFLs, metal halide fixtures and high pressure sodium fixtures*: The impact evaluation of SBES revealed some inconsistencies in the approach used to calculate the unitary wattage values of the following products: hardwired CFLs, metal halide fixtures and high pressure sodium fixtures. For these products, ENSC only considers a ballast factor for the old product that was replaced. For the new product installed, a ballast factor of 1 is applied, which is not appropriate. These types of products include a ballast that consumes a certain wattage. Therefore, Econoler recommends modifying the approach in the future to include a ballast factor in the unitary wattage calculation of hardwired CFLs, metal halide fixtures and high pressure sodium fixtures installed through the program. *See Section 4.2.1 Unitary Savings for Lighting Measures for more details.
Tracking Sheet SBES	3. Develop a validation process for product removals: Some inconsistencies related to product removal were noted in the CDI tracking sheet by the Evaluator. In some cases, an installer had to come back to replace lamps initially installed with another type of energy-efficient lamp, but no deductions were made to subtract the quantities of lamp that were removed. For this year's evaluation, Econoler made some spot checks in the tracking sheet and, when noticing that such situations occurred, adjusted the quantities of products installed accordingly. However, the Evaluator could not go through all the projects recorded in the tracking sheet. Therefore, it is essential for ENSC to develop a validation process to ensure the accuracy of the quantities of product entered in the tracking sheet and that deductions are made when some products are removed or replaced by other energy-efficient products. 4. Specify the detailed characteristics of each lighting product: The current tracking sheet does not specify some of the characteristics of the old or new lighting products. In fact, such details as the number of lamps per fixture, the wattage of the lamps and the ballast factor are all squeezed into one field with the name of the product. Information presented in this way does not allow the Evaluator to differentiate two similar lighting products yet including different key components such as ballasts, or to validate the unitary wattage values used in the savings calculations. Therefore, the Evaluator recommends adding fields in the tracking sheet to specify the characteristics of the old and new lighting products separately.

Tracking Sheet SBES	5. Develop a validation process for savings calculations: To ensure that the savings recorded in the tracking sheet correspond to those calculated using the parameters filled out for each measure (quantity, unitary wattage value, hours of operation, etc.), ENSC should develop a validation process using a formula that would automatically calculate the savings using the parameters entered in the tracking sheet. This would ensure the consistency of the energy savings recorded for each measure. In this year's tracking sheet, for 7 percent of the measures, the savings recorded differ from those calculated by the Evaluator using the parameters entered in the tracking sheet. Moreover, other fields should be added to the tracking sheet in order to also keep track of the net savings calculations. These calculations should be linked to a table which presents self-declaration ratios, installation rates, NTGR and interactive effects.
	6. Investigate the possibility of better identifying installations with lighting controls: The way the installation of occupancy sensors are filled out in the DSMDS does not allow, at this time, for indicating in the tracking sheet whether occupancy sensors were installed with the lighting products. The only way to identify and confirm this measure is to compare the old and new hours of operation. A reduction in hours of operation would indicate that an occupancy sensor was installed. It is therefore recommended that ENSC investigates the possibility of developing a new mechanism that would allow for easier identification of the installation of lighting controls on each measure implemented and eliminate entry errors in the hours of operation.
	7. Add a field to indicate if the measures were installed inside or outside the building*: The tracking sheet already includes a field with the specific location of each group of lighting measures implemented. Since all buildings are different, locations can be entered differently from one group to another, which precludes easily identifying if the measures were installed indoors or outdoors. Therefore, Econoler recommends including a field, in addition to the location, to simply identify if the measures were installed indoors or outdoors. This would facilitate the evaluation of the interactive effects factor. *See Section 4.3 Interactive Effects for more details.

Tracking Sheet CDI	8. Develop a validation process for product removals: Some inconsistencies related to product removal were noted in the CDI tracking sheet by the Evaluator. In some cases, an installer had to come back to replace lamps initially installed with another type of energy-efficient lamp, but no deductions were made to subtract the quantities of lamp that were removed. For this year's evaluation, Econoler made some spot checks in the tracking sheet and, when noticing that such situations occurred, adjusted the quantities of products installed accordingly. However, the Evaluator could not go through all the projects recorded in the tracking sheet. Therefore, it is essential for ENSC to develop a validation process to ensure the accuracy of the quantities of product entered in the tracking sheet and that deductions are made when some products are removed or replaced by other energy-efficient products. 9. Calculate energy savings directly in the tracking sheet: The real tracked energy and demand savings calculations are not included in the tracking sheet. They are calculated separately by the PM. Consequently, it is difficult for the PM and the Evaluator to monitor savings generated by the program and to identify the parameters used to calculate these savings. Therefore, Econoler recommends adding fields to the tracking sheet in order to keep track of the gross and net savings calculations. These calculations should be linked to a table which presents unitary savings values, installation rates, NTGR and interactive effects.

Tracking Sheet CDI	10. Make sure that all the fields are systematically filled out: The Evaluator noted that some fields were left blank: - Business type: This field could be useful for evaluating some unitary savings values, which vary depending on the business type, such as DHW tank wrap. In 39 percent of the cases, it was entered as “Other” or missing. - Contact information: Some contact information entries were not filled out, such as the first and last names (11%) and phone number (12%). Also, the tracking sheet does not have a field to enter the postal code of the participating facility, which would facilitate grouping participants by region for on-site visit sampling. - Rate code: This field is used to determine the line loss factor. It was left empty in 17 percent of the records. - Water heating type: This field needs to be filled out to distinguish between electricity and non-electricity savings when DHW products are installed. It was left blank for 3 percent of the participating facilities where DHW tank wrap, pipe insulation, faucet aerator and/or low-flow showerhead were installed. All this information is useful for field activities (on-site visits and telephone survey) and is often essential for impact evaluation. Therefore, it is recommended to limit the number of blank entries in these fields to the maximum extent possible. For business type, ENSC is already considering expanding the list of business types to prevent participants from always choosing “Other”. Regarding the fields for rate codes and contact information, these fields are mandatory since the end of 2012, which should correct the situation rapidly.
	11. Collect information on the heating energy source and air conditioning: The tracking sheet should include information on the energy source used for space heating and indicate if air conditioning is used. This information would be useful for the interactive effects factor calculations.
	12. Set limitations for entries: To ensure the validity of the values entered in the tracking sheet, Econoler recommends that ENSC set some limitations to standardize information collection, facilitate the identification of blank entries and limit errors. For instance, under each category of eligible products, a “0” value should be entered when no installation is done. Currently, the tracking sheet presents a mix of 0 values and blank entries.

Gross Savings SBES	13. If heat pump measures gain in popularity in the future, collect information on the use of air-conditioning in the facility before the installation of the heat pump and calculate savings on cooling.
Gross Savings CDI	14. Collect the hours of operation for the products installed through CDI.
	15. Track the DHW tank size in the tracking sheet for all participating facilities where hot water tank wraps are installed.

APPENDIX II – ON-SITE VISIT PROTOCOL (CDI)

1. General Information

Date of visit: _____

ID Number: _____

Company Name: _____

Contact Name: _____

Address _____

Telephone: _____

Business Type: _____

2. Product Installation information

For lighting products:

Product	Number in Tracking Sheet	Number On-Site	Explanation, If Different	Type of Lamp Replaced	Wattage of Lamp replaced
13W CFL					
23W CFL					
CFL Chandelier					
8W CFL Dimmable					
14W CFL Dimmable					
16W CFL Dimmable					

Product	Number in Tracking Sheet	Number On-Site	Explanation, If Different	Type of Lamp Replaced	Wattage of Lamp replaced
R30 CFL					
2.3W LED Chandelier					
14W LED PAR 30					
17W LED PAR 38					
7W MR16 LED					
MR16					
LED Exit Kit					

Notes:

For domestic hot water (DHW) related products:

Water Heating Type: ☐ Electric ☐ Non-Electric

Tank Size (in gallons): _____

Product	Number in Tracking Sheet	Number On-Site	Explanation, If Different	Locations
Pre-Rinse Spray Valve				
Pipe Insulation				N/A
Hot Water Tank Wrap				N/A
Faucet Aerators				
Low Flow Showerheads				

Notes:

APPENDIX III – FIRMOGRAPHICS

The profile of the program participants interviewed for the survey is presented in the following tables.

A wide range of businesses participated in the two program components, with the most common type being retail business (16%) for SBES, and service (13%) and food service/ restaurant (13%) for CDI.

Table 46: Business Type

Business Type	2011 SBES (%)	2012	
		SBES (%)	CDI (%)
<i>Sample Size</i>	61	76	75
Retail – other than mall	15%	16%	9%
Office	5%	9%	7%
Automotive repair	--	9%	--
Enclosed mall or strip mall	10%	8%	11%
Manufacturing	3%	8%	5%
Recreation centre/ Community hall	--	8%	1%
Religious worship	5%	7%	7%
Service	8%	5%	13%
Food service/Grocery	8%	4%	4%
Warehouse and storage	13%	3%	3%
Maintenance /Depot facility	--	3%	3%
Farming	--	3%	3%
Education	--	3%	1%
Food service/Restaurant	--	1%	13%
Health care – outpatient	3%	1%	5%
Financial institution	--	1%	3%
Food manufacturing	--	1%	3%
Public assembly	--	1%	--
Public order and safety	--	1%	--
Museum/Art gallery	--	--	5%
Lodging	2%	--	1%
Car dealership/repair	7%	--	--
Transportation	5%	--	--
Government	2%	--	--
Electrical distribution	2%	--	--
Others	13%	8%	1%
Don't know	--	--	1%

The majority of businesses for both the SBES (74%) and CDI (75%) components were small businesses with 9 or fewer employees.

Table 47: Full-time Equivalent Workers

Full-time Employees	2011 SBES (%)	2012	
		SBES (%)	CDI (%)
<i>Sample Size</i>	61	76	75
Fewer than 5	51%	53%	55%
5 to 9	23%	21%	20%
10 to 19	16%	18%	15%
20 to 49	7%	4%	7%
50 to 99	--	1%	3%
100 to 249	2%	--	--
250 or more	--	--	--
Don't know	2%	3%	1%

On average, SBES participants operated their business 60 hours per week while CDI participants operated their business 65 hours per week.

Table 48: Hours of Operation

Hours of Operation	2011 SBES (%)	2012	
		SBES (%)	CDI (%)
<i>Sample Size</i>	61	76	75
Less than 40	8%	12%	15%
40 to 79	66%	64%	59%
80 to 119	13%	18%	21%
120 or more	5%	4%	5%
Depends/varies	8%	--	--
Average hours	64	60	65

The majority of participants were independent businesses (79% for SBES and 80% for CDI); the remaining small number of SBES and CDI participants was respectively part of a larger organization.

Table 49: Type of Company

Type of Company	2011 SBES (%)	2012	
		SBES (%)	CDI (%)
<i>Sample Size</i>	61	76	75
Independent	84%	79%	80%
Part of a larger company	13%	13%	17%
Franchise	--	--	--
Others	3%	7%	3%
Refused	--	1%	--

In terms of the number of business locations in Nova Scotia, most participants had only one business location (78% for SBES and 71% for CDI).

Table 50: Number of Business Locations in Nova Scotia

Number of Locations	2011 (%)	2012	
		SBES (%)	CDI (%)
<i>Sample Size</i>	61	76	75
1	64%	78%	71%
2-10	23%	11%	19%
11-30	7%	4%	3%
More than 30	2%	4%	3%
Don't know	5%	3%	5%
Refused	--	1%	--

APPENDIX IV – PARTICIPANT SURVEY QUESTIONNAIRE

Participant Survey

ENSC Business Energy Solutions Program

October 30, 2012

Could I speak with [INSERT NAME]?

1. Yes [GO TO INTRODUCTION]
2. No [SAY “Perhaps you can help me anyway.” GO TO INTRODUCTION]

INTRODUCTION

Hello, I am with CRA (Corporate Research Associates), and we are performing an evaluation of energy efficiency services provided by Efficiency Nova Scotia Corporation. Our records indicate that you or your firm recently participated in Efficiency Nova Scotia Corporation’s Business Energy Solutions Program. We would appreciate your cooperation in answering questions related to your participation in this program. The information you provide will be used to help Efficiency Nova Scotia Corporation evaluate and improve the program. Are you the right person to answer this survey?

1. Yes [CONTINUE]
2. No [PROMPT: “Is there someone else in your organization who would know about having participated in the Business Energy Solutions Program?”]
___Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
___No [THANK & TERMINATE]
3. Don’t know [PROMPT: “Is there someone else in your organization who would know about having participated in the Business Energy Solutions Program?”]
___Yes [ASK TO SPEAK TO THEM AND REPEAT INTRODUCTION]
___No [THANK & TERMINATE]
4. Refused [THANK AND TERMINATE]

The survey will take about ten minutes. Is this a good time for you?

[IF REFUSED, ASK “Can we schedule a more convenient time for you to conduct this survey?”]

[SCHEDULED, IF NECESSARY, FOR: _____]

You may have participated in one or both of the Business Energy Solutions program components, either the Small Business Energy Solutions component and/or the Commercial Direct Install component. The Small Business Energy Solutions program component offers up to an 80% incentive

to upgrade energy efficient lighting and non-lighting measures. The Commercial Direct Install component provides direct installation of cost-effective energy-efficient measures at no cost to small businesses.

Verification and Recall (Series V)

- V1. Our records indicate that your company or organization participated in Efficiency Nova Scotia's Business Energy Solutions Program. Is this correct?
1. Yes (GO TO V2)
 2. No (GO TO V1A)
 3. (Don't know) (GO BACK TO INTRODUCTION TO SPEAK TO SOMEONE ELSE)
 4. (Refused) (THANK AND TERMINATE)
- V1a. [ASK IF NO IN V1] Are you sure? The program is comprised of two components: Small Business Energy Solutions (SBES) and Commercial Direct Install (CDI). The SBES component offers up to an 80% incentive to upgrade energy efficient lighting and non-lighting measures. The CDI component provides direct installation of cost-effective energy-efficient measures at no cost to small businesses...
1. Yes (GO TO V2)
 2. No (THANK AND TERMINATE)
 3. (Don't know) (GO BACK TO INTRODUCTION TO SPEAK TO SOMEONE ELSE)
 4. (Refused) (THANK AND TERMINATE)
- V2. In which of the two Business Energy Solutions components did you take part in 2012? [READ CHOICES TO RESPONDENT. CHOOSE ONLY ONE ANSWER]
1. Small Business Energy Solutions (SBES) component
 2. Commercial Direct Install (CDI) component
 3. Both
 98. (Don't know) USE SAMPLE
 99. (Refused) USE SAMPLE
- V3. According to our information, through its participation in the Business Energy Solutions Program, your business or organization installed energy-efficient products in the facility located at [FACILITY ADDRESS STREET]. When answering the survey questions, please take into account only this facility.
- Also, throughout the survey, I will refer to the [PROGRAM COMPONENT] component of the program only. If you took part in both program components, please think only of the [PROGRAM COMPONENT] when answering the survey.

Program Awareness and Participation (Series P)

- P1. How did you first learn about the [Small Business Energy Solutions/Commercial Direct Install] program? [DO NOT READ – ACCEPT MULTIPLE RESPONSES]
1. (From a phone call from a [Small Business Energy Solutions/Commercial Direct Install] representative)
 2. (From [Small Business Energy Solutions/Commercial Direct Install] literature I received in the mail)
 3. (From Efficiency Nova Scotia's website)
 4. (From a Efficiency Nova Scotia presentation)
 5. (From a Efficiency Nova Scotia staff person)
 6. (From a contractor or vendor)
 7. (From a business associate or friend (word of mouth))
 8. (From another/previous participant)
 9. (Newspaper/media)
 10. (ENSC bill insert)
 11. (Cold call)
 96. (Or some other way? (Please Specify: _____))
 98. (Don't know)
 99. (Refused)
- P2. What was the SINGLE most important reason your company or organization chose to participate in the [Small Business Energy Solutions/Commercial Direct Install] program? (DO NOT READ – ACCEPT ONE RESPONSE)
1. (To take advantage of program incentives)
 2. (To see what else I should be doing as part of a planned project)
 3. (To save on energy costs/bills)
 4. (To reduce maintenance costs)
 5. (To improve existing lighting conditions)
 6. (To help protect the environment)
 7. (Recommended by contractor)
 8. (Energy efficiency in general)
 9. (Improve building in general)
 96. (Other (Please explain _____))
 98. (Don't know/Don't recall) [GO TO SECTION S)
 99. (Refused) [GO TO SECTION S)
- P3. [DO NOT POSE IF 98 OR 99 IN Q.P2] What was SECOND most important reason your company or organization chose to participate in the [Small Business Energy Solutions/Commercial Direct Install] program? [DO NOT READ – ACCEPT ONE RESPONSE – SAME LIST AS P2]
97. No other reasons

Satisfaction (Series S)

- S1. Thinking of your OVERALL experience with the [Small Business Energy Solutions/Commercial Direct Install] program, including any services or energy efficient products received and installed, how satisfied were you overall with the program on a scale from 1 to 5, where 1='not at all satisfied' and 5='very satisfied'?
[RECORD NUMBER, DO NOT ACCEPT A RANGE, 98 = Don't know, 99 = Refused]
- S2. [IF DISSATISFIED, S1 = 1, 2 or 3] You indicated that you were not satisfied with the [Small Business Energy Solutions/Commercial Direct Install] program overall. What was the SINGLE most important reason you were dissatisfied with the [Small Business Energy Solutions/Commercial Direct Install] program overall? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT ONE RESPONSE]
1. (The energy evaluation took too long)
 2. (Products installed don't suit my needs)
 3. (I expected more savings)
 4. (I did not like the evaluator who visited the building)
 5. (I expected faster savings)
 6. (I did not like the payment plan)
 7. (I would have liked a higher incentive/Incentive too low)
 96. (Other [SPECIFY: _____])
 98. (Don't know) (GO TO S4)
 99. (Refused) (GO TO S4)
- S3. [IF DISSATISFIED, S1 = 1, 2 or 3] Were there any other reasons you were dissatisfied? [DO NOT READ. PROBE FOR SPECIFIC REASONS. ACCEPT MULTIPLE] [SAME LIST AS S2 ABOVE]
- 97 No other reasons
- S4. How satisfied were you with the interval of time between when you applied for the [Small Business Energy Solutions/Commercial Direct Install] program and when measures were implemented in your facility? Please answer on a scale from 1 to 5, where 1='not at all satisfied' and 5='very satisfied'.
[RECORD NUMBER, DO NOT ACCEPT A RANGE, 98 = Don't know, 99 = Refused]

Barriers (Series B)

- B1. Were there any barriers that your company or organization faced in implementing the energy efficiency measures provided through the [Small Business Energy Solutions/Commercial Direct Install] program?
1. Yes
 2. No (GO TO R1)
 98. (Don't know/Don't recall) (GO TO R1)
 99. (Refused) (GO TO R1)
- B5. What was the SINGLE most important barrier? [DO NOT READ - ONE RESPONSE]
1. (Concern that actual bill savings would be less than estimated)
 2. (Lack of information to make an informed decision)
 3. (Too little incentive)
 4. (Too much work required to obtain funding)
 5. (Too little information about the program)
 6. (Cost savings not worth the effort of applying)
 7. (Approval takes too long)
 8. (Lack of financing)
 9. (Energy-efficient equipment does not meet payback requirements)
 10. (Decision made elsewhere)
 11. (Do not own building – have to work through owner)
 12. (Lack of technical knowledge)
 13. (Lack of time / too busy)
 14. (Focused on core business)
 96. (Other (Specify: _____))
 98. (Don't know/Don't recall) (GO TO R1)
 99. (Refused) (GO TO R1)
- B6. What was the SECOND most important barrier? [DO NOT READ - ONE RESPONSE – SAME LIST AS B5]
97. No other barriers

Recommendations to Improve the Program (Series R)

- R1. Do you have any suggestions to improve the [Small Business Energy Solutions/Commercial Direct Install] program? Consider all aspects of the program: Process, marketing, interactions with utility staff, interactions with contractors and program forms. PROBE: Anything else? [RECORD VERBATIM, CODE ALL THAT APPLY]
98. Don't know

Free-Ridership SBES (Series FRS)

[ASK THIS SECTION TO RESPONDENTS FROM THE SBES COMPONENT ONLY]

The following questions will be about the lighting measures, such as T8 fluorescent lamps, compact fluorescent light bulbs and L-E-D lamps that you installed at a low cost through the Small Business Energy Solutions program.

FRS1. BEFORE participating in the Small Business Energy Solutions Program, did your company or organization have plans to install the specific energy-efficient lighting products that were installed through the Program?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

2. FRS1a. IF FRS1=YES, THEN ASK: I just want to make sure I understand - **Before** you decided to participate in the Efficiency Nova Scotia Small Business Energy Solutions Program, you had already made the decision to install the energy-efficient lighting products?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Small Business Energy Solutions Program.

FRS2. If your company or organization had not participated in the Small Business Energy Solutions Program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you "Definitely **Would Not** Have Taken the Action," and a 10 indicating that you "Definitely **Would Have** Taken the Action."
[AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: "AND NEXT, In the absence of the Program, would you have . . . DO NOT ACCEPT A RANGE – POSE FRS2 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FRS2a. . . . installed exactly the same energy-efficient lighting products that you installed through the Program?

___ Response ___98 Don't Know ___99 Refused

FRS2b. . . . installed standard lighting products instead of energy-efficient lighting products?

___ Response ___98 Don't Know ___99 Refused

FRS2c. . . . installed the energy-efficient lighting products that you installed through the Program *but at a later date*?

___ Response ___ 98 Don't Know ___ 99 Refused

IF FRS2c > 5, then ask:

FRS2cc. [DO NOT POSE FRS2cc IF DON'T KNOW OR REFUSED IN Q.FR2c] You indicated in your previous response that if the Small Business Energy Solutions program had not been available there was an [FR2c] in 10 likelihood that you would have installed the same lighting products *but at a later date*. Approximately how many months later would you have installed these products? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. ___ months later
96. (Never)
97. (At the same time)
98. (Don't Know)
99. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FRS2cc ANSWER IN MONTHS, READ]:

Would it have been within...

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FRS3. Efficiency Nova Scotia paid up to 80% of the \$[TOTAL PROJECT COST] total project cost. If your company had not received the incentive from Efficiency Nova Scotia, would you have done the project and paid for the full cost of the project, including the portion covered by the incentive? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not Have Paid** the full project cost” and a 10 indicating that you “Definitely **Would Have Paid** the full project cost.” [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

___ Response ___ 88 Don't Know ___ 99 Refused

3.

4. FRS4. Next, I'm going to ask you to rate the importance of the Program as well as other factors that might have influenced your decision to install the *energy-efficient* lighting

products. Please answer on a scale of 0 to 10, where 0 means “Not at all important” and 10 means “Extremely important.” Now using this scale please rate the importance of each of the following in your decision to implement the energy-efficient lighting products you installed through the Program: [PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

Factor (READ AND RANDOMIZE)	Responses
a. Efficiency Nova Scotia Financial Assistance	___ Response ___98 Don't Know ___99 Refused
b. Information received during the initial contact by the program representative.	___ Response ___98 Don't Know ___99 Refused
c. Efficiency Nova Scotia funded lighting audit.	___ Response ___98 Don't Know ___99 Refused
d. Recycling of removed lamps and fixtures	___ Response ___98 Don't Know ___99 Refused
f. The standard practice in your industry	___ Response ___98 Don't Know ___99 Refused
g. Existing energy efficiency code	___ Response ___98 Don't Know ___99 Refused
h. Previous experience with the Small Business Energy Solutions Program, or a similar program either from Efficiency Nova Scotia or Nova Scotia Power	___ Response ___98 Don't Know ___99 Refused

Free-Ridership CDI (Series FRC)

[ASK THIS SECTION TO RESPONDENTS FROM THE CDI COMPONENT ONLY]

The following questions will be about the lighting measures, such as compact fluorescent light bulbs and L-E-D lamps that you had installed at no cost through the Commercial Direct Install program.

FRC0a. I am going to read you a list of measures that, according to our records, were installed in the facility I just mentioned to you: [READ WHAT IS ON RECORD (MEASURE=TRUE IN THE SAMPLE)]. For each one, can you please verify that this information is correct and that the measure was installed? [1=YES, INSTALLED, 2=NO, NOT INSTALLED, 98=DON'T KNOW, 99=REFUSED]?

NOTE FOR PROGRAMMER: DO NOT PUT THE NUMBER OF EACH MEASURE

- a) CFL bulbs
- b) LED bulbs
- c) LED Exit Signs
- d) Pipe insulation/Tank wraps
- e) Faucet aerators
- f) Low-flow showerheads
- g) Pre-rinse spray valves

FRC0b. [FOR EACH OF FRC0a: a-g = NO and RECORD = YES] Are you sure? According to our records someone would have come to your facility and installed ... [READ WHAT IS ON RECORD] [1=YES → RECORD AS YES] [2=NO, 98=DON'T KNOW, 99=REFUSED → RECORD AS NO]

- a. [CFL bulbs]
- b. [LED bulbs]
- c. [LED Exit Signs]
- d. [Pipe insulation/Tank wraps]
- e. [Faucet aerators]
- f. [Low-flow showerheads]
- g. [Pre-rinse spray valves]

INSTRUCTION:

IF NO IN ALL OF FRC0A/FRC0B, SKIP TO SECTION F

(FOR RESPONDENTS WITH MORE THAN TWO ("YES") MEASURES VERIFIED IN FRC0a AND FRC0b, CHOOSE TWO MEASURES VERIFIED. THE RESPONDENT WILL ANSWER ACCORDING TO THESE TWO MEASURES THROUGHOUT SECTION FRC WHEN IDENTIFIED LIKE SO: [MEASURE 1 or 2].)

SELECTION METHOD FOR THE TWO MEASURES:

- IF CFL ARE VERIFIED IN FRC0a AND FRC0b, RESPONDENT WILL AUTOMATICALLY ANSWER ACCORDING TO CFL
- THEN, CHOOSE ANOTHER MEASURE VERIFIED IN FRC0a AND FRC0b AT RANDOM, AMONG THE FOLLOWING:
 - o LED bulbs
 - o LED Exit Signs
 - o Pipe insulation/Tank Wraps
 - o Faucet aerators

[NOTE: IF THERE ARE ONLY TWO MEASURES VERIFIED IN FRC0a AND FRC0b, RESPONDENT WILL AUTOMATICALLY ANSWER ACCORDING TO THESE TWO MEASURES. IF THERE IS ONLY ONE MEASURE VERIFIED IN FRC0a AND FRC0b, RESPONDENT WILL ANSWER ABOUT THIS UNIQUE MEASURE ONLY]

The next questions will be about the [MEASURE 1] you had installed through the Commercial Direct Install program.

FRC1M1. Did you have any specific plans to install [MEASURE 1] in your facility prior to talking with anyone about the Commercial Direct Install program?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

FRC1aM1. IF FRC1M1=YES, THEN ASK: I just want to make sure I understand - **Before** you decided to participate in the Commercial Direct Install program, you had already made the decision to install [MEASURE 1]?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Commercial Direct Install program.

If you had not participated in the Commercial Direct Install program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Taken the Action,” and a 10 indicating that you “Definitely **Would Have** Taken the Action.” AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY

SAYING: "AND NEXT. In the absence of the Commercial Direct Install program, would you have . . .
[DO NOT ACCEPT A RANGE – POSE FRC2M1 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FRC2aM1. . . . installed the [MEASURE 1] that were installed through the Commercial Direct Install program?

___ Response ___ 98 Don't Know ___ 99 Refused

FRC2bM1. . . . installed standard equipment instead of energy-efficient [MEASURE 1]?

___ Response ___ 98 Don't Know ___ 99 Refused

FRC2cM1. . . . installed the [MEASURE 1] that were installed through the Commercial Direct Install program *but at a later date*?

___ Response ___ 98 Don't Know ___ 99 Refused

IF FRC2CM1 > 5, THEN ASK:

[DO NOT ASK IF FRC2cM1=98 OR 99]

FRC2ccM1. You indicated in your previous response that if the Commercial Direct Install program had not been available there was an [FRC2cM1] in 10 likelihood that you would have installed the same energy-efficient products *but at a later date*. Approximately how many months later would you have installed these products? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. ___ months later
2. (Never)
3. (At the same time)
98. (Don't know)
99. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FRC2ccM1 ANSWER IN MONTHS, READ]:

Would it have been within . . .

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FRC3M1. If Efficiency Nova Scotia had not installed [MEASURE 1] for free, would you have paid the full cost of the [MEASURE 1]?

- 1. Yes
- 2. No
- 97. (Depends on the cost)
- 98. (Don't know)
- 99. (Refused)

[IF ONLY ONE MEASURE VERIFIED IN FRC0a-FRC0b, SKIP TO SECTION F]

The next questions will be about the [MEASURE 2] you had installed through the Commercial Direct Install program.

FRC1M2. Did you have any specific plans to install [MEASURE 2] in the common area of your building prior to talking with anyone about the Commercial Direct Install program?

- 1. (Yes)
- 2. (No)
- 98. (Don't know)
- 99. (Refused)

FRC1aM2. IF FRC1M2=YES, THEN ASK: I just want to make sure I understand - **Before** you decided to participate in the Commercial Direct Install program, you had already made the decision to install [MEASURE 2]?

- 1. Yes
- 2. No
- 98. (Don't know)
- 99. (Refused)

[READ FIRST TIME THROUGH ONLY] Now I would like to ask you to consider what actions you would have taken in the absence of the Commercial Direct Install program.

If you had not participated in the Commercial Direct Install program, what is the likelihood that you would have taken one of the following actions? Please answer on a scale of 0 to 10, with a 0 indicating that you “Definitely **Would Not** Have Taken the Action,” and a 10 indicating that you “Definitely **Would Have** Taken the Action.” [AFTER FIRST TIME THROUGH THE SEQUENCE, START HERE FOR SECOND AND SUBSEQUENT SEQUENCES. START SECOND/SUBSEQUENT SEQUENCES BY SAYING: “AND NEXT. In the absence of the Commercial Direct Install program, would you have . . . DO NOT ACCEPT A RANGE – POSE FRC2M2 SEQUENCE IN ORDER/DO NOT RANDOMIZE]

FRC2aM2. . . . installed the [MEASURE 2] that was installed through the Commercial Direct Install program?

___ Response ___ 98 Don't Know ___ 99 Refused

FRC2bM2. . . . installed standard equipment instead of energy-efficient [MEASURE 2]?

___ Response ___98 Don't Know ___99 Refused

FRC2cM2. . . . installed the [MEASURE 2] that was installed through the Commercial Direct Install program *but at a later date*?

___ Response ___98 Don't Know ___99 Refused

IF FRC2CM2 > 5, THEN ASK:

[DO NOT ASK IF FRC2cM2=98 OR 99]

FRC2ccM2. You indicated in your previous response that if the Commercial Direct Install program had not been available there was an [FRC2cM2] in 10 likelihood that you would have installed the same energy-efficient products *but at a later date*. Approximately how many months later would you have installed these products? [DO NOT READ RESPONSES - PROBE FOR SPECIFIC RESPONSE – DO NOT ACCEPT A RANGE]

1. _____ months later
2. (Never)
3. (At the same time)
98. (Don't know)
99. (Refused)

[IF RESPONDENT HAS DIFFICULTY SPECIFYING AN FRC2ccM2 ANSWER IN MONTHS, READ]:

Would it have been within . . .

1. Less than 6 months?
2. 6 months to less than 1 year later?
3. 1 to less than 2 years later?
4. 2 to less than 3 years later?
5. 3 to less than 4 years later?
6. 4 or more years later?
7. (Never)
98. (Don't Know)
99. (Refused)

FRC3M2. If Efficiency Nova Scotia had not installed [MEASURE 2] for free, would you have paid the full cost of the [MEASURE 2]?

1. Yes
2. No
97. (Depends on the cost)
98. (Don't know)
99. (Refused)

[ASK FRC4 ONCE, NOT FOR EACH MEASURE VERIFIED IN FRC0a-FRC0b]

FRC4. Next, I'm going to ask you to rate the importance of the Commercial Direct Install program as well as other factors that might have influenced your decision to install energy efficient measures through the Commercial Direct Install program. Using a scale from 0 to 10 where 0 means "Not at all important" and 10 means "Extremely important", please rate the importance of each of the following in your decision to install the energy-efficient products you installed through the Commercial Direct Install program. [DO NOT ACCEPT A RANGE]

Factor (READ AND RANDOMIZE)	Responses
a. The free installation of energy-efficient products offered by the program	___ Response ___98 Don't Know ___99 Refused
b. Information or advice provided by program staff throughout the upgrade process	___ Response ___98 Don't Know ___99 Refused
c. Previous experience with a similar program either from Efficiency Nova Scotia, Nova Scotia Power or Conserve Nova Scotia	___ Response ___98 Don't Know ___99 Refused

Spillover (Series SP)

[ASK THIS SECTION TO RESPONDENTS FROM THE SBES COMPONENT ONLY]

SP1. Now I'd like you to think of the time **since you participated** in the Small Business Energy Solutions program. Has your company purchased and installed any additional energy-efficient lighting products on its own for this facility?

1. Yes
2. No [GO TO F1]
98. (Don't know [GO TO F1])
99. (Refused) [GO TO F1]

SP2. IF SP1= YES, THEN ASK: I just want to make sure I understand - **After** you participated in the Small Business Energy Solutions program, your company installed additional energy-efficient lighting products on its own for this facility. Is that correct?

1. Yes [GO TO SP3]
2. No [GO TO F1]
98. (Don't know) [GO TO F1]
99. (Refused) [GO TO F1]

From now on, I will specifically talk about the additional energy-efficient lighting products your company installed on its own after participating in the Small Business Energy Solutions program.

SP3. [IF SP2 = 'YES'] Have the additional energy-efficient lighting products purchased benefited from any other financing or incentive from any other *Efficiency Nova Scotia* program, or do you plan to submit a funding request for these purchases in the future?

1. Yes [GO TO F1]
2. No
98. (Don't know [GO TO F1])

SP4. [IF SP3 = 2 'NO'] I would like to know what are the additional energy-efficient lighting products that you have installed on your own after participating in the Small Business Energy Solutions program. Did you install... [READ AND ROTATE, CODE ONE ONLY PER OPTION.

- a. Compact Fluorescent Lamps (CFLs)?
- b. Halogen PAR lamps?
- c. Fixtures with T8 fluorescent lamps?
- d. Fixtures with T5 high output fluorescent lamps?
- e. Metal Halide lamps?
- f. High Pressure Sodium (HPS) lamps?
- g. L-E-D exit signs?
- h. L-E-D lamps?

- 1 Yes
- 2 No
- 8 Don't know
- 9 Refused

[ASK FOR EACH 'YES' IN RESPONSE IN SP4A-H] SP4b_1. How many additional [INSERT PRODUCT] have you installed since participating in the Small Business Energy Solutions program? [ENTER NUMBER. PROBE FOR A SPECIFIC ANSWER. DON'T KNOW=98, REFUSED=99]

SP4i. Are there any other energy efficient lighting products that you have installed on your own after participating in the Small Business Energy Solutions program?

1. Yes
2. No
97. (Don't know)

[IF YES]

SP4i_1. What are the other energy-efficiency lighting products that you have installed since participating in the Small Business Energy Solutions program? [RECORD VERBATIM. RECORD DIFFERENT PRODUCTS SEPARATELY. PROBE FOR A SPECIFIC ANSWER. DON'T KNOW=98, REFUSED=99] CODE UP TO FIVE DIFFERENT PRODUCTS]

SP4i_2. [ASK FOR EACH ANSWER TO SP4i_1] How many of these [INSERT RESPONSE FROM SPI_1 HERE] energy-efficiency lighting products have you installed since participating in the Small Business Energy Solutions program?

SP5. [IF SP3 = 2 'NO'] Did your experience with the energy-efficient lighting products installed through the Small Business Energy Solutions program influence your decision to install some or all of these additional energy-efficient lighting products on your own? Please, give your answer on a scale of 0 to 10, where 0 indicates that the Small Business Energy Solutions program "had no influence at all on your decision to install the energy-efficient lighting" and 10 indicates that the program was "extremely influential to your decision to install the energy efficiency lighting." [RECORD RESPONSE 0-10, 98 = Don't know, 99 = REFUSED] [DO NOT ACCEPT A RANGE]

Firmographics (Series F)

F1. What is the main activity of the facility where the energy efficiency improvements were implemented under the program? [DO NOT READ—BUT CONFIRM WITH RESPONDENT THAT THE CATEGORY YOU CHOOSE IS CORRECT]

1. (Education)
2. (Food Sales (grocery))
3. (Food Service (restaurant))
4. (Health Care – Inpatient)
5. (Health Care – Outpatient)
6. (Lodging)
7. (Mercantile – Enclosed and Strip Malls)
8. (Mercantile – Retail (Other than Mall))
9. (Office)
10. (Public Assembly)
11. (Public Order and Safety)

- 12. (Religious Worship)
- 13. (Service)
- 14. (Warehouse and Storage)
- 15. (Manufacturing) (Identify Industry Type _____
(e.g., chemical, food, paper, etc.)
- 16. (Other: please explain _____)
- 17. (Vacant building)
- 98. (Don't know)
- 99. (Refused)

F3. Approximately how many full-time equivalent workers are employed at this facility? [DO NOT READ, CODE APPROPRIATE CATEGORY]

- 1. (Fewer than 5)
- 2. (5 to 9)
- 3. (10 to 19)
- 4. (20 to 49)
- 5. (50 to 99)
- 6. (100 to 249)
- 7. (250 or More)
- 98. (Don't know)
- 99. (Refused)

F4. We want to estimate the number of operating hours of the building where the energy efficiency improvements were implemented.

F4a. On average, how many hours per day is the facility open?
[RECORD NUMBER OF HOURS 0-24, ACCEPT DECIMAL] [98 = Don't know/don't recall, 99 = Refused]

F4b. How many days per week is the facility open?
[RECORD NUMBER OF DAYS 0-7, ACCEPT DECIMAL] [98 = Don't know/don't recall, 99 = Refused]

F4c. And how many weeks per year is the facility open?
[RECORD NUMBER OF WEEKS 0-52, ACCEPT DECIMAL] [98 = Don't know/don't recall, 99 = Refused]

F5. Is your company independent, or part of a larger company?

- 1. (Independent)
- 2. (Part of a larger company)
- 96. (Other: please explain: _____)
- 98. (Don't know)
- 99. (Refused)

F6. How many business locations does your organization have in Nova Scotia? [RECORD A NUMBER 1-99; 998 = Don't know, 999 = Refused]

END: Those are all the questions I have for you. I thank you very much for your time and cooperation and have a nice day!

APPENDIX V – ALGORITHM FOR FREE-RIDERSHIP CALCULATION (SBES & CDI)

SBES Component

FR2a. If your company had not participated in SBES what is the likelihood that you would have installed exactly the same energy-efficient lighting products that you installed through SBES? (Scale 0 to 10)	FR2a = Answer x 10%
FR2b. If your company had not participated in SBES, what is the likelihood that you would have installed standard lighting products instead of energy-efficient lighting products? (Scale 0 to 10)	FR2b = (10 – Answer) x 10%
PA1 Score:	MEAN VALUE OF: (FR2a ; FR2b)
FR1. Before participating in SBES, did your company have plans to install the specific energy-efficient lighting products that were installed through SBES?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just want to make sure I understand - Before you decided to participate in SBES, you had already made the decision to install the energy-efficient lighting products?	IF 1. Yes: FR1 = 100% IF 2 OR 9 : FR1 = 0%
FR3. If your company had not received the incentive from ENSC, would you have done the project and paid for the full cost of the project, including the portion covered by the incentive? (Scale 0 to 10)	FR3 = Answer x 10%
PA2 Score:	IF FR1 = 0% : FR3 / 2 IF FR1 = 100% : FR3
FR4. Level of influence (Scale 0 to 10) Factors a, b, c and h = Program factors Factor f = Non program factor	FR4_P = SUM(a ; b ; c ; h) FR4_NP = f
PA3 Score:	100% - [FR4_P/(FR4_P+FR4_NP)]
FR2c. If your company had not participated in SBES, what is the likelihood that you would have installed the energy-efficient lighting products but at a later date ? (Scale 0 to 10)	IF FR2c > 5 : ASK FR2cc Otherwise: PA4 = EMPTY
FR2cc. Approximately how many months later would you have installed these products? 1. Less than 6 months? 2. 6 months to less than 1 year later? 3. 1 to less than 2 years later? 4. 2 to less than 3 years later? 5. 3 to less than 4 years later? 6. 4 or more years later? 7. (Never) 9. (Don't know / Refused)	IF 1. : FR2cc = 100% IF 2. : FR2cc = 50% IF 3. : FR2cc = 25% IF 4. : FR2cc = 0% IF 5. : FR2cc = 0% IF 6. : FR2cc = 0% IF 7. : FR2cc = 0% IF 9. : FR2cc = 0%
PA4 Score:	FR2cc
Final Free-Ridership	MEAN VALUE OF : (PA1 ; PA2 ; PA3 ; PA4)
Inconsistency Test #1	IF ABS(FR2a – FR2b) ≥ 30%: PA1 = MIN OF (FR2a ; FR2b)
Inconsistency Test #2	IF FR3 ≥ 70% AND IF (FR2a OR FR2b < 70%: PA2 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)

CDI Component

FR2a. If your company had not participated in CDI, what is the likelihood that you would have installed exactly the same energy-efficient products that you installed through CDI? (Scale 0 to 10)	FR2a = Answer x 10%
FR2b. If your company had not participated in CDI, what is the likelihood that you would have installed standard products instead of energy-efficient products? (Scale 0 to 10)	FR2b = (10 – Answer) x 10%
PA1 Score:	MEAN VALUE OF: (FR2a ; FR2b)
FR1. Did your company have any specific plans to install the energy-efficient products in your facility prior to talking with anyone about CDI?	IF 1. Yes: Use FR1a IF 2 OR 9 : FR1 = 0%
FR1a. I just want to make sure I understand - Before you decided to participate in CDI, you had already made the decision to install the energy-efficient products in your facility?	IF 1. Yes: FR1 = 100% IF 2 OR 9 : FR1 = 0%
FR3. If ENSC had not installed energy-efficient products for free, would you have paid the full cost of the energy-efficient products?	IF 1. Yes: FR3 = 100% IF 2 OR 9 : FR3 = 0%
PA2 Score:	IF FR1 = 0% : FR3 / 2 IF FR1 = 100% : FR3
FR4. Level of influence (Scale 0 to 10) Factors a, b and c = Program factors	FR4_P = MAX(a ; b ; c)
PA3 Score:	(10 - FR4_P) x 10%
FR2c. If your company had not participated in CDI, what is the likelihood that you would have installed the energy-efficiency products but at a later date ? (Scale 0 to 10)	IF FR2c > 5 : ASK FR2cc Otherwise: PA4 = EMPTY
FR2cc. Approximately how many months later would you have installed these products? 1. Less than 6 months? 2. 6 months to less than 1 year later? 3. 1 to less than 2 years later? 4. 2 to less than 3 years later? 5. 3 to less than 4 years later? 6. 4 or more years later? 7. (Never) 9. (Don't know / Refused)	IF 1. : FR2cc = 100% IF 2. : FR2cc = 50% IF 3. : FR2cc = 25% IF 4. : FR2cc = 0% IF 5. : FR2cc = 0% IF 6. : FR2cc = 0% IF 7. : FR2cc = 0% IF 9. : FR2cc = 0%
PA4 Score:	FR2cc
Final Free-Ridership	MEAN VALUE OF : (PA1 ; PA2 ; PA3 ; PA4)
Inconsistency Test #1	IF ABS(FR2a – FR2b) ≥ 30%: PA1 = MIN OF (FR2a ; FR2b)
Inconsistency Test #2	IF FR3 ≥ 70% AND IF (FR2a OR FR2b) < 70%: PA2 = EMPTY
Revised Free-Ridership	MEAN VALUE OF: (PA1 ; PA2 ; PA3 ; PA4)

APPENDIX VI – CALCULATION EXAMPLE

This Appendix presents a sample worksheet showing step-by-step calculations that have produced the results for one of the lighting measures reviewed in the impact evaluation of SBES. First, the equations used for the savings calculations are presented, followed by the tracked savings estimated by ENSC and the savings results revised during this evaluation, mainly based on a review of the tracking sheet and on-site metering results.

The lighting measure cited in this example belongs to the “T8 fluorescents” category, which contributed 52 percent of SBES’ total gross savings and, therefore, was its most important category in 2012. Econoler chose to present a calculation example for T8 fluorescents, when only the lamp was replaced (“Relamp” installation type), because adjustments were made to both the unitary wattage values and the hours of operation for this specific product.

Savings Equations

For each T8 fluorescent lighting measure, the savings were calculated using the following equations:

$$\text{Annual Demand Savings} \left[\frac{W}{\text{year}} \right] = (Qty \times Watt)_{\text{Baseline}} - (Qty \times Watt)_{\text{New}}$$

$$\text{Annual Energy Savings} \left[\frac{kWh}{\text{year}} \right] = \frac{(Qty \times Watt \times Hrs)_{\text{Baseline}} - (Qty \times Watt \times Hrs)_{\text{New}}}{1,000 \text{ W/kW}}$$

Where:

- > Qty represents the quantity of lighting fixtures installed;
- > Baseline and new Watt represent the unitary wattage values, which include the number of lamps per fixture, the wattage of the lamps and the ballast factor;
- > Hrs represents the annual hours of operation declared by the participants.

Tracked Savings Calculations

For each T8 fluorescent lighting measure, when only the lamp was replaced (“Relamp” installation type), ENSC proceeded to calculate energy and demand savings with the information available in the tracking sheet, i.e. the quantity installed, the unitary wattage value and the hours of operation declared by the participant. For the unitary wattage value, no ballast factor was considered for the newly installed lamp, while a ballast factor was included in the unitary wattage values of the old lamp replaced (baseline).

The table below presents the values used by ENSC in the specific case of a “T8-2LAMP-4FOOT-32W” replacing a “T8-2LAMP-4FOOT-28W”, with only the lamp replaced.

Parameter	Value	Source
Baseline Measure "T8-2LAMP-4FOOT-32W"		
Quantity	1	Tracking Sheet
Unitary Wattage	59	Tracking Sheet (2 lamps*32W*B.F.)
Hours of Operation (h/year)	2,080	Tracking Sheet
New Measure "T8-2LAMP-4FOOT-28W"		
Quantity	1	Tracking Sheet
Unitary Wattage	56	Tracking Sheet (2 lamps*28W)
Hours of Operation (h/year)	2,080	Tracking Sheet
Savings		
Tracked Demand Savings (W)	3	Calculation
Tracked Energy Savings (kWh)	6.24	Calculation

Revised Savings Calculations

Econoler revised the savings after reviewing the parameters used in the savings calculations and results of the on-site metering study.

As for the unitary wattage value, Econoler noticed that no ballast factor was considered for the newly installed lamp, but a ballast factor was included in the unitary wattage values of the old lamp replaced. In the case of a lamp replacement, only the lamp wattage should be used in the savings calculations for both products. Therefore, Econoler adjusted the unitary wattage value of the baseline by taking into account only the lamp wattage of the old lamp replaced.

As for the hours of operation, a metering study was conducted to monitor the hours of operation in different sections of the selected participating facilities. An average self-declaration ratio of 0.98 was established through this study and applied to T8 fluorescent lighting measures.

Based on these adjustments, Econoler revised the parameters used in the tracking sheet to calculate savings for the same specific case of a “T8-2LAMP-4FOOT-32W” replacing a “T8-2LAMP-4FOOT-28W”.

Parameter	Value	Source
Baseline Measure “T12-2LAMP-4FOOT-32W”		
Quantity	1	Same as in the tracking sheet
Unitary Wattage	64	Value adjusted to exclude the ballast factor (2 lamps * 32W)
Hours of Operation (h/year)	2,038	Value adjusted with the self-declaration ratio (2,080 h/yr * 0.98)
New Measure “T8-2LAMP-4FOOT-28W”		
Quantity	1	Same as in the tracking sheet
Unitary Wattage	56	Same as in the tracking sheet
Hours of Operation (h/year)	2,038	Value adjusted with the self-declaration ratio (2,080 h/yr * 0.98)
Savings		
Tracked Demand Savings (W)	8	Calculation
Tracked Energy Savings (kWh)	16.3	Calculation

Adjustment ratios

In this specific case, the adjustments made to the unitary wattage value and the hours of operation have resulted in an increased ratio for both the demand savings and energy savings, respectively at 2.67 and 2.61:

$$\text{Adjustment Ratio on Demand Savings}_{\text{Measure}} = \frac{\text{Revised } W}{\text{Tracked } W} = \frac{8 \text{ W}}{3 \text{ W}} = 2.67$$

$$\text{Adjustment Ratio on Energy Savings}_{\text{Measure}} = \frac{\text{Revised kWh}}{\text{Tracked kWh}} = \frac{16.3 \text{ kWh}}{6.24 \text{ kWh}} = 2.61$$

As for demand savings, the ratio only included the adjustment to the unitary wattage values. To establish the average adjustment ratio of 1.122, which was used to revise the unitary wattage values of all T8 fluorescent lighting measures with only a lamp replacement, the Evaluator revised each demand savings calculation. A positive adjustment ratio of 1.122 was established by comparing the revised values with the tracked values.



ECONOLER

INTRODUCTION OF NEW CODES AND STANDARDS IN NOVA SCOTIA

IMPACT EVALUATION 2012

EFFICIENCY NOVA SCOTIA CORPORATION

Final Report

March 5, 2013



ECONOLER

ACRONYMS

AC	Alternating Current
BR	Bulged Reflector
CEM	Consumer Electronics Market
C&S	Codes & Standards
DC	Direct Current
DVR	Digital Video Recorder
EEMAC	Electrical Equipment Manufacturers Association of Canada
EER	Energy Efficiency Ratio
EFC	Electro-Federation Canada
ENSC	Efficiency Nova Scotia Corporation
EPG	Electronic Program Guide
ER	Elliptical Reflector
HP	Horsepower
HRAI	Heating, Refrigeration, and Air Conditioning Institute of Canada
IPTV	Internet Protocol TV
MEPS	Minimum Energy Performance Standards
NRCan	Natural Resources Canada
OEE	Office of Energy Efficiency
PAR	Parabolic Aluminized Reflector
POD	Point of Deployment
PVRs	Digital Video Players/Recorders
R	Reflector
SPVHP	Single Package Vertical Heat Pumps

DEFINITIONS

Demand savings	Savings occurring at specific peak hours of energy demand.
Diversity factor	The ratio of the sum of the individual maximum demands of the various subsystems to the maximum demand of the whole system.
Energy Efficiency Ratio	A ratio calculated by dividing the cooling capacity (in Btu/h) by the power input (in watts) at a given set of rating conditions.
Evaluated savings	Gross and net savings calculated by the Evaluator using the parameters (unitary savings values, installation rates, distortion effects, interactive effects, etc.) validated or measured during the evaluation process.
Gross energy savings	Energy savings generated by energy efficiency measures, before distortion effects and interactive effects are taken into consideration.
Line loss factor	Percentage of the electrical energy losses occurring in the transmission and distribution system between the utility generator and the customer meter.

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EXECUTIVE SUMMARY

This report presents the results of the 2012 impact evaluation of Codes & Standards (C&S). The 2012 evaluation was based on secondary data research and interviews with 15 distributors as well as 19 manufacturers.

CONTEXT AND BACKGROUND

In order to improve the efficiency of energy-using products sold in Canada, Natural Resources Canada (NRCan) is constantly implementing “regulated minimum energy efficiency standards through amendments to the *Energy Efficiency Regulations*.”¹ As part of Canada’s Clean Air Regulatory Agenda,² which was established in 2006, three amendments to the *Energy Efficiency Regulations* “to deliver energy, greenhouse gas and air pollutant reductions” were planned.³

This amendment not only increases the stringency and/or scope of existing minimum energy performance standards (MEPS) for seven currently regulated products, but also introduces new MEPS for five products. Below are the products targeted by *Amendment 11*.

Table 1: Products Targeted by *Amendment 11*⁴

Products	Existing MEPS prior to <i>Amendment 11</i>	Reference code
Electric motors	Yes	CAN/CSA 390-10
Residential gas boilers	Yes	CSA P.2-07
Residential oil boilers	Yes	CSA P.2-07
Dry-type transformers	Yes	CAN/CSA 802.2-06
Large air conditioners and heat pumps	Yes	CAN/CSA 746-2006
Commercial self-contained refrigeration	Yes	HRAI Standard 1200-2008
General service incandescent reflector lamps	Yes	CAN/CSA 862-09
Standby for electronic products	No	CAN/CSA 62301-07
External power supplies	No	CSA 381.1-08
Electric boilers	No	CSA P.2-07
Single package vertical air conditioners and heat pumps	No	C746-06
Digital television adapters	No	CSA 380-08

With the introduction of the new C&S in the Canadian market in 2012, Efficiency Nova Scotia Corporation (ENSC) set out to assess what the impact would be for Nova Scotia in terms of energy

¹ Office of Energy Efficiency, *ecoENERGY Efficiency for Equipment Standards and Labelling*, <http://oee.nrcan.gc.ca/corporate/13752>, October 26, 2011.

² Environment Canada. *Clean Air Regulatory Agenda: Background*, <http://www.ec.gc.ca/default.asp?lang=En&n=56D4043B-1&news=295B1964-9737-4F80-B064-B3088D9910BE>, October 28, 2011.

³ Office of Energy Efficiency, *Publication of Regulations amending Canada’s Energy Efficiency Regulations*, <http://oee.nrcan.gc.ca/regulations/14566>, October 24, 2011.

⁴ Ibid.

and demand savings. To achieve this, ENSC contracted Econoler to conduct an impact evaluation of the introduction of new C&S in the Nova Scotia market.

KEY FINDINGS

The evaluation allowed an estimation of the impact, in terms of energy and demand savings, for the introduction of new C&S on the Nova Scotian market on products targeted by *Amendment 11*, as a result of the increase of stringency and/or scope on existing MEPS. However, since the Province did not implement the new MEPS for residential boilers (gas, oil and electric boilers) before the end of 2012, these three specific C&S were left out of the evaluation. Moreover, since it was not possible to obtain either a market analysis or any shipment data for digital television adapters, and assuming that the market size of these products is negligible, it was decided not to evaluate this C&S. Finally, single package vertical air conditioners and heat pumps, dry-type transformers and commercial self-contained refrigeration were also excluded from the evaluation because of a lack of reliable data available about the market size of these products and the difficulties to collect information through interviews with market experts.

The final total energy and demand savings per evaluated product are outlined in the next table.

Table 2: 2012 Evaluated Energy and Demand Savings at the Generator

Products	Estimated Shipments to Nova Scotia in 2012	Average Non-Compliance rate	Total Energy Savings at Generator	Total Demand Savings at Generator
Electric motors	3,338	61%	1.219 GWh	0.290 MW
General service incandescent reflector lamps	178,825	80.1%	7.267 GWh	4.073 MW
Large air conditioners and heat pumps	215	90%	0.898 GWh	0.300 MW
Standby for electronic products	181,590	15.3%	3.204 GWh	-
External power supplies	2,075,919	66.9%	3,765 GWh	-
Total	2,439,887	62,7%	16.353 GWh	4.663 MW

RECOMMENDATIONS

Evaluating the energy impact of any regulations or policy will always be more challenging than calculating the impact of a DSM program with a list of participants and a number of products distributed. For codes and standards, the main challenge resides in the necessity of understanding the whole market of the targeted products. This does not only include finding the quantity of products sold in a specific market, but also requires an in-depth characterisation of that market (e.g. quantity per size, type, efficiency level, etc.). Depending on the product, this information can be hard to obtain and may even be impossible to obtain in some cases, as shown by the exclusion of some C&S from this evaluation. Based on the activities conducted and results found, Econoler recommends the following to improve the success rate of future C&S impact evaluations:

- CS-R1. Collect all the studies conducted by NRCan on new MEPS implementation:** Before implementing any new standards, NRCan normally conducts a market analysis and an energy impact analysis. These studies allow NRCan to validate the minimum efficiency requirements of their new standards and analyze its potential impact on the market. These studies generally include information on the market size by category, the non-compliance rate and the estimated unitary savings values. As demonstrated in this report, this information is necessary for ENSC to estimate the energy impact of each standard on the Nova Scotia market. Therefore, the Evaluator recommends that ENSC request all the studies conducted by NRCan on new MEPS to be implemented in the future and for which ENSC intends to evaluate its impact.
- CS-R2. Prepare a list of contact names that could provide market information specific to Nova Scotia:** The Evaluator recommends that, for future evaluations, once ENSC knows which MEPS will be implemented during the target period, ENSC start preparing a list of contact names that could be interviewed. The objective of these interviews is to collect market information on each product and to validate the information provided in the NRCan studies mentioned in the preceding recommendation. The list of contact names should be prepared for each product by including manufacturers, distributors and any associations which might be able to provide information specific to the Nova Scotia market. Since the information available from NRCan is quite often at the national level, province-specific information or data cannot be easily derived or generated. Therefore, it is important to develop such a list specific to Nova Scotia.

1 CONTEXT AND BACKGROUND

In order to improve the efficiency of energy-using products sold in Canada, NRCan is constantly implementing “regulated minimum energy efficiency standards through amendments to the *Energy Efficiency Regulations*.”⁵ As part of Canada’s Clean Air Regulatory Agenda,⁶ which was established in 2006, three amendments to the *Energy Efficiency Regulations* “to deliver energy, greenhouse gas and air pollutant reductions” were planned.⁷ The second of these amendments, *Amendment 11*, was published in the *Canada Gazette* on October 12, 2011.

This amendment not only increases the stringency and/or scope of existing MEPS for seven currently regulated products, but also introduces new MEPS for five products.⁸ The new C&S were implemented six months after being published in the *Canada Gazette*, on April 12, 2012. Below are the products targeted by *Amendment 11*.

Table 3: Products Targeted by *Amendment 11*⁹

Products	Existing MEPS prior to <i>Amendment 11</i>	Reference code
Electric motors	Yes	CAN/CSA 390-10
Residential gas boilers	Yes	CSA P.2-07
Residential oil boilers	Yes	CSA P.2-07
Dry-type transformers	Yes	CAN/CSA 802.2-06
Large air conditioners and heat pumps	Yes	CAN/CSA 746-2006
Commercial self-contained refrigeration	Yes	HRAI Standard 1200-2008
General service incandescent reflector lamps	Yes	CAN/CSA 862-09
Standby for electronic products	No	CAN/CSA 62301-07
External power supplies	No	CSA 381.1-08
Electric boilers	No	CSA P.2-07
Single package vertical air conditioners and heat pumps	No	C746-06
Digital television adapters	No	CSA 380-08

⁵ Office of Energy Efficiency, *ecoENERGY Efficiency for Equipment Standards and Labelling*, <http://oee.nrcan.gc.ca/corporate/13752>, October 26, 2011.

⁶ Environment Canada. *Clean Air Regulatory Agenda: Backgrounder*, <http://www.ec.gc.ca/default.asp?lang=En&n=56D4043B-1&news=295B1964-9737-4F80-B064-B3088D9910BE>, October 28, 2011.

⁷ Office of Energy Efficiency, *Publication of Regulations amending Canada’s Energy Efficiency Regulations*, <http://oee.nrcan.gc.ca/regulations/14566>, October 24, 2011.

⁸ Ibid.

⁹ Ibid.

With the introduction of the new C&S in the Canadian market in 2012, ENSC set out to assess what the impact would be for Nova Scotia in terms of energy and demand savings. To achieve this, ENSC contracted Econoler to conduct an impact evaluation of the introduction of new C&S in the Nova Scotia market. However, since the Province did not implement the new MEPS for residential boilers (gas, oil and electric boilers) before the end of 2012, these three specific C&S were left out of the evaluation. Moreover, since it was not possible to obtain neither a market analysis nor any shipment data for digital television adapters, and assuming that the market size of these products is negligible, it was decided not to evaluate this C&S.

2 METHODOLOGY

2.1 OBJECTIVE AND APPROACH OF THE IMPACT EVALUATION

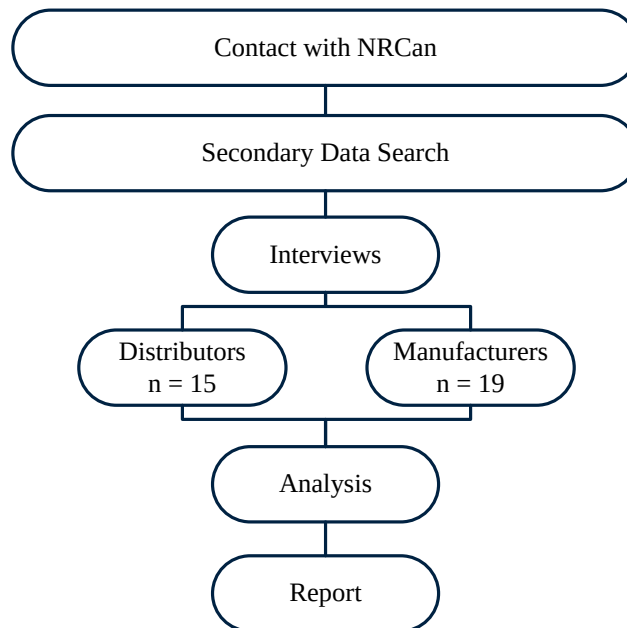
The purpose of the evaluation is to quantify, in terms of energy and demand savings, the impact of the introduction of eight new C&S in the Nova Scotia market in 2012. To achieve this, three major parameters are set:

- > The market size of each product category;
- > The portion of the market on which the C&S have had an impact;
- > The unitary savings values for each C&S, i.e., the difference between baseline consumption and consumption of products that meet the C&S.

2.2 METHODOLOGICAL MODEL

The figure below illustrates the research strategy used and features the different activities conducted throughout the evaluation.

Figure 1: Methodological Model



2.3 METHODOLOGY DESCRIPTION

2.3.1 Contact with Natural Resources Canada

NRCan was contacted in October and asked to provide documentation, including market analyses, produced for NRCan for all C&S evaluated, excluding C&S for digital television adapters.

For reference purposes, the protocol used by Econoler and its subcontractor, Extract Marketing Research, during the interview with NRCan is presented in Appendix I.

2.3.2 Secondary Data Search

As a first step to secondary research, the Evaluator sought out general information about the standards, such as:

- > Former regulation (where applicable);
- > Energy performance standards;
- > Unitary savings;
- > Effective date;
- > Harmonization with other standards around the world;
- > Largest distributors and manufacturers of the products targeted by the standards (phone numbers, addresses, websites and e-mail addresses).

The Evaluator also consulted all market analysis provided by NRCan in order to identify the market size of each product targeted by the eight C&S and the proportion impacted by the C&S for those same products.

The data gathered, mostly dating back between 2005 and 2007, were then extrapolated to yield 2012 estimates based on past market trends. To come up with a value for the market size in Nova Scotia, estimates were made based on provincial population ratios from the latest census. Consequently, it was estimated that shipments to Nova Scotia of all the products evaluated would account for 2.75% of total shipments to Canada.¹⁰

These estimates were also compared to data from Statistics Canada's Canadian International Merchandise Trade database.¹¹ Using that data, it was possible to obtain a rough estimate of the market size of some of the products evaluated by subtracting exports from imports. However, in most cases, the product categories used by Statistics Canada made that comparison impossible.

¹⁰ Statistics Canada. Population and dwelling counts, for Canada, provinces and territories, 2011 and 2006 censuses, November 4, 2012.

¹¹ Statistics Canada. Canadian International Merchandise Trade Database. Merchandise imports and exports between "Canada" and "World", by Harmonized System section, customs basis, September 2012.

Table 4: Methodology Used to Estimate Market Sizes

	Method to Estimate Total Shipments to Canada	Method to Estimate Shipments to Nova Scotia
Market Analysis Reports Shared by NRCan	Extrapolated to 2012 based on past market trends	Using the population ratio of Nova Scotia
Statistics Canada's Canadian International Merchandise Trade Database	Imports – (Re-exports + Exports)	Imports – (Re-exports + Exports)

Once estimates of the market size for all products and of the portion of the market impacted by the standards were completed, interviews were conducted by the Evaluator to validate the findings and collect additional information specific to Nova Scotia.

2.3.3 In-Depth Interviews with Distributors and Manufacturers

From November 12 to December 21, 34 in-depth interviews were conducted with distributors (15) and manufacturers (19) of products targeted by the eight standards evaluated. When setting up appointments with the organizations to be interviewed, the Evaluator asked for the person in the best position to provide estimates of the market size for products in Nova Scotia. These interviews were used to validate the estimates made regarding the market size for each product targeted by the standards and to help determine the portion of the market impacted by the standards.

When no data was found during the course of secondary data research, interviewees were asked to estimate the number of shipments made by their organization and the market share held by their organization to the best of their knowledge.

For reference purposes, the interview guides used by the Evaluator during the in-depth interviews with distributors and manufacturers are presented in Appendix II to VIII.

2.3.4 Analysis

Once all interviews were completed, the original estimates were adjusted based on comments made by the distributors and manufacturers interviewed. Once the market size for each product and the portion of the market impacted by the standards was determined, it was possible to estimate what impact the introduction of those new standards had on the market in Nova Scotia using the unitary savings determined in the secondary data research. This made it possible to estimate the savings attributable to each of the standards.

3 IMPACT EVALUATION

3.1 ELECTRIC MOTORS

3.1.1 Product Description

The definition of “electric motors” was changed with Amendment 11 to widen the scope of the former standards.¹² Under the new regulations, an electric motor is defined as a motor that:

- > is rated for continuous duty operation;
- > is a design type that is
 - an electric three-phase induction design,
 - a cage or squirrel-cage design, and
 - a NEMA design A, B or C with NEMA T or U frame dimensions, or IEC design N or H;
- > is designed to operate at a single speed;
- > has a nominal output power of not less than 0.746 kW, which equals 1 horsepower (HP), and not more than 375 kW (500 HP);
- > has a nominal voltage of not more than 600 V AC;
- > has a nominal frequency of 50/60 Hz or 60 Hz;
- > has a two-, four-, six- or eight-pole construction;
- > has an IP code from 00 to 66;
- > is of open or enclosed construction;
- > is of foot-mounted construction or flange-mounted construction; and
- > has a standard shaft, R-shaft or S-shaft, or is a close-coupled pump motor or a vertically-mounted solid shaft normal thrust motor;¹³

On the other hand, the new regulation does not include:

- > a NEMA design A or C motor of more than 150 kW (200 HP) and not more than 375 kW (500 HP) or an IEC design H motor of more than 150 kW (200 HP) and not more than 375 kW (500 HP).¹⁴

It is important to understand that if the motor is incorporated into another product, whether that said product is covered by MEPS or not, the motor would also need to conform to the MEPS for electric motors.¹⁵

¹² Office of Energy Efficiency, *Electric motors – October 2011 – Final Bulletin on Amending the Standard – Bulletin on Amendment 11*, <http://oe.e.nrcan.gc.ca/regulations/bulletins/11972>, October 12, 2011.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ Office of Energy Efficiency, *Electric motors – March 2009 – Bulletin on Proposed Regulations*, <http://oe.e.nrcan.gc.ca/regulations/bulletins/13494>, April 20, 2009.

3.1.2 Regulation Description

Previous Regulations

There have been MEPS for electric motors in Canada since 1995, with the introduction of the first *Canadian Energy Efficiency Regulations*.¹⁶ At that time, only 1 to 200 HP motors were targeted by the standards. In 1997, an amendment was introduced so that explosion-proof and integral-gear assembly motors were included. That amendment also increased the stringency of the standards. However, no substantial amendment to the standards had been introduced since 1997.

This former version of the standards would only cover 2-, 4- and 6-pole motors sized 1 to 200 HP.¹⁷

New Regulation

NRCan modified three elements regarding the MEPS for electric motors with the introduction of Amendment 11. The new regulations:

- > Increase the stringency of current motor efficiency requirements for 1 to 200 HP (0.75 to 150 kW) class motors to premium efficiency levels;
- > Eliminate most of the current exclusions for 1 to 200 HP (0.75 to 150 kW) motors so that they will have to meet the current efficiency levels, resulting in MEPS coverage for over 90% of motors sold in this size range;
- > Extend the MEPS coverage to include 201 to 500 HP (151 kW to 185 kW) motors, which were previously excluded, to current efficiency levels.¹⁸

Consequently, *Amendment 11* both increases the scope and the stringency of the former regulations. Table 5 and Table 6 present the new minimum performance levels required for electric motors. More specifically, Table 5 shows premium efficiency levels that a motor with all of the following classifications must meet or exceed:

- > rated size of 1 HP and up to and including 200 HP or IEC design motor of size greater than 0.746 kW and up to and including 150 kW, and
- > two, four or six poles, and
- > NEMA T frame or IEC frame designation of 90 or above, and
- > NEMA design A or B, or IEC design N, and
- > standard shaft, R-shaft or S-shaft or an IEC equivalent.¹⁹

¹⁶ Ibid.

¹⁷ Nielsen Engineering, *Harmonization of Minimum Efficiency Levels and Standards for Three Phase Induction Motors*, 2007, p. 4.

¹⁸ Office of Energy Efficiency, *Electric motors – March 2009 – Bulletin on Proposed Regulations*, <http://oee.nrcan.gc.ca/regulations/bulletins/13494>, April 20, 2009.

¹⁹ Office of Energy Efficiency, *Electric Motors – Updated Bulletin on Amending the Standards - June 2010 (as pre-published)*, <http://oee.nrcan.gc.ca/regulations/bulletins/17333>, January 20, 2011.

Table 6 shows efficiency levels that a motor with any of the following classifications must meet or exceed:

- > 8-pole construction, or
- > U frame or equivalent IEC dimensions, or
- > NEMA design C or IEC design H, or
- > close-coupled pump motor, or
- > fire pump duty motor, or
- > vertically-mounted solid shaft normal thrust motor, as tested in the horizontal configuration, or
- > footless construction, or
- > 2-, 4- or 6-pole, NEMA design B motor of size greater than 200 HP and up to and including 500 HP or IEC design N motor of size greater than 150 kW and up to and including 375 kW.²⁰

The new regulation came into force on April 12, 2012 for targeted motors for which the manufacturing process was completed on or after January 1, 2011.²¹ It harmonizes with MEPS established for similar products in the United States.

²⁰ Ibid.

²¹ Office of Energy Efficiency, *Electric motors – October 2011 – Final Bulletin on Amending the Standard – Bulletin on Amendment 11*, <http://oee.nrcan.gc.ca/regulations/bulletins/11972>, October 12, 2011.

Table 5: Electric Motors – Minimum Nominal Efficiency Standard (Premium)²²

Item	Power in HP	Power in kW	Energy Efficiency Standard (Percentage)					
			Open			Enclosed		
			2 Pole	4 Pole	6 Pole	2 Pole	4 Pole	6 Pole
1.	1	0.75	77.0	85.5	82.5	77.0	85.5	82.5
2.	1.5	1.1	84.0	86.5	86.5	84.0	86.5	87.5
3.	2	1.5	85.5	86.5	87.5	85.5	86.5	88.5
4.	3	2.2	85.5	89.5	88.5	86.5	89.5	89.5
5.	4	3.0	86.5	89.5	89.5	88.5	89.5	89.5
6.	5	3.7	86.5	89.5	89.5	88.5	89.5	89.5
7.	5.5	4.0	86.5	89.5	89.5	88.5	89.5	89.5
8.	7.5	5.5	88.5	91.0	90.2	89.5	91.7	91.0
9.	10	7.5	89.5	91.7	91.7	90.2	91.7	91.0
10.	15	11	90.2	93.0	91.7	91.0	92.4	91.7
11.	20	15	91.0	93.0	92.4	91.0	93.0	91.7
12.	25	19	91.7	93.6	93.0	91.7	93.6	93.0
13.	30	22	91.7	94.1	93.6	91.7	93.6	93.0
14.	40	30	92.4	94.1	94.1	92.4	94.1	94.1
15.	50	37	93.0	94.5	94.1	93.0	94.5	94.1
16.	60	45	93.6	95.0	94.5	93.6	95.0	94.5
17.	75	55	93.6	95.0	94.5	93.6	95.4	94.5
18.	100	75	93.6	95.4	95.0	94.1	95.4	95.0
19.	125	90	94.1	95.4	95.0	95.0	95.4	95.0
20.	150	110	94.1	95.8	95.4	95.0	95.8	95.8
21.	175	132	95.0	95.8	95.4	95.4	96.2	95.8
22.	200	150	95.0	95.8	95.4	95.4	96.2	95.8

²² Office of Energy Efficiency, *Electric Motors – Updated Bulletin on Amending the Standards - June 2010 (as pre-published)*, <http://oee.nrcan.gc.ca/regulations/bulletins/17333>, January 20, 2011.

Table 6: Electric Motors – Minimum Nominal Efficiency Standard (Energy Efficient)²³

Item	Power in HP	Power in kW	Energy Efficiency Standard (Percentage)							
			Open				Enclosed			
			2 Pole	4 Pole	6 Pole	8 Pole	2 Pole	4 Pole	6 Pole	8 Pole
1.	1	0.75	75.5	82.5	80.0	74.0	75.5	82.5	80.0	74.0
2.	1.5	1.1	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
3.	2	1.5	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
4.	3	2.2	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
5.	4	3	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
6.	5	3.7	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
7.	5.5	4	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
8.	7.5	5.5	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
9.	10	7.5	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
10.	15	11	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
11.	20	15	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5
12.	25	19	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
13.	30	22	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
14.	40	30	91.7	93.0	93.0	91.0	91.7	93.0	93.0	91.0
15.	50	37	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
16.	60	45	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
17.	75	55	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
18.	100	75	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0
19.	125	90	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
20.	150	110	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
21.	175	132	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
22.	200	150	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
23.	250	185	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
24.	300	225	95.0	95.4	95.4		95.4	95.4	95.0	
25.	350	260	95.0	95.4	95.4		95.4	95.4	95.0	
26.	400	300	95.4	95.4			95.4	95.4		
27.	450	335	95.8	95.8			95.4	95.4		
28.	500	375	95.8	95.8			95.4	95.8		

²³ Office of Energy Efficiency, *Electric Motors – Updated Bulletin on Amending the Standards - June 2010 (as pre-published)*, <http://oee.nrcan.gc.ca/regulations/bulletins/17333>, January 20, 2011.

3.1.3 Products Covered by the Introduction of the New Standard

The new regulations require the majority of electric motors that were already regulated (2-, 4- and 6 pole motors sized 1 to 200 HP) to meet or exceed higher MEPS (premium efficiency).²⁴

On the other hand, motors that were not already covered by the standards, such as 8-pole motors and motors sized 201 to 500 HP, are henceforth required to meet the efficiency levels of the former regulations.

Thus, most three-phase electric motors of 1 to 500 HP are affected by the introduction of this new standard.

3.1.4 Estimation of the Market Size

In a report prepared for NRCan, Nielsen Engineering analyzed sales data supplied by the Electrical Equipment Manufacturers Association of Canada (EEMAC).²⁵ Using Excel's trend function, Nielsen Engineering extrapolated this data to 2010. Using a similar approach, Econoler was able to approximate the market size of electric motors in Canada for 2012 (see Table 7). The estimated number of shipments to Nova Scotia in 2012 was obtained using the demographic weight of the province.

Table 7: Estimated 2012 Market Size of Three-Phase Electric Motors in Canada and in Nova Scotia

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
Three-phase electric motors sized 1 to 5 HP	50,526 shipments	1,389 shipments
Three-phase electric motors sized 6 to 25 HP	43,850 shipments	1,206 shipments
Three-phase electric motors sized 26 to 100 HP	23,034 shipments	633 shipments
Three-phase electric motors sized 101 to 200 HP	2,423 shipments	67 shipments
Three-phase electric motors sized 201 to 500 HP	1,552 shipments	43 shipments

²⁴ Office of Energy Efficiency, *Electric Motors – Updated Bulletin on Amending the Standards - June 2010 (as pre-published)*, <http://oee.nrcan.gc.ca/regulations/bulletins/17333>, January 20, 2011.

²⁵ Nielsen Engineering, *Harmonization of Minimum Efficiency Levels and Standards for Three Phase Induction Motors*, 2007, p. 16.

Statistics Canada's Canadian International Merchandise Trade Database contains general data regarding importations and exportations of electric motors.²⁶ However, the information is provided for electric motors of different sizes, without specific data for three-phase electric motors. Since data is not yet available for the fourth quarter of 2012, the average of the numbers for the first three quarters was used to produce an estimate for the whole year. Subtracting exportations and re-exportations from importations, an estimation of the market size of all electric motors in Canada and in Nova Scotia was made. It is presented in Table 8.

Table 8: Estimated 2012 Market Size of All Electric Motors in Canada and in Nova Scotia²⁷

Product Class	Canada: Importations – (Re-exportations + Exportations) in 2012	Nova Scotia: Importations - Exportations in 2012
Electric motors sized 1 to 100 HP	312,965 shipments	152 shipments
Electric motors sized 101 to 500 HP	3,839 shipments	0 shipment

Consequently, both the number from the Nielsen Engineering report and from Statistics Canada's Canadian International Merchandise Trade Database (with rounded numbers) were presented to the 2 distributors and 5 manufacturers interviewed so they could help us identify which one is closest to reality. During the course of the interviews, it became obvious that manufacturers and distributors of electric motors did not have accurate information regarding the market size and the non-compliance rate of their products. However, in most cases, the initial estimates based on Nielsen Engineering's report were deemed acceptable by the interviewees.

As a result, the estimates based on Statistics Canada's Canadian International Merchandise Trade Database were discarded and no modifications were made to the shipment numbers based on Nielsen Engineering's report (see Table 8).

3.1.5 Portion of the Market Impacted by the Standard

In the report prepared by Nielsen Engineering, the ratio of NEMA Premium efficiency motors sales is provided for 2003 to 2007. This data comes from both a survey of motor manufacturers, dealers and distributors across Canada and from a survey conducted by EEMAC among its members.²⁸ Considering motors from 1 to 200 HP will have to meet premium efficiency standards, it is easy to estimate the ratio of non-compliant electric motors in that category.

²⁶ Statistics Canada. Canadian International Merchandise Trade Database. Merchandise imports and exports between "Canada" and "World", by Harmonized System section, customs basis, September 2012.

²⁷ Statistics Canada, Table 970-0085, Table 980-0085 & Table 990-0085: Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles, September 2012

²⁸ Nielsen Engineering, Harmonization of Minimum Efficiency Levels and Standards for Three Phase Induction Motors, 2007, pp. 18-19.

For electric motors sized 201 to 500 HP, the MEPS being less stringent, the ratio of NEMA Premium efficiency motors sales only allow us to estimate a maximum ratio of non-compliant electric motors. Unfortunately, Nielsen Engineering's report does not provide provincial information regarding the sales of non-compliant electric motors. Nevertheless, the Canadian compliance rates were deemed applicable for all provinces and were therefore used for Nova Scotia. Table 9 shows the initial estimate of the portion of the market impacted by the standard.

Table 9: Initial Estimate of the Portion of the Three-Phase Electric Motors Market Impacted by the Standard

Product Class	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012
Three-phase electric motors sized 1 to 5 HP	71.2%
Three-phase electric motors sized 6 to 25 HP	56.1%
Three-phase electric motors sized 26 to 100 HP	48.3%
Three-phase electric motors sized 101 to 200 HP	47.5%
Three-phase electric motors sized 201 to 500 HP	77.1%

During the course of the interviews, participants had a difficult time estimating the portion of the electric motors market impacted by the standard. Faced with contradictory information, it proved impossible to reach a consensus among the interviewees. Since the non-compliance rates calculated by Nielsen Engineering were based on a wider effort in terms of survey size, Econoler deemed the results obtained acceptable.

3.1.6 Unitary Savings Values

In *Amendment 11*, the unitary savings values for some types of electric motors are provided. That information is presented in Table 10.

Table 10: Unitary Savings Values – Electric Motors²⁹

Product Class	Annual Peak Demand Savings (W/yr./unit)	Annual Energy Savings (kWh/yr./unit)
5 horsepower	51	133
15 horsepower	103	325
30 horsepower	175	637
75 horsepower	464	2,161
150 horsepower	565	2,677
300 horsepower	1,568	8,536

3.1.7 At Meter Energy Savings

The Evaluator estimated the impact of the introduction of this standard in the Nova Scotian market, in terms of “at meter” energy savings, by using the data collected on unitary savings, the market size of electric motors in Nova Scotia and the non-compliance rate. Since NRCan had only provided unitary savings values for specific sizes of electric motors, a sole value for motors of the same size category had to be used. Also, for three-phase electric motors sized 26 to 100 HP, Econoler took the unitary savings values given for 30 HP electric motors (637 kWh/yr./unit) and for 75 HP electric motors (2,161 kWh/yr./unit) and used the average of these two values (1,399 kWh/yr./unit).

As presented in Table 11, the introduction of the electric motors standard in the Nova Scotian Market resulted in an estimated total energy savings, at meter, of 1.146 GWh.

²⁹ Office of Energy Efficiency, *Energy Efficiency Act: Regulations Amending the Energy Efficiency Regulations*, <http://canadagazette.gc.ca/rp-pr/p2/2011/2011-10-12/html/sor-dors182-eng.html>, October 12, 2011.

Table 11: Energy Savings from the Introduction of the Electric Motors Standard in the Nova Scotian Market

Product Class	Shipments to Nova Scotia in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012	Annual Energy Savings	Total Energy Savings at Meter for 2012
Three-phase electric motors sized 1 to 5 HP	1,389 shipments	71.2%	133 kWh/yr./unit	0.132 GWh
Three-phase electric motors sized 6 to 25 HP	1,206 shipments	56.1%	325 kWh/yr./unit	0.220 GWh
Three-phase electric motors sized 26 to 100 HP	633 shipments	48.3%	1,399 kWh/yr./unit	0.428 GWh
Three-phase electric motors sized 101 to 200 HP	67 shipments	47.5%	2,677 kWh/yr./unit	0.085 GWh
Three-phase electric motors sized 201 to 500 HP	43 shipments	77.1%	8,536 kWh/yr./unit	0.281 GWh
Total	3 338 shipments	61.0%		1.146 GWh

3.1.8 At Meter Demand Savings

Finally, the Evaluator estimated the “at meter” demand savings by using the data collected on peak demand savings, the market size of electric motors in Nova Scotia, the non-compliance rate and a diversity factor. As for energy savings, a sole value for motors of the same size category had to be used and Econoler used the average of 30 HP and 75 HP electric motors for three-phase electric motors sized 26 to 100 HP. A diversity factor of 93 percent was used, based on the on-site visits conducted through Business Energy Rebates (BER), to estimate the diversity factor for similar motors.

As presented in Table 12, the introduction of the electric motors standard in the Nova Scotian market resulted in an estimated total demand savings, at meter, of 0.272 MW.

Table 12: Demand Savings from the Introduction of the Electric Motors Standard in the Nova Scotian Market

Product Class	Shipments to Nova Scotia in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012	Peak Demand Savings	Diversity Factor	Total Demand Savings at Meter for 2012
Three-phase electric motors sized 1 to 5 HP	1,389 shipments	71.2%	51 W/yr./unit	93 %	0.047 MW
Three-phase electric motors sized 6 to 25 HP	1,206 shipments	56.1%	103 W/yr./unit	93 %	0.065 MW
Three-phase electric motors sized 26 to 100 HP	633 shipments	48.3%	337 W/yr./unit	93 %	0.096 MW
Three-phase electric motors sized 101 to 200 HP	67 shipments	47.5%	565 W/yr./unit	93 %	0.017 MW
Three-phase electric motors sized 201 to 500 HP	43 shipments	77.1%	1,568 W/yr./unit	93 %	0.048 MW
Total	3 338 shipments	61.0%			0.272 MW

3.2 GENERAL SERVICE INCANDESCENT REFLECTOR LAMPS

3.2.1 Product Description

Incandescent reflector lamps are lamps that emit both light and heat in all directions. They are called reflector lamps because they direct light primarily away from the base by means of a reflective coating on a portion of the inside surface of the bulb. There are four principal incandescent-reflector-lamp bulb shapes: reflector (R), parabolic aluminized reflector (PAR), bulged reflector (BR), and elliptical reflector (ER).

For the purposes of energy efficiency regulations in both Canada and the U.S., incandescent reflector lamps are divided into categories by wattage (i.e. electricity consumption). A minimum average efficacy is typically attributed to each wattage category.

3.2.2 Regulation Description

Previous Regulations

When the first *Canadian Energy Efficiency Regulations* came into effect in 1995, MEPS were introduced for general service incandescent reflector lamps.³⁰ “Consistent with the *U.S. Energy Policy Act of 1992*” these regulations solely covered R and PAR lamps, as well as lamps with similar bulb shapes.³¹

In 2002, the Canadian government revised the regulations to widen their scope. At the time, the MEPS applied to ER and BR lamps. However, some BR lamps were exempted: BR30 lamps of 66 watts or less; 85-watt BR30 lamps and BR38 to BR40 lamps with a rated power of less than 121 watts.

The following tables show the former MEPS (2002 – April 11, 2012) for general service incandescent reflector lamps:

Table 13: Former Minimum Efficacy Levels for PAR, R, BR Lamps and ER Lamps³²

Rated Wattage (W)	Minimum Average Efficacy (lm/W)
40–50	10.5
51–59	11.0
60–85	12.5
86–115	14.0
116–155	14.5
156–205	15.0

Table 14: Former Minimum Efficacy Levels for ER Lamps³³

Rated Wattage (W)	Minimum Average Efficacy (lm/W)
50	7.0
75	6.5
120	10.0

³⁰ Office of Energy Efficiency, *General Service Incandescent Reflector Lamps – First Bulletin on Amending the Standards*. January 2009, <http://oee.nrcan.gc.ca/regulations/bulletins/8877>, April 20, 2009.

³¹ Ibid.

³² Ibid.

³³ Ibid.

New Regulations

With Amendment 11, NRCan has applied the current MEPS for PAR, R and BR lamps (see Table 15) to all regulated general service incandescent reflector lamps, with the exception of certain ER lamps (ER30 and ER40 lamps of 50 watts or less and ER40 lamps of 65 watts).

In addition to the current exemptions for specialty products (e.g. coloured lamps, heat lamps, plant growth lamps, some special-service and special-use lamps, etc.), the following lamps are exempted:

- > R lamps with a diameter of 63.5 mm or less (R 20) and a rated power ≤ 45 watts;
- > BR30 (95 mm) and BR40 (127 mm) of 50 watts or less and BR30 and BR40 lamps of 65 watts;
- > Silver bowl lamps;
- > Lamps for heat-sensitive applications.³⁴

All lamps exempted from the new regulations will continue to be required to meet pre-amendment efficiency levels.

Table 15 shows the MEPS that, as of April 12, 2012, all general service incandescent reflector lamps are required to meet if their manufacturing process was completed on or after June 1, 2009.

Table 15: Current Minimum Efficacy Levels for PAR, R and BR Lamps³⁵

Rated Wattage (W)	Minimum Average Efficacy (lm/W)
ER 30 or ER 40 lamps	
≤ 50	7.0
All other lamps	
40–50	10.5
51–59	11.0
60–85	12.5
86–115	14.0
116–155	14.5
156–205	15.0

These new regulations are primarily harmonized with the *U.S. Energy Independence and Security Act of 2007*, signed into law in December 2007.³⁶

³⁴ Office of Energy Efficiency, *General Service Incandescent Reflector Lamps – First Bulletin on Amending the Standards*. January 2009, <http://oee.nrcan.gc.ca/regulations/bulletins/8877>, April 20, 2009.

³⁵ Office of Energy Efficiency, *General Service Incandescent Reflector Lamps – Final Bulletin on Amending the Standard*, <http://oee.nrcan.gc.ca/regulations/488>, October 25, 2011.

³⁶ Ibid.

3.2.3 Products Covered by the Introduction of the New Standard

The following types of lamps were previously not required to meet current MEPS for PAR, R and BR lamps but are required to do so from now on:

- > BR18 to BR30 lamps of 65 watts or less (with the exception of BR30 lamps of 50 watts or less and BR30 lamps of 65 watts);
- > BR30 lamps of 85 watts;
- > BR38 to BR40 lamps of 120 watts or less (with the exception of BR40 lamps of 50 watts or less and BR40 lamps of 65 watts);
- > ER lamps (with the exception of ER30 lamps of 50 watts or less, ER40 lamps of 50 watts or less and ER40 lamps of 65 watts).

3.2.4 Estimating the Market Size

In a report prepared by Navigant Consulting (a report commissioned by NRCan in order to prepare the amendment to the Regulations targeting general service incandescent reflector lamps), national Canadian shipment estimates for BR and ER lamps.³⁷ This data came from both a survey conducted in 2006 by Navigant Consulting among members of Electro-Federation Canada (EFC) and a 2002 study conducted by EFC. However, the data that came from the BR lamp survey was not complete enough to prepare an energy savings analysis.³⁸ Consequently, Navigant Consulting came up with estimates of the 2005 Canadian shipments of BR lamps, scaling from the same proportions observed in the 2002 study.

Using the same method presented in the Methodology section of this report, available data was extrapolated to yield 2012 estimates. Since no provincial shipment estimates were provided in Navigant Consulting's report, estimates for Nova Scotia were obtained using provincial population ratios from the 2011 census. Consequently, it was estimated that 2.75% of total Canadian shipments went to the Nova Scotia market. Table 16 shows estimated total shipments of BR and ER lamps to both Canada and Nova Scotia for 2012.

³⁷ Navigant Consulting, Evaluation of Updating Regulations for Bulge Reflector Lamps and Elliptical Reflector Lamps, March 31, 2007, p. 20.

³⁸ *Ibid.* p. 22.

Table 16: Estimated 2012 Market Size of BR and ER Lamps in Canada and in Nova Scotia³⁹

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
60–66 W BR – residential	2,110,512 shipments	58,039 shipments
67–85 W BR – residential	1,253,259 shipments	34,465 shipments
86–115 W BR – residential	131,036 shipments	3,603 shipments
116–155 W BR – residential	337,911 shipments	9,293 shipments
75 W ER30 – residential	84 shipments	2 shipments
120 W ER40 – residential	5 shipments	0 shipment
60–66 W BR – commercial	1,726,782 shipments	47,487 shipments
67–85 W BR – commercial	736,041 shipments	20,241 shipments
86–115 W BR – commercial	5,460 shipments	150 shipments
116–155 W BR – commercial	190,075 shipments	5,227 shipments
75 W ER30 – commercial	4,558 shipments	125 shipments
120 W ER40 – commercial	496 shipments	14 shipments

Unfortunately, it was impossible to compare these estimates to data from Statistics Canada's Canadian International Merchandise Trade database, since there are no specific categories for incandescent reflector lamps in that database. Consequently, during the interviews, manufacturers and distributors were asked to validate the data contained in Table 16.

However, to facilitate the interview process, some product classes were regrouped and shipment numbers were rounded (see Table 17).

**Table 17: Data Presented to Manufacturers and Distributors during the Interviews – 2012
Market Size of BR and ER Lamps in Canada and in Nova Scotia**

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
60–85 W BR – residential	3,350,000 shipments	92,500 shipments
86–155 W BR – residential	470,000 shipments	12,800 shipments
75 W ER30 – residential	84 shipments	2 shipments
120 W ER40 – residential	5 shipments	0 shipment
60–85 W BR – commercial	2,500,000 shipments	68,000 shipments
86–155 W BR – commercial	195,000 shipments	5,400 shipments
75 W ER30 – commercial	4,550 shipments	125 shipments
120 W ER40 – commercial	500 shipments	14 shipments

³⁹ Navigant Consulting, Evaluation of Updating Regulations for Bulge Reflector Lamps and Elliptical Reflector Lamps, March 31, 2007, pp. 22-24.

Interviews were conducted with 2 manufacturers and 4 distributors. During the interviews, most participants agreed with the initial estimates regarding the market size of general service incandescent reflector lamps in Nova Scotia. However, since the residential ER30 lamps of 75 W, the residential ER40 lamps of 120 W and the commercial ER40 lamps of 120 W markets are marginal in Nova Scotia (less than 20 units sold), those categories were excluded from the analysis.

Table 18 shows the final estimates of the market size of BR and ER lamps in Canada and in Nova Scotia.

Table 18: 2012 Market Size of BR and ER Lamps in Canada and in Nova Scotia

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
60–85 W BR – residential	3,350,000 shipments	92,500 shipments
86–155 W BR – residential	470,000 shipments	12,800 shipments
60–85 W BR – commercial	2,500,000 shipments	68,000 shipments
86–155 W BR – commercial	195,000 shipments	5,400 shipments
75 W ER30 – commercial	4,550 shipments	125 shipments

3.2.5 Portion of the Market Impacted by the Standard

In its report, Navigant Consulting does not provide data regarding the percentage of shipments that would be affected by *Amendment 11* (i.e. ratio of non-compliant lamps shipments). Therefore, only an average of the data collected from the interviews could be used to estimate the portion of the market impacted by the adoption of the standard (see Table 19).

Table 19: Portion of the BR and ER Lamps Market Impacted by the Standard

Product Class	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012
60–85 W BR – residential	82.5%
86–155 W BR – residential	81.3%
60–85 W BR – commercial	77.0%
86–155 W BR – commercial	77.0%
75 W ER30 – commercial	75.0%

3.2.6 Unitary Savings Values

When *Amendment 11* was published in the *Canada Gazette*, the Office of Energy Efficiency (OEE) published the unitary savings values for some of the general service incandescent reflector lamps targeted by the Regulations. This information is presented in Table 20.

Table 20: Unitary Savings Values – General Service Incandescent Reflector Lamps⁴⁰

Product Class	Annual Peak Demand Savings (W/yr./unit)	Annual Energy Savings (kWh/yr./unit)
Residential		
85 watt BR30 – residential	21	18
75 watt BR38 – residential	21	18
120 watt BR40 – residential	26	22
75 watt ER30 – residential	21	18
120 watt ER40 – residential	26	22
Commercial		
85 watt BR30 – commercial	25	89
75 watt BR38 – commercial	25	89
120 watt BR40 – commercial	30	107
75 watt ER30 – commercial	25	89
120 watt ER40 – commercial	30	107

⁴⁰ Office of Energy Efficiency, *Energy Efficiency Act: Regulations Amending the Energy Efficiency Regulations*, <http://canadagazette.gc.ca/rp-pr/p2/2011/2011-10-12/html/sor-dors182-eng.html>, October 12, 2011.

3.2.7 At Meter Energy Savings

Econoler estimates that 6.716 GWh were saved, at meter, in Nova Scotia in 2012 as a result of the introduction of the standard for general service incandescent reflector lamps.

Table 21: Energy Savings from the Introduction of the General Service Incandescent Reflector Lamps Standard in the Nova Scotia Market

Product Class	Shipments to Nova Scotia in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012	Annual Energy Savings	Total Energy Savings at Meter for 2012
60–85 W BR – residential	92,500 shipments	82.5%	18 kWh/yr./unit	1.374 GWh
86–155 W BR – residential	12,800 shipments	81.3%	22 kWh/yr./unit	0.229 GWh
60–85 W BR – commercial	68,000 shipments	77.0%	89 kWh/yr./unit	4.660 GWh
86–155 W BR – commercial	5,400 shipments	77.0%	107 kWh/yr./unit	0.445 GWh
75 W ER30 – commercial	125 shipments	75.0%	89 kWh/yr./unit	0.008 GWh
Total	178,825 shipments	80.1%		6.716 GWh

3.2.8 At Meter Demand Savings

Econoler estimates that 3.764 MW were saved, at meter, in Nova Scotia in 2012 as a result of introducing the standard for general service incandescent reflector lamps. The diversity factor of 97 percent comes from the 2012 BER evaluation report, wherein on-site visits were used to estimate the average diversity factor of lighting products installed inside and outside participating buildings.

Table 22: Demand Savings from the Introduction of the General Service Incandescent Reflector Lamps Standard in the Nova Scotia Market

Product Class	Shipments to Nova Scotia in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012	Annual Demand Savings	Diversity Factor	Total Demand Savings at Meter for 2012
60–85 W BR – residential	92,500 shipments	82.5%	21 W/yr./unit	97 %	1.554MW
86–155 W BR – residential	12,800 shipments	81.3%	26 W/yr./unit	97 %	0.262 MW
60–85 W BR – commercial	68,000 shipments	77.0%	25 W/yr./unit	97 %	1.270 MW
86–155 W BR – commercial	5,400 shipments	77.0%	30 W/yr./unit	97 %	0.121 MW
75 W ER30 – commercial	125 shipments	75.0%	25 W/yr./unit	97 %	0.002 MW
Total	178,825 shipments	80.1%			3.764 MW

3.3 DRY-TYPE TRANSFORMERS

3.3.1 Product Description

The definition for dry-type transformers was amended in the last revision of the regulations.⁴¹ Since April 12, 2012, a dry-type transformer, according to the new standard, is defined as:

A transformer in which the core and windings are in a gaseous or dry compound and that is:

- > either single phase and nominal power of 15 to 833 kVA, or three-phase and nominal power of 15 to 7,500 kVA;
- > 60 Hz;
- > high-voltage winding of 35 kV or less.

This description excludes:

- > auto transformers;
- > drive (isolation) transformers with two or more output windings or a nominal low-voltage line current greater than 1,500 A;
- > grounding transformers;
- > rectifier transformers;
- > sealed transformers;
- > non-ventilated transformers, including encapsulated;
- > testing transformers;
- > furnace transformers;
- > welding transformers;
- > special impedance transformers;
- > transformers with a nominal low-voltage line current of 4,000 A or more;
- > on-load regulating transformers;
- > resistance grounding transformers.

Encapsulated transformers are considered a subset of non-ventilated transformers and are excluded from this Regulation.⁴²

⁴¹ Navigant Consulting, *Market Analysis for Dry-type Transformers*, June 6, 2008, p. 10.

⁴² Office of Energy Efficiency, *Dry-type transformers – Final Bulletin on Amending the Standard – October 2011*, <http://oee.nrcan.gc.ca/regulations/bulletins/16910>, October 12, 2011.

3.3.2 Regulation Description

Previous Regulations

The first regulation of dry-type transformers was introduced on April 23, 2003 with an effective date of January 1, 2005.⁴³ After being made aware by manufacturers of the presence of “some loopholes in the Regulations that would allow lower-cost, exempt transformers to compete unfairly with transformers that comply with the regulations,” NRCAN amended the regulations in 2006 to “eliminate some of the exemptions.”⁴⁴ The other major change that amendment introduced was the adoption of two basic impulse insulation level (BIL) groupings for medium-voltage dry-type transformers.⁴⁵

Until the introduction of *Amendment 11*, single-phase dry-type transformers of 15 to 833 kilovolt-amperes (kVA) and three-phase dry-type transformers of 15 to 7,500 kVA were covered by the regulations.⁴⁶ Here are the MEPS that had to meet covered dry-type transformers before the most recent modification of the regulations.

⁴³ Office of Energy Efficiency, *Dry-type transformers – November 2006 – Bulletin on Amendment Final*, <http://oee.nrcan.gc.ca/regulations/bulletins/13719>, June 30, 2009.

⁴⁴ *Ibid.*

⁴⁵ Navigant Consulting, *Market Analysis for Dry-type Transformers*, June 6, 2008, p. 10.

⁴⁶ *Ibid.* p. 11.

Table 23: Former Minimum Efficiency Levels for Dry-type Transformers⁴⁷

Single-phase				Three-phase			
	Voltage Class = 1.2 kV	Voltage Class > 1.2 kV			Voltage Class = 1.2 kV	Voltage Class > 1.2 kV	
		BIL ≤ 60 kV	BIL > 60 kV			BIL ≤ 60 kV	BIL > 60 kV
kVA	Efficiency, % at 0.35 per Unit Nameplate Load	Efficiency, % at 0.5 per Unit Nameplate Load	Efficiency, % at 0.5 per Unit Nameplate Load	kVA	Efficiency, % at 0.35 per Unit Nameplate Load	Efficiency, % at 0.5 per Unit Nameplate Load	Efficiency, % at 0.5 per Unit Nameplate Load
15	97.70	97.60	97.60	15	97.00	96.80	96.80
25	98.00	97.90	97.90	30	97.50	97.30	97.30
37.5	98.20	98.10	98.10	45	97.70	97.60	97.60
50	98.30	98.20	98.20	75	98.00	97.90	97.90
75	98.50	98.40	98.40	112.5	98.20	98.10	98.10
100	98.60	98.50	98.50	150	98.30	98.20	98.20
167	98.70	98.80	98.70	225	98.50	98.40	98.40
250	98.80	98.90	98.80	300	98.60	98.60	98.50
333	98.90	99.00	98.90	500	98.70	98.80	98.70
500	–	99.10	99.00	750	98.80	98.90	98.80
667	–	99.20	99.00	1,000	98.90	99.00	98.90
833	–	99.20	99.10	1,500	–	99.10	99.00
				2,000	–	99.20	99.00
				2,500	–	99.20	99.10
				3,000	–	99.20	99.10
				3,750	–	99.30	99.20
				5,000	–	99.30	99.20
				7,500	–	99.30	99.20

⁴⁷ Canadian Standards Association, *Minimum efficiency for dry-type transformers*, http://www.hammondpowersolutions.com/upload_files/csa_c802%202-2006.pdf, January 23rd, 2007, p. 6.

New Regulation

Amendment 11 introduces more stringent minimum efficiency levels solely for dry-type transformers with a BIL greater than 1.2kV. Those with a BIL of 1.2 kV are required to meet the same MEPS as before (see Table 24).⁴⁸

In that new version of the regulations, the classification of dry-type transformers with regards to the BIL has been modified in an effort to harmonize the Canadian standards with the new U.S. Department of Energy (U.S. DOE) minimum efficiency established on January 1, 2010.⁴⁹ However, since the American regulation did not set minimum efficiency levels for some ranges of transformers that were currently regulated in Canada, NRCAN modified the efficiency levels to include those products.⁵⁰

Table 24: Minimum Efficiency Performance Standards for Dry-type Transformers Having a Primary Voltage BIL Rating Greater than 1.2kV

kVA	Single Phase Efficiency (%)			kVA	Three Phase Efficiency (%)		
	20-45kV BIL	46-95kV BIL	96-199kV BIL		20-45kV BIL	46-95kV BIL	96-199kV BIL
15	98.10	97.86	97.60	15	97.50	97.18	96.80
25	98.33	98.12	97.90	30	97.90	97.63	97.30
37.5	98.49	98.30	98.10	45	98.10	97.86	97.60
50	98.60	98.42	98.20	75	98.33	98.12	97.90
75	98.73	98.57	98.53	112.5	98.49	98.30	98.10
100	98.82	98.67	98.63	150	98.60	98.42	98.20
167	98.96	98.83	98.80	225	98.73	98.57	98.53
250	99.07	98.95	98.91	300	98.82	98.67	98.63
333	99.14	99.03	98.99	500	98.96	98.83	98.80
500	99.22	99.12	99.09	750	99.07	98.95	98.91
667	99.27	99.18	99.15	1,000	99.14	99.03	98.99
833	99.31	99.23	99.20	1,500	99.22	99.12	99.09
-				2,000	99.27	99.18	99.15
-				2,500	99.31	99.23	99.20
-				3,000	99.34	99.26	99.24
-				3,750	99.38	99.30	99.28
-				5,000	99.42	99.35	99.33
-				7,500	99.48	99.41	99.39

⁴⁸ Office of Energy Efficiency, *Dry-type transformers – Final Bulletin on Amending the Standard – October 2011*, <http://oee.nrcan.gc.ca/regulations/bulletins/16910>, October 12, 2011.

⁴⁹ Office of Energy Efficiency, *Dry-type transformers – June 2010 – Bulletin on Amending the Standards Update*, <http://oee.nrcan.gc.ca/regulations/bulletins/10086>, June 10, 2010.

⁵⁰ Ibid.

Since April 12, 2012, targeted dry-type transformers are required to meet these MEPS if their manufacturing process was completed on or after January 1, 2010.⁵¹

3.3.3 Products Covered by the Introduction of the New Standard

Only dry-type transformers with a BIL greater than 1.2 kV are targeted by the new, more stringent MEPS. Dry-type transformers of 1.2 kV are not affected by this revision and are still required to meet the same efficiency levels.⁵²

3.3.4 Estimation of the Market Size

The initial estimation of the market size was based on a report written by Navigant Consulting in 2008. Navigant Consulting surveyed five manufacturers, asking them to comment on a straw man estimate it had prepared beforehand, thus obtaining an estimate of the number of shipments of dry-type transformers to Canada in 2007.⁵³ Without more recent data, nor older data to use for an extrapolation, the shipment numbers from 2007 were assumed to still be valid in 2012.

Also, NRCan and Navigant Consulting decided to conduct economic analysis solely for three-phase dry-type transformers.⁵⁴ Since no analyses were made for single-phase dry-type transformers, the Evaluator decided to adopt the same methodology used by Navigant Consulting.

Moreover, since no provincial data was provided, the Evaluator used the demographic weight of Nova Scotia to prepare the initial estimation of the market size.

⁵¹ Ibid.

⁵² Office of Energy Efficiency, *Dry-type transformers – Final Bulletin on Amending the Standard – October 2011*, <http://oee.nrcan.gc.ca/regulations/bulletins/16910>, October 12, 2011.

⁵³ Navigant Consulting, *Market Analysis for Dry-type Transformers*, June 6, 2008, p. 1.

⁵⁴ Ibid. p. 12.

Table 25: Estimated 2012 Market Size of Three-phase Dry-type Transformers in Canada and in Nova Scotia⁵⁵

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
15 kVA	3 shipments	0 shipment
30 kVA	5 shipments	0 shipment
45 kVA	5 shipments	0 shipment
75 kVA	6 shipments	0 shipment
112,5 kVA	8 shipments	0 shipment
150 kVA	8 shipments	0 shipment
225 kVA	12 shipments	0 shipment
300 kVA	18 shipments	0 shipment
500 kVA	40 shipments	1 shipment
750 kVA	57 shipments	2 shipments
1,000 kVA	93 shipments	3 shipments
1,500 kVA	107 shipments	3 shipments
2,000 kVA	128 shipments	4 shipments
2,500 kVA	164 shipments	5 shipments
3,000 kVA	84 shipments	2 shipments
3,750 kVA	44 shipments	1 shipment
5,000 kVA	24 shipments	1 shipment
7,500 kVA	14 shipments	0 shipment
Total	820 shipments	23 shipments

Those numbers could not be compared with data from Statistics Canada, since its database only compiles statistics for all types of transformers. Consequently, the following estimate was presented to manufacturers and distributors during the interviews.

⁵⁵ Navigant Consulting, *Market Analysis for Dry-type Transformers*, June 6, 2008, p. 4.

Table 26: Data Presented to Manufacturers and Distributors during the Interviews – 2012
Market Size of Three-phase Dry-type Transformers in Canada and in Nova Scotia

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
Three-phase dry-type transformers of 15 to 750 kVA	160 shipments	4 shipments
Three-phase dry-type transformers of 1,000 kVA	90 shipments	3 shipments
Three-phase dry-type transformers of 1,500 kVA	110 shipments	3 shipments
Three-phase dry-type transformers of 2,000 kVA	130 shipments	4 shipments
Three-phase dry-type transformers of 2,500 to 7,500 kVA	330 shipments	9 shipments
Total (Three-phase dry-type transformers of 15 to 7,500 kVA)	820 shipments	23 shipments

Interviews were conducted with only 2 manufacturers. During the course of the interviews, both participants mentioned that the estimated shipment numbers for three-phase dry-types transformers of 15 to 7,500 kVA were much too low. Unfortunately, both interviewees were unable to provide shipment data and were also unable to estimate the non-compliance rate of these transformers. As a result, the Evaluator could not draw any conclusions regarding this standard and it was decided to exclude it from the analysis.

3.4 SELF-CONTAINED COMMERCIAL REFRIGERATORS AND FREEZERS

3.4.1 Product Description

As written in *Amendment 11*:

The Regulations apply to self-contained, commercial refrigerators, freezers and refrigerator-freezers that have cabinet doors, cabinet drawers or no doors, including refrigerators designed for pull-down temperature application.

The Regulations do not apply to buffet tables, preparation tables, and walk-in refrigerators and freezers.⁵⁶

3.4.2 Regulation Description

Previous Regulations

In November 2006, an amendment to the Regulations introduced minimum efficiency levels for the self-contained commercial refrigeration market for the first time.⁵⁷ From April to December 2007, products whose manufacturing process was completed on or after April 1, 2007 that were subject to the standard were required to meet a first set of efficiency levels. Then, from January 1, 2008 and onward, those same products were required to meet more stringent efficiency levels.

The products covered by this standard are the same covered since the introduction of *Amendment 11* (see 1.4.1 Product Description).⁵⁸

Here are the MEPS that targeted products had to meet before *Amendment 11*.

⁵⁶ Office of Energy Efficiency, Self-Contained, Commercial Refrigerators, Freezers and Refrigerator-Freezers – Final Bulletin on Amending the Standard – October 2011, <http://oee.nrcan.gc.ca/regulations/bulletins/12205>, October 12, 2011.

⁵⁷ Office of Energy Efficiency, *Self-Contained, Commercial Refrigerators and Freezers – Bulletin Update – November 2006*, <http://oee.nrcan.gc.ca/regulations/2688>, April 20, 2009.

⁵⁸ Ibid.

Table 27: Former Minimum Efficacy Levels for Self-contained Refrigerators and Freezers⁵⁹

Product		Maximum E daily (kWh/day)	
	Door or Drawer Type	April 1, 2007 - December 31, 2007	on or after January 1, 2008
Self-contained commercial refrigerators	Opaque doors or drawers	0.00441 V + 4.22	0.00441 V + 2.76
	Transparent doors	0.00607 V + 5.78	0.00607 V + 4.77
	Other*	N/A	N/A
Self-contained commercial freezers	Opaque doors	V < 340	7.62
		V ≥ 340	0.0141 V + 2.83
	Transparent doors	0.0332 V + 5.10	0.0332 V + 5.10
	Other*	N/A	N/A
Self-contained commercial refrigerator-freezers	Opaque doors	0.00964 AV + 2.63	0.00964 AV + 1.65
	Other*	N/A	N/A

Note: V is the refrigerator volume measured in litres

AV (adjusted volume, in litres) is equal to the refrigerator volume plus 1.63 times the freezer volume.

E_{daily} = Maximum daily energy consumption (kWh)

*No maximum daily energy consumption is specified. However, manufacturers still have to test their units, have the performance verified and report the value.

New Regulation

During the preparatory phase leading to the introduction of *Amendment 11*, NRCan decided to strengthen the regulated levels for units with doors or drawers (i.e. closed) units and update the testing procedure reference for self-contained commercial refrigeration in Canada.⁶⁰ Thus, no-door or no-drawer (i.e. open) appliances are still not required to meet a specific efficiency level.

As of April 12, 2012, all targeted self-contained commercial refrigerators, refrigerator-freezers and freezers are required to meet the following efficacy levels if their manufacturing process was completed on or after January 1, 2010.⁶¹ This new regulation harmonizes with the performance levels,

⁵⁹ Office of Energy Efficiency, *Self-Contained, Commercial Refrigerators and Freezers – Bulletin Update – November 2006*, <http://oee.nrcan.gc.ca/regulations/2688>, April 20, 2009.

⁶⁰ Office of Energy Efficiency, *Self-Contained, Commercial Refrigerators, Freezers and Refrigerator-Freezers – Updated Bulletin on Amending the Standards – June 2010*, <http://oee.nrcan.gc.ca/regulations/bulletins/10769>, June 24th, 2010.

⁶¹ Office of Energy Efficiency, *Self-Contained, Commercial Refrigerators, Freezers and Refrigerator-Freezers – Final Bulletin on Amending the Standard – October 2011*, <http://oee.nrcan.gc.ca/regulations/bulletins/12205>, October 12, 2011.

test standards and effective dates in the Direct Final Rule published by the U.S. DOE on October 18, 2005 (performance levels) and U.S. Direct Final Rule December 8, 2006 (test standard).

Table 28: Current Minimum Efficacy Levels for Self-contained Refrigerators and Freezers⁶²

Product	Door or Drawer Type	Maximum Daily Energy Consumption
Refrigerators	Solid	$0.00353V + 2.04$
	Transparent not designed for pull-down temperature application	$0.00424V + 3.34$
	Transparent designed for pull-down temperature application	$0.00445V + 3.51$
Refrigerator-freezers	Solid	greater of either $(0.00953 AV - 0.71)$ or 0.70
Freezers	Solid	$0.01413V + 1.38$
	Transparent	$0.02649V + 4.10$

Note: V is the refrigerator volume measured in litres

AV (adjusted volume, in litres) is equal to the refrigerator volume plus 1.63 times the freezer volume.

E_{daily} = Maximum daily energy consumption (kWh)

Note that to be considered transparent, the glass area must cover at least 75% of the principal display surface.

3.4.3 Products Covered by the Introduction of the New Standard

The new standard for self-contained commercial refrigerators and freezers does not widen the scope of previous regulations; it actually increases the stringency of former MEPS. As a result, the products now required to meet stricter efficiency levels are self-contained, commercial refrigerators, freezers and refrigerator-freezers that:

- > have cabinet doors or cabinet drawers, including refrigerators designed for pull-down temperature application;
- > are designed for the storage and/or freezing of food, beverages, flowers, ice or other perishable or non-perishable merchandise; and
- > have a self-contained refrigeration system that requires an energy input.⁶³

⁶² Office of Energy Efficiency, Self-Contained, Commercial Refrigerators, Freezers and Refrigerator-Freezers – Final Bulletin on Amending the Standard – October 2011, <http://oee.nrcan.gc.ca/regulations/bulletins/12205>, October 12, 2011.

⁶³ Office of Energy Efficiency, Self-Contained, Commercial Refrigerators, Freezers and Refrigerator-Freezers – Updated Bulletin on Amending the Standards – June 2010, <http://oee.nrcan.gc.ca/regulations/bulletins/10769>, June 24th, 2010.

3.4.4 Estimation of the Market Size

Caneta Research produced a report in 2010 for NRCan regarding the market and economics of the commercial refrigeration equipment market in Canada.⁶⁴ While this report does not provide the market size of self-contained appliances as such, it gives interesting insights regarding the whole commercial refrigeration market.

For example, Caneta Research notes that “manufacturers of commercial refrigeration equipment occupy niche markets in the industry; as such they do not develop a broad view of the market and therefore have difficulty commenting on the industry as a whole.”⁶⁵ This reality makes it difficult to estimate the market size of commercial refrigerators and freezers.

Despite this difficulty, Caneta Research was able to provide an estimate of the market size of those products using both the technical support documents of the U.S. DOE for commercial refrigeration equipment regulations and a report developed by the Heating, Refrigeration, and Air Conditioning Institute of Canada (HRAI). These sources present sales figures for the U.S. and for North America, respectively. Caneta Research then used the demographic weight of Canada to get a rough estimation of its commercial refrigeration equipment market size. This method indicated that there were approximately 18,400 shipments of commercial refrigeration equipment to Canada in 2009.

Caneta Research also contacted twenty-four manufacturers and distributors, but obtained a very low response rate. Nevertheless, what emerged from these interviews is that there were roughly 20,100 shipments of those products in Canada in 2009.

Given the discrepancy between these sales figures, Caneta Research decided to make an average of those two estimations, thus presuming there were **19,300 shipments** of commercial refrigerators, refrigerator-freezers and freezers to Canada in 2009.

The only products for which Caneta Research provides an estimated market size are self-contained commercial ice cream-type freezers. According to the report, there would have been **72 shipments** of self-contained commercial opaque ice cream-type freezers and **1,494 shipments** of self-contained commercial transparent ice cream-type freezers to Canada in 2012. Using the demographic weight of Nova Scotia, the same methodology employed by Caneta Research in its report, the Evaluator obtained the following figures:

⁶⁴ Caneta Research, *Commercial Refrigeration Study*, September 27, 2010.

⁶⁵ *Ibid.* pp. 3-4.

Table 29: Estimated 2012 Market Size of Self-contained Commercial Ice Cream-type Freezers in Canada and in Nova Scotia⁶⁶

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
Opaque ice cream-type freezers	72 shipments	2 shipments
Transparent ice cream-type freezers	1,494 shipments	41 shipments

Considering that Statistics Canada does not compile data of imports and exports of self-contained commercial refrigerating equipment, it was impossible to estimate the market size of these types of products in Canada in 2012 using that particular source. Thus, given the lack of specific data, manufacturers and distributors were asked during the interviews to share their own shipment numbers and their estimated market share. They were also asked to give their impression regarding the estimated number of shipments of self-contained commercial ice cream-type freezers.

Interviews were conducted with 4 manufacturers and 2 distributors. However, the information gathered during the interviews was either contradictory or vague in most cases. It was impossible to draw any conclusion from the answers provided by participants. Without shipment data for most categories of self-contained commercial refrigerators and freezers, the Evaluator had no choice but to exclude an analysis of this market.

⁶⁶ Caneta Research, *Commercial Refrigeration Study*, September 27, 2010.

3.5 LARGE AIR CONDITIONERS AND HEAT PUMPS

3.5.1 Product Description

The products that are subject to the current regulations are factory-assembled unitary air conditioners and heat pumps ranging in capacity from 19 kilowatts (kW) (65,000 Btu/h) to 223 kW (760,000 Btu/h), and factory-assembled large air-conditioning condensing units with cooling capacities between 19 kW (65,000 Btu/h) and 70 kW (240,000 Btu/h).⁶⁷ This standard does not cover single package vertical air conditioners (see Section 3.6 Single Package Vertical Air Conditioners and Heat Pumps).

3.5.2 Regulation Description

Previous Regulations

Since 2006, MEPS exist for large air conditioners, heat pumps and air-conditioning condensing units with cooling capacities between 19 kW (65,000 Btu/h) and 70 kW (240,000 Btu/h).⁶⁸ The following table presents the efficiency levels that these products had to meet prior to the introduction of *Amendment 11*. It is important to note that the MEPS for air-conditioning condensing units (Table 30) are still valid, as they were not modified by *Amendment 11*.

⁶⁷ Office of Energy Efficiency, Large Air Conditioners and Heat Pumps – Final Bulletin on Amending the Standard – October 2011, <http://oee.nrcan.gc.ca/%20/1230>, October 12, 2011.

⁶⁸ Office of Energy Efficiency, *Large Air Conditioners and Heat Pumps – Bulletin Update – May 2005*, <http://oee.nrcan.gc.ca/regulations/12191>, April 17, 2009.

Table 30: Former Minimum Efficiency Levels for Large Air Conditioners and Heat Pumps⁶⁹

Product Class (ARI type classification)	Product Description	Cooling Capacity Range – kW (1000Btu/h)	Cooling Minimum Efficiency – Electric or No Heating Section (EER)	Cooling Minimum Efficiency – All Other Heating Section (EER)	Heating Minimum Efficiency (COP at 8.3°C)	Heating Minimum Efficiency (COP at –8.3°C)
SP-A, RC-A, RCU-A-C, SPY-A, RCY-A, RCU-A-CB, RCUY-A-CB	Air conditioner, air-cooled	19-40 (65-135)	10.3	10.1		
SP-A, RC-A, RCU-A-C, SPY-A, RCY-A, RCU-A-CB, RCUY-A-CB	Air conditioner, air-cooled	>40-70 (135-240)	9.7	9.5		
SP-E, SP-W, RC-E, RC-W, SPY-E, SPY-W, RCY-E, RCY-W, RCU-E-C, RCU-W-C, RCU-E-CB, RCU-W-CB, RCUY-E-CB, RCUY-W-CB	Air conditioner, water- & evaporatively cooled	19-40 (65-135)	11.5	11.3		
SP-E, SP-W, RC-E, RC-W, SPY-E, SPY-W, RCY-E, RCY-W, RCU-E-C, RCU-W-C, RCU-E-CB, RCU-W-CB, RCUY-E-CB, RCUY-W-CB	Air conditioner, water- and evaporatively cooled	>40-70 (135-240)	11.0	10.8		
HSP-A, HRC-A-C, HRCU-A-C, HRC-A-CB, HRCU-A-CB	Heat pump	19-40 (65-135)	10.1	9.9	3.2	2.2
HSP-A, HRC-A-C, HRCU-A-C, HRC-A-CB, HRCU-A-CB	Heat pump	>40-70 (135-240)	9.3	9.1	3.1	2.0

⁶⁹ Office of Energy Efficiency, *Large Air Conditioners and Heat Pumps – Bulletin Update – May 2005*, <http://oe.e.nrcan.gc.ca/regulations/12191>, April 17, 2009.

Table 31: Minimum Efficiency Levels for Air-conditioning Condensing Units⁷⁰

Product Class (ARI type classification)	Product Description	Cooling Capacity Range kW(1000Btu/h)	Cooling Minimum Efficiency (EER)	Cooling Minimum Efficiency (IPLV)
RCU-A	Condensing unit, air-cooled	19-70 (135-240)	10.1	11.2
RCU-E, RCU-W	Condensing unit, water- or evaporatively cooled	40-70 (135-240)	13.1	13.1

New Regulation

With *Amendment 11*, NRCan opted for more stringent MEPS for already covered large air conditioners and heat pumps (cooling capacities between 65,000 Btu/h and 240,000 Btu/h).⁷¹ However, “minimum efficiency levels for large condensing units (19 kW to 70 kW) have not changed with this amendment.”⁷²

Also, as seen in the product description, NRCan decided to extend the regulations’ coverage to larger equipment, i.e. large air conditioners and heat pumps with cooling capacities greater than 70 kW (240,000 Btu/H) and up to 223 kW (760,000 Btu/h).⁷³ Thus, this new standard introduces an increase in both the stringency and the scope of previous regulations. Table 32 shows the MEPS in force since April 12, 2012 for products whose manufacturing process was completed on or after January 1, 2011. Those MEPS are harmonized with those of ASHRAE 90.1-2007 that are enforced in the U.S.⁷⁴

⁷⁰ Office of Energy Efficiency, *Large Air Conditioners and Heat Pumps – Bulletin Update – May 2005*, <http://oee.nrcan.gc.ca/regulations/12191>, April 17, 2009.

⁷¹ Office of Energy Efficiency, *Large Air Conditioners, Heat Pumps, and Condensing Units – Updated Bulletin on Amending the Standards – June 2010*, <http://oee.nrcan.gc.ca/regulations/bulletins/16827>, June 14th, 2010.

⁷² Office of Energy Efficiency, *Large Air Conditioners and Heat Pumps – Final Bulletin on Amending the Standard – October 2011*, <http://oee.nrcan.gc.ca/%20/1230>, October 12, 2011.

⁷³ Office of Energy Efficiency, *Large Air Conditioners, Heat Pumps, and Condensing Units – Updated Bulletin on Amending the Standards – June 2010*, <http://oee.nrcan.gc.ca/regulations/bulletins/16827>, June 14th, 2010.

⁷⁴ Office of Energy Efficiency, *Large Air Conditioners and Heat Pumps – Final Bulletin on Amending the Standard – October 2011*, <http://oee.nrcan.gc.ca/%20/1230>, October 12, 2011.

Table 32: Minimum Efficiency Levels for Large Air Conditioners and Heat Pumps⁷⁵

Product Class HRAI Type Classification	Product Description	Cooling Capacity Range kW (1000 Btu/h)	Cooling Min. Effic. – Electric or No Heating Section EER and IEER	Cooling Min. Effic. – all other heating section EER and IEER	Heating Min. Effic. COP at 8.3C	Heating Min. Effic. COP at –8.3C
SP-A, RC-A, RCU-A-C, SPY-A, RCY-A, RCU-A-CB, RCUY-A-CB	Air conditioner, air-cooled	≥19 <40 (≥65 <135)	11.2 11.4IEER	11.0 11.2IEER		
SP-A, RC-A, RCU-A-C, SPY-A, RCY-A, RCU-A-CB, RCUY-A-CB	Air conditioner, air-cooled	≥40 <70 (≥135 <240)	11.0 11.2IEER	10.8 11.0IEER		
SP-A, RC-A, RCU-A-C, SPY-A, RCY-A, RCU-A-CB, RCUY-A-CB	Air conditioner, air-cooled	>70 <223 (≥240 <760)	10.0 10.1IEER	9.8 9.9IEER		
SP-E, SP-W, RC-E, RC-W, SPY-E, SPY-W, RCY-E, RCY-W, RCU-E-C, RCU-W-C, RCU-E-CB, RCU-W-CB, RCUY-E-CB, RCUY-W-CB	Air conditioner, water- & evaporatively cooled	≥19 <40 (≥65 <135)	11.5 11.7IEER	11.3 11.5IEER		
SP-E, SP-W, RC-E, RC-W, SPY-E, SPY-W, RCY-E, RCY-W, RCU-E-C, RCU-W-C, RCU-E-CB, RCU-W-CB, RCUY-E-CB, RCUY-W-CB	Air conditioner, water- & evaporatively cooled	≥40 <70 (≥135 <240)	11.0 11.2IEER	10.8 11.0IEER		
SP-E, SP-W, RC-E, RC-W, SPY-E, SPY-W, RCY-E, RCY-W, RCU-E-C, RCU-W-C, RCU-E-CB, RCU-W-CB, RCUY-E-CB, RCUY-W-CB	Air conditioner, water- & evaporatively cooled	>70 <223 (≥240 <760)	11.0 11.1IEER	10.8 10.9IEER		
HSP-A, HRC-A-C, HRCU-A-C, HRC-A-CB, HRCU-A-CB	Heat pump	≥19 <40 (≥65 <135)	11.0 11.2IEER	10.8 11.0IEER	3.3	2.25
HSP-A, HRC-A-C, HRCU-A-C, HRC-A-CB, HRCU-A-CB	Heat pump	≥40 <70 (≥135 <240)	10.6 10.7IEER	10.4 10.5IEER	3.2	2.05
HSP-A, HRC-A-C, HRCU-A-C, HRC-A-CB, HRCU-A-CB	Heat pump	>70 <223 (≥240 <760)	9.5 9.6IEER	9.3 9.4IEER	3.2	2.05

⁷⁵ Office of Energy Efficiency, Large Air Conditioners and Heat Pumps – Final Bulletin on Amending the Standard – October 2011, <http://oee.nrcan.gc.ca/%20/1230>, October 12, 2011.

3.5.3 Products Covered by the Introduction of the New Standard

With *Amendment 11*, large air conditioners and heat pumps ranging in capacity from 19 kW (65,000 Btu/h) to 70 kW (240,000 Btu/h) are now required to meet stricter efficiency levels, while large air conditioners and heat pumps with cooling capacities greater than 70 kW (240,000 Btu/h) and up to 223 kW (760,000 Btu/h) are regulated for the first time.⁷⁶ Air-conditioning condensing units are not impacted by the new standard.

3.5.4 Estimation of the Market Size

In 2008, Caneta Research produced a report for NRCan titled *Market, Benchmark and Technical Analysis for Large Air Conditioners and Heat Pumps for Future Regulation Amendment*.⁷⁷ In this study, Caneta Research observes that from 2002 to 2006, the Canadian market of large air conditioners and heat pumps grew. In fact, based on shipment data provided by the HRAI, large air conditioners shipments had a 19% increase and large heat pumps shipments a 74% increase.

The most recent shipment data provided by this report is from 2006. Therefore, Econoler had to use the Microsoft Excel “forecast” formula to get estimations for 2012. Regarding shipments to Nova Scotia, Caneta Research’s report provides sales figures in the Maritimes for 2002 to 2006. Using Nova Scotia’s demographic weight within the Maritimes (39.6%⁷⁸) and the Microsoft Excel “forecast” formula, it was possible to get an estimate of the market size of large air conditioners and heat pumps in Nova Scotia in 2012 (see Table 33).

⁷⁶ Office of Energy Efficiency, Large Air Conditioners and Heat Pumps – Final Bulletin on Amending the Standard – October 2011, <http://oee.nrcan.gc.ca/%20/1230>, October 12, 2011.

⁷⁷ Caneta Research, *Market, Benchmark and Technical Analysis for Large Air Conditioners and Heat Pumps for Future Regulation Amendment*, February 2008, p. 8.

⁷⁸ Statistics Canada. Population and dwelling counts, for Canada, provinces and territories, 2011 and 2006 censuses, November 4th 2012.

Table 33: Estimated 2012 Market Size of Large Air Conditioners and Heat Pumps in Canada and in Nova Scotia⁷⁹

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
Medium air conditioners (≥ 19.0 kW and < 39.6 kW (≥ 65,000 Btu/h and < 135,000 Btu/h))	15,587 shipments	181 shipments
Large air conditioners (≥ 39.6 kW and < 73.3 kW (≥ 135,000 Btu/h and < 250,000 Btu/h))	5,890 shipments	150 shipments
Very large and extremely large air conditioners (≥ 73.3 kW (≥ 250,000 Btu/h))	1,295 shipments	15 shipments
Medium heat pumps (≥ 19.0 kW and < 39.6 kW (≥ 65,000 Btu/h and < 135,000 Btu/h))	492 shipments	27 shipments
Large heat pumps (≥ 39.6 kW and < 70.3 kW (≥ 135,000 Btu/h and < 240,000 Btu/h))	77 shipments	4 shipments
Very large and extremely large heat pumps (≥ 73.3 kW (≥ 250,000 Btu/h))	0 shipment	0 shipment

There are a few limits to this estimate. Firstly, “the upper capacity limit for large equipment is 250 kBTu/h instead of the 240 kBTu/h” used by the new standard.”⁸⁰ Therefore, large air conditioners with cooling capacities between 70 kW (240,000 Btu/h) and 73.3 kW (250,000 Btu/h) are included in the “large” size category instead of the “very large.” Additionally, very large air conditioners (≥ 73.3 kW and < 223 kW (≥ 250,000 Btu/h and < 760,000 Btu/h)) and extremely large air conditioners (≥ 223 kW (≥ 760,000 Btu/h)) were regrouped in the same category, while only the former are regulated. Finally, “the shipment data does not distinguish between the use of air-cooled and water-cooled condensers.”⁸¹

Moreover, categories used by Statistics Canada to classify air conditioners and heat pumps being completely different from those used by NRCAN for the purpose of the regulation, that source could not be used to correct the limits of Caneta Research’s estimations.

⁷⁹ Caneta Research, Market, Benchmark and Technical Analysis for Large Air Conditioners and Heat Pumps for Future Regulation Amendment, February 2008, pp. 9-10.

⁸⁰ *Ibid.* p. 8.

⁸¹ *Ibid.*

Interviews were conducted with 2 manufacturers and 2 distributors. Since a sole unitary savings value was given for all large heat pumps targeted by the standard, manufacturers and distributors were asked to comment on the total market size of large heat pumps with capacities between 19 kW (65,000 Btu/h) or more.

Once again, the Evaluator was unable to gather precise shipment data during the interviews, as participants provided widely diverging estimations. Nonetheless, it was suggested by some interviewees to contact HRAI to get up to date shipment data for Nova Scotia. Table 34 shows the data obtained from HRAI, which cover the January to November period.

Table 34: 2012 Market Size of Large Air Conditioners and Heat Pumps in Nova Scotia⁸²

Product Class	Shipments to Nova Scotia in 2012
Medium air conditioners (≥ 19.0 kW and < 39.6 kW ($\geq 65,000$ Btu/h and $< 135,000$ Btu/h))	338 shipments
Large air conditioners (≥ 39.6 kW and < 70 kW ($\geq 135,000$ Btu/h and $< 240,000$ Btu/h))	176 shipments
Very large and extremely large air conditioners (≥ 73.3 kW ($\geq 250,000$ Btu/h))	18 shipments
Large heat pumps and single package vertical heat pumps (≥ 19.0 kW ($\geq 65,000$ Btu/h))	90 shipments

These sales figures being the most precise data available, and considering that they are conservative since they only cover 8 months of 2012, the Evaluator decided to use the HRAI data to estimate the impact of the introduction of the new standard. However, HRAI's data did not make any distinction between large heat pumps and single package vertical heat pumps (SPVHP) (see *Section 3.6 Single Package Vertical Air Conditioners and Heat Pumps*).

⁸² Heating, Refrigeration and Air Conditioning Institute of Canada, 2012.

3.5.5 Portion of the Market Impacted by the Standard

In its report, Caneta Research notes that “at the time of the study [2008, ed], of equipment sold in Canada, 90% were minimum-efficiency, 7% were mid-efficiency and only 3% were high-efficiency.”⁸³ Without more precision regarding non-compliance rates and without clear and converging estimations from the interviewees, it was assumed that all types of equipment targeted by the standard had a 90% rate of non-compliance, whether in Canada in general or specifically in Nova Scotia.

Table 35: Portion of the Large Air Conditioners and Heat Pumps Market Impacted by the Standard

Product Class	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012
Medium air conditioners (≥ 19.0 kW and < 39.6 kW (≥ 65,000 Btu/h and < 135,000 Btu/h))	90%
Large air conditioners (≥ 39.6 kW and < 70 kW (≥ 135,000 Btu/h and < 240,000 Btu/h))	90%
Very large air conditioners (≥ 70 kW and < 223 kW (≥ 240,000 Btu/h and < 760,000 Btu/h))	90%
Large heat pumps (≥ 19.0 kW (≥ 65,000 Btu/h))	90%

⁸³ Caneta Research, Market, Benchmark and Technical Analysis for Large Air Conditioners and Heat Pumps for Future Regulation Amendment, February 2008, p. 12.

3.5.6 Unitary Savings Values

In *Amendment 11*, NRCan specified average unitary savings values for categories of large air conditioners and heat pumps. That information is presented in Table 36.

Table 36: Unitary Savings Values – Large Air Conditioners and Heat Pumps⁸⁴

Product Class	Peak Demand Savings (W/yr./unit)	Annual Energy Savings (kWh/yr./unit)
Medium air conditioners (≥ 19.0 kW and < 39.6 kW (≥ 65,000 Btu/h and < 135,000 Btu/h))	652	717
Large air conditioners (≥ 39.6 kW and < 70 kW (≥ 135,000 Btu/h and < 240,000 Btu/h))	2,071	2,279
Very large air conditioners (≥ 70 kW and < 223 kW (≥ 240,000 Btu/h and < 760,000 Btu/h))	1,779	1,975
Large heat pumps (≥ 19.0 kW (≥ 65,000 Btu/h))	3,480	2,871

3.5.7 At Meter Energy Savings

Using these unitary savings, estimates of the market size of large air conditioners and heat pumps in Nova Scotia and estimates of total shipments to Nova Scotia affected by the standard in 2012, the Evaluator estimates that the introduction of the large air conditioners and heat pumps standard resulted in energy savings, at meter, of 0.844 GWh.

⁸⁴ Office of Energy Efficiency, *Energy Efficiency Act: Regulations Amending the Energy Efficiency Regulations*, <http://canadagazette.gc.ca/rp-pr/p2/2011/2011-10-12/html/sor-dors182-eng.html>, October 12, 2011.

Table 37: Energy Savings from the Introduction of the Large Air Conditioners and Heat Pumps Standard in the Nova Scotian Market

Product Class	Shipments to Nova Scotia in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012	Annual Energy Savings	Total Energy Savings at Meter for 2012
Medium air conditioners (≥ 19.0 kW and < 39.6 kW (≥ 65,000 Btu/h and < 135,000 Btu/h))	338 shipments	90%	717 kWh/yr./unit	0.218 GWh
Large air conditioners (≥ 39.6 kW and < 70 kW (≥ 135,000 Btu/h and < 240,000 Btu/h))	176 shipments	90%	2,279 kWh/yr./unit	0.361 GWh
Very large and extremely large air conditioners (≥ 73.3 kW (≥ 250,000 Btu/h))	18 shipments	90%	1,975 kWh/yr./unit	0.032 GWh
Large heat pumps and single package vertical heat pumps (≥ 19.0 kW (≥ 65,000 Btu/h))	90 shipments	90%	2,871 kWh/yr./unit	0.233 GWh
Total	215 shipments	90%		0.844 GWh

3.5.8 At Meter Demand Savings

Econoler estimates that 0.282 MW were saved, at meter, in Nova Scotia in 2012 as a result of introducing the standard for general service incandescent reflector lamps. A diversity factor of 0 percent was applied to air conditioners since the peak period for electricity demand in Nova Scotia occurs in the months of December, January and February⁸⁵. On the other hand, a diversity factor of 100 percent was applied to heat pump based on the 2012 BER evaluation report. During this evaluation, on-site visits were conducted to estimate the diversity factor at facilities where heat pumps of similar sizes were installed.

⁸⁵ Nova Scotia Power, Domestic Service Time-Of-Day Tariff, www.nspower.ca.
<http://www.nspower.ca/en/home/aboutnspi/ratesandregulations/electricityrates/domesticservicetimeofdaytariffoptional.aspx>.

Table 38: Demand Savings from the Introduction of the Large Air Conditioners and Heat Pumps Standard in the Nova Scotian Market

Product Class	Shipments to Nova Scotia in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012	Annual Demand Savings	Diversity Factor	Total Demand Savings at Meter for 2012
Medium air conditioners (≥ 19.0 kW and < 39.6 kW (≥ 65,000 Btu/h and < 135,000 Btu/h))	338 shipments	90%	652 W/yr./unit	0 %	0 MW
Large air conditioners (≥ 39.6 kW and < 70 kW (≥ 135,000 Btu/h and < 240,000 Btu/h))	176 shipments	90%	2,072 W/yr./unit	0 %	0 MW
Very large and extremely large air conditioners (≥ 73.3 kW (≥ 250,000 Btu/h))	18 shipments	90%	1,779 W/yr./unit	0 %	0 MW
Large heat pumps and single package vertical heat pumps (≥ 19.0 kW (≥ 65,000 Btu/h))	90 shipments	90%	3,480 W/yr./unit	100 %	0.282 MW
Total	215 shipments	90%			0.282 MW

3.6 SINGLE PACKAGE VERTICAL AIR CONDITIONERS AND HEAT PUMPS

3.6.1 Product Description

As defined by NRCAN, single package vertical air conditioners (SPVAC) and SPVHP are “air-cooled single packaged equipment with components arranged vertically [...] This equipment can be mounted on the exterior or adjacent interior to, or through the wall.”⁸⁶ SPVAC do not necessarily come with fossil-fired heating. In its report, Caneta Research mentions that “this equipment is typically used in schools and manufactured, modular, or portable buildings, and may be powered with single-phase or three-phase electricity.”⁸⁷

3.6.2 Regulation Description

Previous Regulations

SPVAC and SPVHP had not been previously regulated.⁸⁸

New Regulation

In 2009, NRCAN decided to regulate SPVAC and SPVHP, products that had been exempted from regulations for large air conditioners and heat pumps.⁸⁹ A separate standard was then introduced on April 12, 2012 for SPVAC and SPVHP of all sizes whose manufacturing process was completed on or after January 1, 2011.⁹⁰ This regulation harmonizes with ASHRAE 90.1-2007 requirements. Table 39 shows the MEPS that SPVAC and SPVHP are now required to comply with.

⁸⁶ Office of Energy Efficiency, Single Package Vertical Air Conditioners and Heat Pumps – October 2011 – Final Bulletin on Developing the Standard Update, <http://oee.nrcan.gc.ca/regulations/bulletins/4372>, October 12, 2011.

⁸⁷ Caneta Research, Market, Benchmark and Technical Analysis for Large Air Conditioners and Heat Pumps for Future Regulation Amendment, February 2008, p. 1.

⁸⁸ Office of Energy Efficiency, Single Package Vertical Air Conditioners and Heat Pumps – July 2009 – Bulletin on Developing Standards, <http://oee.nrcan.gc.ca/regulations/bulletins/7111>, July 31, 2009.

⁸⁹ Ibid.

⁹⁰ Office of Energy Efficiency, Single Package Vertical Air Conditioners and Heat Pumps – October 2011 – Final Bulletin on Developing the Standard Update, <http://oee.nrcan.gc.ca/regulations/bulletins/4372>, October 12, 2011.

Table 39: Minimum Efficiency Levels for Single Package Vertical Air Conditioners and Heat Pumps (SPVAC and SPVHP)⁹¹

Type	Mode	Size	Minimum Efficiency Requirement
SPVAC and SPVHP	Cooling	< 65,000 Btu/h	EER = 9.0
		≥ 65,000 Btu/h to < 135,000 Btu/h	EER = 8.9
		≥ 135,000 Btu/h	EER = 8.6
SPVHP	Heating	< 65,000 Btu/h	COP = 3.0
		≥ 65,000 Btu/h to < 135,000 Btu/h	COP = 3.0
		≥ 135,000 Btu/h	COP = 2.9

3.6.3 Products Covered by the Introduction of the New Standard

All SPVAC and SPVHP are covered by the introduction of this new standard, and none of them were regulated before the implementation of *Amendment 11*.⁹²

3.6.4 Estimation of the Market Size

With regard to the market size of SPVAC and SPVHP, NRCAN mentions that the majority of the appliances that are sold “are less than 65,000 Btu/h in cooling capacity.”⁹³ Moreover, NRCAN writes that “in Canada, total annual shipments are about 2,100 SPVAC and SPVHP.”⁹⁴ Those sales figures were actually estimated by Caneta Research using U.S. shipment data for 2006.⁹⁵ According to Caneta Research, “of these shipments, 87% are AC and 13% are HP.”⁹⁶

Since no shipment data was available before or after 2006, the Evaluator decided to estimate the 2012 market size of SPVAC and SPVHP using the estimated average growth for large air conditioners and heat pumps between 2006 and 2012 (27.6% increase). Then, using Nova Scotia’s demographic weight, a specific estimate for that province was produced. Table 40 shows the initial estimation of the market size of SPVAC and SPVHP in both Canada and Nova Scotia.

⁹¹ Office of Energy Efficiency, *Single Package Vertical Air Conditioners and Heat Pumps – Energy Efficiency Regulations*, <http://oee.nrcan.gc.ca/regulations/products/17983>, April 13th, 2012.

⁹² Office of Energy Efficiency, *Single Package Vertical Air Conditioners and Heat Pumps – October 2011 – Final Bulletin on Developing the Standard Update*, <http://oee.nrcan.gc.ca/regulations/bulletins/4372>, October 12, 2011.

⁹³ Ibid.

⁹⁴ Office of Energy Efficiency, *Single Package Vertical Air Conditioners and Heat Pumps – July 2009 – Bulletin on Developing Standards*, <http://oee.nrcan.gc.ca/regulations/bulletins/7111>, July 31, 2009.

⁹⁵ Caneta Research, *Market, Benchmark and Technical Analysis for Large Air Conditioners and Heat Pumps for Future Regulation Amendment*, February 2008, p. 37.

⁹⁶ Ibid.

Table 40: Estimated 2012 Market Size of Single Package Vertical Air Conditioners and Heat Pumps (SPVAC and SPVHP) in Canada and in Nova Scotia⁹⁷

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
SPVAC	2,371 shipments	165 shipments
SPVHP	344 shipments	24 shipments

Because these products were not catalogued by Statistics Canada, it was impossible to compare Caneta's estimates with data from the Canadian International Merchandise Trade Database.

The two manufacturers and two distributors that were interviewed regarding large air conditioners and heat pumps were also asked questions about the market size and the non-compliance rate of SPVAC and SPVHP. As mentioned in the previous section, interviewees did not give us precise information regarding market size for all different air conditioners and heat pumps. It was therefore decided not to proceed with an analysis of the impact of the introduction of this standard, since no clear data was available for SPVAC and since HRAI's data included large SPVHP (≥ 19.0 kW ($\geq 65,000$ Btu/h)) in its large heat pumps category, for which energy savings were calculated previously.

3.7 STANDBY POWER

3.7.1 Product Description

This standard covers certain products that use standby power. The International Energy Agency defines standby power as "the electricity consumed by appliances while switched off or not."⁹⁸

More specifically, compact audio products, televisions and video products are covered by this standard.⁹⁹ All products being regulated for standby mode and off mode power must be dependent on energy input from mains power, as at least one source of power, and designed to work on a single-phase nominal voltage of 240 volts or lower.

The Regulations apply to products using off mode and/or standby mode power, for the following product groups:

- > **Compact audio products** – An integrated stereo, (also known as a mini, mid, micro or shelf audio system), is an integrated audio system encased in a single housing that includes an amplifier and terrestrial radio tuner, attached or separable speaker, and may reproduce audio from one or more media such as: magnetic tape, compact disk (CD), DVD, or flash memory. A portable stereo is similar to an integrated stereo, typically with attached speakers, and runs on

⁹⁷ Caneta Research, Market, Benchmark and Technical Analysis for Large Air Conditioners and Heat Pumps for Future Regulation Amendment, February 2008, p. 26.

⁹⁸ International Energy Agency, *Standby Power Use and the IEA "1-watt Plan"*, April 2007, p. 1.

⁹⁹ Office of Energy Efficiency, *Standby Power Consumption – October 2011 – Final Bulletin on Amending the Standard Update*, <http://oee.nrcan.gc.ca/regulations/bulletins/8495>, October 12, 2011.

battery power when not hooked to an electrical outlet. These include docking stations for digital audio players, clock radios, portable stereos, integrated stereos and products with a powered external satellite antenna or that have a video output signal.

The definition for compact audio now refers to a terrestrial tuner to exempt internet radio products.

- > **Television (TV)** – A product consisting of a display panel, which may or may not have a tuner/receiver, encased in a single housing, which is designed to receive and display an analog or digital audio/video signal received from a terrestrial, satellite, cable, Internet Protocol TV (IPTV) or other transmission source. Televisions include residential television monitors, component TVs, and multifunction TVs which have built-in VCR, DVD, digital video recorder (DVR) or electronic program guide (EPG) functions, or which have a point of deployment (POD) card slot. Computer monitors and commercial TV monitors are not covered under this amendment, based on comments received.

The definition of television monitors now only refers to household products, which would exclude professional monitors.

- > **Video product** – A residential electronic product encased in a single housing that includes an integral power supply, and for which the primary purpose is to produce or record digital or analog signals to and/or from video tape, reflective disc, hard drive or other storage medium. Video products can include DVD players/recorders, VCR players/recorders, digital video players/recorders (PVRs), Blu-ray players/recorders or a combination of these technologies. This does not include cameras.

The definition of video products now only refers to household products, which would not include professional products.¹⁰⁰

¹⁰⁰ Office of Energy Efficiency, *Standby Power Consumption – October 2011 – Final Bulletin on Amending the Standard Update*, <http://oee.nrcan.gc.ca/regulations/bulletins/8495>, October 12, 2011.

3.7.2 Regulation Description

Previous Regulations

These products had not been previously regulated with regard to their energy consumption in standby mode and off mode.¹⁰¹

New Regulation

As of April 12, 2012, all standby products (compact audio products, televisions and video products) whose manufacturing process was completed on or after May 1, 2011 are required to meet the Tier 1 regulatory requirements (see Table 41).¹⁰²

Table 41: Tier 1 Minimum Energy Performance Power Limits (May 1, 2011) – Standby Power¹⁰³

Product Type	Off Mode Limit	Standby Mode Limit
Compact audio products	1 W	3 W
Televisions	1 W	4 W
Video products	1 W	3 W

Table 42 shows the more stringent MEPS that will be “applied to products manufactured as of January 1, 2013.”¹⁰⁴ This information is solely presented for informational purposes since, for the time frame of this study, targeted products will only be required to meet Tier 1 MEPS.

Table 42: Tier 2 Minimum Energy Performance Power Limits (January 1, 2011) – Standby Power¹⁰⁵

Product Type	Off Mode Limit	Standby Mode Limit	
		With Display	Without Display
Compact audio products that are not clock radios	0.5 W	1 W	0.5 W
Clock radios	1.0 W	2 W	n/a
Televisions	0.5 W	1 W	0.5 W
Video products	0.5 W	1 W	0.5 W

¹⁰¹ Office of Energy Efficiency, *Standby Power – January 2009 – Bulletin on Developing Standards*, <http://oee.nrcan.gc.ca/regulations/bulletins/4411>, February 10, 2011.

¹⁰² Office of Energy Efficiency, *Standby Power Consumption – October 2011 – Final Bulletin on Amending the Standard Update*, <http://oee.nrcan.gc.ca/regulations/bulletins/8495>, October 12, 2011.

¹⁰³ Ibid.

¹⁰⁴ Ibid.

¹⁰⁵ Ibid.

These MEPS are “comparable to the levels set out in California’s 2007 Appliance Efficiency Regulation (CEC-400-2007-016-REV1)” and are also in line with the European Union’s requirements.¹⁰⁶

3.7.3 Products Covered by the Introduction of the New Standard

Compact audio products, televisions and video products using off mode and/or standby power are covered by this new standard (see *Section 3.7.1 Product Description*).¹⁰⁷

3.7.4 Estimation of the Market Size

The initial estimate of the market size of these products was based on a study produced by Ecos. Using different sources such as the *2008 Consumer Electronics Market (CEM) Trends and Forecast* and Navigant Consulting’s *Canadian Retail Store Survey* of 2008, Ecos provides Canadian shipment data for 2002 to 2007.¹⁰⁸ Using both the Microsoft Excel “trend” formula and scatter plots with trend lines, this data was forecasted to 2012. The initial estimate regarding Nova Scotia’s market size was based on the province’s demographic weight. Table 43 shows those initial estimations.

Table 43: Estimated 2012 Market Size of Standby Power Products in Canada and in Nova Scotia¹⁰⁹

Product Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
Integrated stereo	357,905 shipments	9,842 shipments
Portable audio	596,992 shipments	16,417 shipments
Televisions	3,527,905 shipments	97,017 shipments
Non-recording video players	1,507,413 shipments	41,454 shipments
Recording video players	613,057 shipments	16,859 shipments

No similar data was available in Statistics Canada’s Canadian International Merchandise Trade Database. Therefore, sales figures extrapolated from Ecos’ report were used during the interviews.

Interviews were conducted with 1 manufacturer and 3 distributors. Recruiting manufacturers and distributors of electronic products proved to be difficult to achieve. Moreover, when recruited, participants were either unable or not at liberty to share market data. Thus, no modifications were made to the market size estimations.

¹⁰⁶ Ibid.

¹⁰⁷ Ibid.

¹⁰⁸ Ecos, *Market Analysis for Standby Power*, October 22, 2008, pp. 14, 19, 22.

¹⁰⁹ Ecos, *Market Analysis for Standby Power*, October 22, 2008, pp. 15, 20, 24.

3.7.5 Portion of the Market Impacted by the Standard

Non-compliance rate for standby power products was also provided by Ecos, but only for 2007. In the absence of more recent data, that information was assumed to still be valid for the impact of the regulation in 2012. Furthermore, since no provincial statistics were given, the non-compliance rate for Nova Scotia was assumed to be the same as for Canada. Table 44 shows the estimation of the portion of the market impacted by the standard for standby power products.

Table 44: Estimate of the Portion of the Standby Power Products Market Impacted by the Standard¹¹⁰

Product Class	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012
Integrated stereo	51%
Portable audio	5%
Televisions	7%
Non-recording video players	17%
Recording video players	48%

Because of the inability of interviewees to comment on these non-compliance rates, no changes were made to the estimate.

¹¹⁰ Ecos, *Market Analysis for Standby Power*, October 22, 2008, pp. 15, 20, 24.

3.7.6 Unitary Savings Values

In *Amendment 11*, NRCan provided unitary savings values for integrated stereos, portable audio products, television, non-recording video players and recording video players. It also estimated average unitary savings values for clock radios.¹¹¹ However, in its report, Ecos did not provide a specific market size for clock radios in Canada because that information did not exist. Those products were instead included in the “integrated stereo” category.¹¹² Econoler decided to follow that same methodology for this study. Table 45 shows the average unitary savings values for standby power products covered by the standard.

Table 45: Unitary Savings values – Standby Power Products¹¹³

Product Class	Annual Energy Savings (kWh/yr./unit)
Integrated stereo	199
Portable audio	15
Clock radio	44
Televisions	80
Non-recording video player	71
Recording video player	112

3.7.7 At Meter Energy Savings

The Evaluator estimates that the introduction of new MEPS for standby power products resulted in a total saving of 2.961 GWh in Nova Scotia in 2012.

Table 46: Energy Savings from the Introduction of the Standby Power Products Standard in the Nova Scotian Market

Product Class	Shipments to Nova Scotia in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012	Annual Energy Savings	Total Energy Savings at Meter for 2012
Integrated stereo	9,842 shipments	51%	199 kWh/yr./unit	0.999 GWh
Portable audio	16,417 shipments	5%	15 kWh/yr./unit	0.012 GWh
Televisions	97,017 shipments	7%	80 kWh/yr./unit	0.543 GWh
Non-recording video player	41,454 shipments	17%	71 kWh/yr./unit	0.500 GWh
Recording video player	16,859 shipments	48%	112 kWh/yr./unit	0.906 GWh
Total	181,590 shipments	15.3%		2.961 GWh

¹¹¹ Office of Energy Efficiency, *Energy Efficiency Act: Regulations Amending the Energy Efficiency Regulations*, <http://canadagazette.gc.ca/rp-pr/p2/2011/2011-10-12/html/sor-dors182-eng.html>, October 12, 2011.

¹¹² Ecos, *Market Analysis for Standby Power*, October 22, 2008, p. 14.

¹¹³ Ibid.

3.7.8 At Meter Demand Savings

Because of the different nature of each product class and the lack of information necessary to evaluate a diversity factor for each product class, Econoler was unable to estimate demand savings with a sufficient level of precision for this C&S. However, taking into account the characteristics of the different standby power products, Econoler believes that the diversity factor would be minimal for each product, resulting in negligible demand savings.

3.8 EXTERNAL POWER SUPPLIES

3.8.1 Product Description

As defined by NRCan, external power supplies are small external plug-in devices that convert AC 120V line voltage to a lower voltage either alternating current (AC) or direct current (DC) to power various small products. Often called power adaptors, they are commonly sold with portable or electronic end-use products such as portable or mobile phones, modems, camcorders, portable monitors, notebooks, etc.¹¹⁴

¹¹⁴ Office of Energy Efficiency, *External Power Supplies – Final Bulletin on the Standard Update – October 2011*, <http://oee.nrcan.gc.ca/regulations/bulletins/1062>, October 13th, 2011.

3.8.2 Regulation Description

Previous Regulations

External power supplies had not been previously regulated regarding their energy consumption.¹¹⁵

New Regulation

Since April 12, 2012, all EPS whose manufacturing process was completed on or after July 1, 2012 are required to meet new MEPS. “However, there is a delay in the application of MEPS for replacement EPS until July 1, 2013 and an exemption from the no-load performance MEPS for security EPS manufactured prior to July 1, 2017.”¹¹⁶ Here are the new regulatory requirements:

Table 47: Minimum Efficacy Levels – External Power Supplies¹¹⁷

Nameplate Output	Minimum Average Efficiency in Active Mode (In Watts Expressed as a Decimal)	Maximum Power in No-load Mode (Not Applicable to Security EPS)
< 1 watt	0.5 * nameplate output	0.5 watt
≥ 1 watt and ≤ 51 watts	0.09*Ln (nameplate output) + 0.5	0.5 watt
> 51 watts	0.85	0.5 watt

These new regulations “are harmonized with the European Imaging and Sound Association MEPS that came into effect in the U.S. on July 1, 2008 and with H.R.5470 (December 2010) regarding security external power supplies in the U.S.”¹¹⁸

3.8.3 Products Covered by the Introduction of the New Standard

For the purposes of this new standard, NRCan defines an external power supply as a power supply device that:

- > is designed to convert line-voltage AC input into lower-voltage DC or AC output,
- > is able to convert to only one DC or AC output voltage at a time,
- > is designed to be used with a household or office end-use product that constitutes the primary load,
- > is encased in an enclosure separated from that end-use product and is connected to that product by an electrical connection, and
- > has a nominal output power of 250 W or less,

¹¹⁵ Office of Energy Efficiency, *External Power Supplies – Bulletin on Developing Standards – April 2009*, <http://oee.nrcan.gc.ca/regulations/bulletins/14907>, May 21, 2009.

¹¹⁶ Office of Energy Efficiency, *External Power Supplies – Final Bulletin on the Standard Update – October 2011*, <http://oee.nrcan.gc.ca/regulations/bulletins/1062>, October 13th, 2011.

¹¹⁷ Ibid.

¹¹⁸ Ibid.

but does not include a device:

- > that powers the charger of a detachable battery pack of an end-use product,
- > that charges the battery of an end-use product that is fully or primarily motor operated,
- > that is an accessory to a medical device, as defined in section 1 of the Medical Devices Regulations, or
- > that provides power-over-Ethernet with an internal power supply.¹¹⁹

3.8.4 Estimation of the Market Size

In 2012, Ecos produced a market analysis for external power supplies. In this report, based on data from 2008, it is forecasted that 75.5 million external power supplies would be shipped to Canada in 2012.¹²⁰ In a separate Microsoft Excel spreadsheet, Ecos provides the detailed market size for external supplies in Canada.¹²¹ Without province-based data being provided, the Nova Scotian market size was assumed to be proportional to this province's demographic weight.

Table 48: 2012 Market Size of External Power Supplies in Canada and in Nova Scotia¹²²

External Power Supplies Class	Shipments to Canada in 2012	Shipments to Nova Scotia in 2012
Less than 1 W	3,794,219 shipments	104,341 shipments
1 to 5 W	34,131,875 shipments	938,627 shipments
5 to 10 W	14,336,426 shipments	394,252 shipments
11 to 20 W	9,218,512 shipments	253,509 shipments
21 to 50 W	6,481,674 shipments	178,246 shipments
51 to 100 W	5,874,335 shipments	161,544 shipments
More than 100 W	1,650,913 shipments	45,400 shipments
Total	75,487,953 shipments	2,075,919 shipments

Unfortunately, this data was made available to us only after the interviews were completed. Moreover, no specific data was available in Statistics Canada's Canadian International Merchandise Trade Database. Consequently, manufacturers and distributors were asked about their own shipments to Canada and Nova Scotia and their estimated market share instead of having them comment on Econoler's estimate.

Due to time constraints, external power supplies manufacturers and distributors were not included in the sample. It was therefore decided to interview producers and distributors of products that come equipped with an external power supply. Since many products are equipped with external power

¹¹⁹ Office of Energy Efficiency, *External Power Supplies – Final Bulletin on the Standard Update – October 2011*, <http://oee.nrcan.gc.ca/regulations/bulletins/1062>, October 13th, 2011.

¹²⁰ Ecos, 2008 External Power Supply Market Analysis, October 26, 2012, p. 1.

¹²¹ Ecos, 2008 External Power Supply Market Analysis: Canadian EPS Market Spreadsheet, October 26, 2012.

¹²² Ibid.

supplies, the Evaluator decided to focus on the most popular ones in order to facilitate the interview process. Since NRCan provides estimated unitary savings values for various products such as cordless phones, modems, portable video players, camcorders and portable printers, Econoler decided to only cover mobile phones, televisions/monitors and notebooks.

Interviews were conducted with 1 manufacturer and 4 distributors. During the interviews, no participant was able and/or at liberty to share specific data. Most of them were also unfamiliar with the new standard and were therefore unable to estimate its impacts. As a result, the only data that could be used regarding external power supplies is the data NRCan ultimately shared with us. Furthermore, since the standard affects consumer products, Econoler deems appropriate the estimation for Nova Scotia based on its demographic weight.

3.8.5 Portion of the Market Impacted by the Standard

In Ecos' report, non-compliance rates for shipments to Canada in 2008 were estimated.¹²³ However, without provincial statistics, Canadian percentages were applied to the Nova Scotian market. Table 49 shows these non-compliance rates.

Table 49: Portion of the Products Sold with an External Power Supply Impacted by the Standard¹²⁴

Product Class	Percentage of Total Shipments to Canada Affected by the Standard in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012
<1 watts	78%	78%
1-5 watts	63%	63%
5-10 watts	63%	63%
11-20 watts	75%	75%
21-50 watts	80%	80%
51-100 watts	63%	63%
> 100 watts	83%	83%

With study participants being unable to estimate the non-compliance rate of external power supplies with respect to the new MEPS, these numbers were used to estimate the impact of the introduction of this new standard in the Nova Scotian market.

¹²³ Ecos, 2008 External Power Supply Market Analysis, October 26, 2012, p. 2.

¹²⁴ Ibid.

3.8.6 Unitary Savings Values

Below are the unitary savings values provided by Ecos in its spreadsheet:

Table 50: Unitary Savings Values – Products Sold with an External Power Supply¹²⁵

Product Class	Annual Energy Savings (kWh/yr./unit)
<1 watts	5.97
1-5 watts	0.01
5-10 watts	7.99
11-20 watts	0.51
21-50 watts	3.10
51-100 watts	4.51
> 100 watts	0.46

3.8.7 At Meter Energy Savings

Based on Ecos' data, the Evaluator estimates that the standard for external power supplies generated energy savings of 3.480 GWh in Nova Scotia in 2012.

Table 51: Energy Savings from the Introduction of the External Power Supplies Standard in the Nova Scotian Market

Product Class	Shipments to Nova Scotia in 2012	Percentage of Total Shipments to Nova Scotia Affected by the Standard in 2012	Annual Energy Savings	Total Energy Savings at Meter for 2012
<1 watts	104,341 shipments	78%	5.97 kWh/yr./unit	0.484 GWh
1-5 watts	938,627 shipments	63%	0.01 kWh/yr./unit	0.004 GWh
5-10 watts	394,252 shipments	63%	7.99 kWh/yr./unit	1.981 GWh
11-20 watts	253,509 shipments	75%	0.51 kWh/yr./unit	0.097 GWh
21-50 watts	178,246 shipments	80%	3.10 kWh/yr./unit	0.441 GWh
51-100 watts	161,544 shipments	63%	4.51 kWh/yr./unit	0.456 GWh
> 100 watts	45,400 shipments	83%	0.46 kWh/yr./unit	0.017 GWh
Total	2,075,919 shipments	66.9%		3.480 GWh

¹²⁵ Ecos, 2008 External Power Supply Market Analysis: Canadian EPS Market Spreadsheet, October 26, 2012.

3.8.8 At Meter Demand Savings

Econoler did not estimate demand savings for this C&S since the necessary information to calculate a diversity factor for each product class was not available. However, Econoler believes that, considering the nature of the targeted products (i.e. sporadic usage), the diversity factor would be minimal for each product, resulting in negligible demand savings.

3.9 TOTAL SAVINGS AT GENERATOR

Energy savings at meter, for the program were calculated taking into account all product categories for which the necessary information on market size, non-compliance rates and unitary savings values were available. For the calculation of savings at the generator level, Econoler used a line loss factor of 1.100 for the residential sector and 1.064 for the commercial sector, which takes into account transmission and distribution losses. These values were provided by Nova Scotia Power. For product categories targeting both sectors, an average value of 1.082 was used.

Taking everything into account, the 2012 overall energy savings for Codes and Standards are respectively estimated at 15.147 GWh and 4.318 MW at the meter and at 16.353 GWh and 4.663 MW at the generator.

The total savings obtained for Codes and Standards are presented in the next table.

Table 52: Evaluation Results - Energy Savings and Demand Savings for all Codes and Standards

Product Category	Electric Motors	General Service Incandescent Reflector Lamps	Large Air Conditioners and Heat Pumps	Standby Power	External Power Supplies	Total
Energy Savings						
Number of Units	3,338	178,825	215	181,590	2,075,919	2,439,887
Total Energy Savings – at Meter (GWh)	1.146	6.716	0.844	2.961	3.48	15.147
Line Loss Factor	1.064	1.082	1.064	1.082	1.082	-
Total Energy Savings – at Generator (GWh)	1.219	7.267	0.898	3.204	3.765	16.353
Demand Savings						
Total Demand Savings – at Meter (MW)	0.272	3.764	0.282	-	-	4.318
Line Loss Factor	1.064	1.082	1.064	1.082	1.082	-
Total Demand Savings – at Generator (MW)	0.290	4.073	0.300	-	-	4.663

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APPENDIX I – PROTOCOL USED WITH NRCAN

INTRODUCTION (2 minutes)

- Thank Ms. Delves
- Self-introduction by interviewer and colleague
- Introduction of ENSC study

Goal: The objective is to quantify the impact of the introduction of 12 new standards in the Nova Scotia market in terms of energy savings.

The interview should take about 10 minutes.

According to Donald Dodge at ENSC, you are the person best suited to identify who we should speak with for more information about the 12 standards.

Before moving on to the next section: “Do you have any questions before we begin?”

Here is a list of the standards we would like to evaluate:

1. Electric Induction Motors (CAN/CSA 390-10)
2. Incandescent Reflector Lamps from 40W up to 205W (CAN/CSA 862-09)
3. Dry-type Transformers (CAN/CSA 802.2-06)
4. Self-contained Commercial Refrigerator, Freezers and Refrigerator-Freezers (HRAI Standard 1200-2008)
5. Commercial and Industrial Unitary Air Conditioners (CAN/CSA 746-2006)
6. Single Package Vertical Air Conditioners and Heat Pumps (SPVAC & SPVHP) (C746-06)
7. Stand-by Power Consumption (CAN/CSA 62301-07)
8. External Power Supplies (CSA 381.1-08)
9. Digital Television Adaptors (CSA 380-08)

Would it be possible for you to send us some relevant sources of information, such as market analyses, since we are also conducting secondary data research for this project?

CONCLUSION

“This completes our interview. Before we conclude, do you have any comments or suggestions or are there any topics that we haven’t discussed and that you would like to address?”

“Thank you very much for your time. Your participation has truly been helpful. Thank you again and have a nice day.”

APPENDIX II – INTERVIEW GUIDE WITH MANUFACTURERS/DISTRIBUTORS – ELECTRIC MOTORS

INTRODUCTION (2 minutes)

- Thank the interviewee
- The interviewer introduces himself/herself
- The interviewer introduces the ENSC study

Goal: The objective consists in quantifying, in terms of savings, the impact of the introduction of 9 new standards in the Nova Scotian market. The main purpose of this interview is to validate our estimations regarding the Canadian and the Nova Scotian market size for **electric motors of 500 HP or less**.

The interview should take about 10 minutes.

Answers: “There are no wrong answers. We just want you to answer the questions to the best of your knowledge.”

Before going to the next section: “Do you have any questions before we begin?”

[NOTE: EVEN IF THE PARTICIPANT CAN’T PROVIDE QUANTITATIVE DATA, MAKE SURE TO COLLECT ALL RELEVANT QUALITATIVE INFORMATION]

1. To your knowledge, since 2007, have the shipments of electric motors of 500 HP or less to Canada increased, decreased or remained about the same?

To what extent? [Try to obtain the most precise data available, number of units or percentages]

[Note: If the term “shipment” isn’t understood, use the expression “units sold”]

According to our research, there would be approximately [...] in 2012.

Products	Number of Shipments to Canada	Number of Shipments to Nova Scotia
Electric motors of 1 to 5 HP	50 500 shipments	1400 shipments
Electric motors of 6 to 25 HP	44 000 shipments	1200 shipments
Electric motors of 26 to 100 HP	23 000 shipments	600 shipments
Electric motors of 101 to 200 HP	2400 shipments	70 shipments
Electric motors of 201 to 500 HP	1500 shipments	45 shipments
Total (Electric motors of 1 to 500 HP)	120 000 shipments	3300 shipments

2. Does that information seem accurate to you?

If not, what numbers seem wrong to you? And why do you think so?

[IF NUMBERS DO NOT SEEM ACCURATE TO THE RESPONDANT] Do these numbers regarding all electric motors look more realistic to you?

Products	Number of Shipments to Canada	Number of Shipments to Nova Scotia
Electric motors of 1 to 100 HP	313 000 shipments	150 shipments
Electric motors of 101 to 500 HP	3800 shipments	0 shipment
Total (Electric motors of 1 to 500 HP)	315 000 shipments	150 shipments

3. To your knowledge, the shipments to Nova Scotia represent what percentage of total shipments to Canada, in 2012? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products]

Products	Percentage of all Canadian Shipments Being Shipped to Nova Scotia (2012)
Electric motors of 1 to 5 HP	%
Electric motors of 6 to 25 HP	%
Electric motors of 26 to 100 HP	%
Electric motors of 101 to 200 HP	%
Electric motors of 201 to 500 HP	%
Total (Electric motors of 1 to 500 HP)	%

4. To your knowledge, in 2012, approximately which proportion of electric motors of 500 HP or less shipped to Nova Scotia was impacted by the new minimum energy efficiency standard? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products]

Products	Proportion Impacted by the New Standard
Electric motors of 1 to 5 HP	%
Electric motors of 6 to 25 HP	%
Electric motors of 26 to 100 HP	%
Electric motors of 101 to 200 HP	%
Electric motors of 201 to 500 HP	%
Total (Electric motors of 1 to 500 HP)	%

PROBE: The Office of Energy Efficiency has estimated that [...] would be impacted for the whole Canadian market. Do those proportions seem appropriate to you? Provide an explanation.

Products	Proportion Impacted by the New Standard
Electric motors of 1 to 5 HP	71.2%
Electric motors of 6 to 25 HP	56.1%
Electric motors of 26 to 100 HP	48.3%
Electric motors of 101 to 200 HP	47.5%
Electric motors of 201 to 500 HP	77.1%
Total (Electric motors of 1 to 500 HP)	60.7%

5. What sources of information do you use for market data regarding electric motors of 500 HP or less?

CONCLUSION

“Well, this completes our interview. Before we conclude, do you have any comments or suggestions or are there topics that we didn’t address that you would like to talk about?”

“Thank you very much for your time. Your participation was truly helpful. Thank you again and have a nice day!”

APPENDIX III – INTERVIEW GUIDE WITH MANUFACTURERS/DISTRIBUTORS – GENERAL SERVICE INCANDESCENT REFLECTOR LAMPS

INTRODUCTION (2 minutes)

- Thank the interviewee
- The interviewer introduces himself/herself
- The interviewer introduces the ENSC study

Goal: The objective consists in quantifying, in terms of savings, the impact of the introduction of 9 new standards in the Nova Scotian market. The main purpose of this interview is to validate our estimations regarding the Canadian and the Nova Scotian market size for **general service incandescent reflector lamps**.

The interview should take about 10 minutes.

Answers: “There are no wrong answers. We just want you to answer the questions to the best of your knowledge.”

Before going to the next section: “Do you have any questions before we begin?”

[NOTE: EVEN IF THE PARTICIPANT CAN’T PROVIDE QUANTITATIVE DATA, MAKE SURE TO COLLECT ALL RELEVANT QUALITATIVE INFORMATION]

1. To your knowledge, since 2005, have shipments of general service incandescent reflector lamps to Canada increased, decreased or remained about the same?

To what extent? [Try to obtain the most precise data available, number of units or percentages]

[Note: If the term “shipment” isn’t understood, use the expression “units sold”]

According to our research, there would be approximately [...] in 2012. (Read one category at a time and ask Q2 for that category)

Products	Number of Shipments to Canada	Number of Shipments to Nova Scotia
Residential BR lamps of 60 to 85 W	3 350 000 shipments	92 500 shipments
Residential BR lamps of 86 to 155 W	470 000 shipments	12 800 shipments
Commercial BR lamps of 60 to 85 W	2 500 000 shipments	68 000 shipments
Commercial BR lamps of 86 to 155 W	195 000 shipments	5400 shipments
Residential ER30 lamps of 75 W	84 shipments	2 shipments
Residential ER40 lamps of 120 W	5 shipments	0 shipment
Commercial ER30 lamps of 75 W	4550 shipments	125 shipments
Commercial ER40 lamps of 120 W	500 shipments	14 shipments

2. Does that information seem accurate to you?

If not, what numbers seem wrong to you? And why do you think so?

3. To your knowledge, the shipments to Nova Scotia represent what percentage of total shipments to Canada, in 2012? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Percentage of All Canadian Shipments Being Shipped to Nova Scotia (2012)
Residential BR lamps of 60 to 85 W	%
Residential BR lamps of 86 to 155 W	%
Commercial BR lamps of 60 to 85 W	%
Commercial BR lamps of 86 to 155 W	%
Residential ER30 lamps of 75 W	%
Residential ER40 lamps of 120 W	%
Commercial ER30 lamps of 75 W	%
Commercial ER40 lamps of 120 W	%

4. To your knowledge, in 2012, approximately which proportion of general service incandescent reflector lamps shipped to Nova Scotia was impacted by the new minimum energy efficiency standard? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Proportion Impacted by the New Standard
Residential BR lamps of 60 to 85 W	%
Residential BR lamps of 86 to 155 W	%
Commercial BR lamps of 60 to 85 W	%
Commercial BR lamps of 86 to 155 W	%
Residential ER30 lamps of 75 W	%
Residential ER40 lamps of 120 W	%
Commercial ER30 lamps of 75 W	%
Commercial ER40 lamps of 120 W	%

5. What sources of information do you use for market data regarding general service incandescent reflector lamps?

CONCLUSION

“Well, this completes our interview. Before we conclude, do you have any comments or suggestions or are there topics that we didn’t address that you would like to talk about?”

“Thank you very much for your time. Your participation was truly helpful. Thank you again and have a nice day!”

APPENDIX IV – INTERVIEW GUIDE WITH MANUFACTURERS/DISTRIBUTORS – DRY-TYPE TRANSFORMERS

INTRODUCTION (2 minutes)

- Thank the interviewee
- The interviewer introduces himself/herself
- The interviewer introduces the ENSC study

Goal: The objective consists in quantifying, in terms of savings, the impact of the introduction of 9 new standards in the Nova Scotian market. The main purpose of this interview is to validate our estimations regarding the Canadian and the Nova Scotian market size for three-phase dry-type transformers with a nominal power of 15 to 7500 kVA (kilovolt-amperes).

The interview should take about 10 minutes.

Answers: “There are no wrong answers. We just want you to answer the questions to the best of your knowledge.”

Before going to the next section: “Do you have any questions before we begin?”

[NOTE: EVEN IF THE PARTICIPANT CAN’T PROVIDE QUANTITATIVE DATA, MAKE SURE TO COLLECT ALL RELEVANT QUALITATIVE INFORMATION]

1. To your knowledge, since 2007, have the shipments of three-phase dry-type transformers to Canada increased, decreased or remained about the same?

To what extent? [Try to obtain the most precise data available, number of units or percentages]

[Note: If the term “shipment” isn’t understood, use the expression “units sold”]

According to our research, there would be approximately [...] in 2012.

Products	Number of Shipments to Canada	Number of Shipments to Nova Scotia
Three-phase dry-type transformers of 15 to 750 kVA	160 shipments	4 shipments
Three-phase dry-type transformers of 1000 kVA	90 shipments	3 shipments
Three-phase dry-type transformers of 1500 kVA	110 shipments	3 shipments
Three-phase dry-type transformers of 2000 kVA	130 shipments	4 shipments
Three-phase dry-type transformers of 2500 to 7500 kVA	330 shipments	9 shipments
Total (Three-phase dry-type transformers of 15 to 7500 kVA)	820 shipments	23 shipments

2. Does that information seem accurate to you?

If not, what numbers seem wrong to you? And why do you think so?

[IF NUMBERS DO NOT SEEM ACCURATE TO THE RESPONDANT]

According to Statistics Canada Imports Database, there would have been approximately 100,000 dry-type transformers imported to Canada in 2012 with a capacity exceeding 15 kVA

Does this number seem more accurate to you? Why?

3. To your knowledge, the shipments to Nova Scotia represent what percentage of total shipments to Canada, in 2012? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Percentage of All Canadian Shipments Being Shipped to Nova Scotia (2012)
Three-phase dry-type transformers of 15 to 750 kVA	%
Three-phase dry-type transformers of 1000 kVA	%
Three-phase dry-type transformers of 1500 kVA	%
Three-phase dry-type transformers of 2000 kVA	%
Three-phase dry-type transformers of 2500 to 7500 kVA	%
Total (Three-phase dry-type transformers of 15 to 7500 kVA)	%

4. To your knowledge, in 2012, approximately which proportion of three-phase dry type transformers shipped to Nova Scotia was impacted by the new minimum energy efficiency standard? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products]

Products	Proportion Impacted by the New Standard
Three-phase dry-type transformers of 15 to 750 kVA	%
Three-phase dry-type transformers of 1000 kVA	%
Three-phase dry-type transformers of 1500 kVA	%
Three-phase dry-type transformers of 2000 kVA	%
Three-phase dry-type transformers of 2500 to 7500 kVA	%
Total (Three-phase dry-type transformers of 15 to 7500 kVA)	%

PROBE: The Office of Energy Efficiency has estimated that [...] would be impacted for the whole Canadian market. Do those proportions seem appropriate to you? Provide an explanation.

Products	Proportion Impacted by the New Standard
Three-phase dry-type transformers of 15 to 750 kVA	97%
Three-phase dry-type transformers of 1000 kVA	95%
Three-phase dry-type transformers of 1500 kVA	95%
Three-phase dry-type transformers of 2000 kVA	95%
Three-phase dry-type transformers of 2500 to 7500 kVA	90%
Total (Three-phase dry-type transformers of 15 to 7500 kVA)	93%

5. What sources of information do you use for market data regarding dry-type transformers?

CONCLUSION

“Well, this completes our interview. Before we conclude, do you have any comments or suggestions or are there topics that we didn’t address that you would like to talk about?”

“Thank you very much for your time. Your participation was truly helpful. Thank you again and have a nice day!”

APPENDIX V – INTERVIEW GUIDE WITH MANUFACTURERS/DISTRIBUTORS – SELF-CONTAINED COMMERCIAL REFRIGERATORS AND FREEZERS

INTRODUCTION (2 minutes)

- Thank the interviewee
- The interviewer introduces himself/herself
- The interviewer introduces the ENSC study

Goal: The objective consists in quantifying, in terms of savings, the impact of the introduction of 9 new standards in the Nova Scotian market. The main purpose of this interview is to validate our estimations regarding the Canadian and the Nova Scotian market size for **commercial self-contained refrigerators and freezers**.

The interview should take about 10 minutes.

Answers: “There are no wrong answers. We just want you to answer the questions to the best of your knowledge.”

Before going to the next section: “Do you have any questions before we begin?”

[NOTE: EVEN IF THE PARTICIPANT CAN'T PROVIDE QUANTITATIVE DATA, MAKE SURE TO COLLECT ALL RELEVANT QUALITATIVE INFORMATION]

1. To your knowledge, since 2009, have the shipments of commercial self-contained refrigerators and freezers to Canada increased, decreased or remained about the same?

To what extent? [Try to obtain the most precise data available, number of units or percentages]

[Note: If the term “shipment” isn’t understood, use the expression “units sold”]

According to our research, there would be approximately [...] in 2012.

Products	Number of Shipments to Canada	Number of Shipments to Nova Scotia
Opaque self-contained ice cream-type freezer	70 shipments	2 shipments
Transparent self-contained ice cream-type freezer	1500 shipments	40 shipments

Also according to our research, there was approximately 20 000 shipments to Canada of commercial refrigerators and freezers of all types in 2012 (not only the self-contained products).

2. Does that information seem accurate to you?
If not, what numbers seem wrong to you? And why do you think so?

3. What percentage of total shipments of commercial refrigerators and freezers to Canada do you think the sales of these products represent?

Products	Percentage of Total Commercial Refrigerator and Freezer shipments
Opaque self-contained refrigerator	%
Transparent self-contained refrigerator	%
Opaque self-contained freezer	%
Transparent self-contained freezer	%
Opaque self-contained ice cream-type freezer	%
Transparent self-contained ice cream-type freezer	%

4. To your knowledge, the shipments to Nova Scotia represent what percentage of total shipments to Canada, in 2012? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Percentage of All Canadian Shipments Being Shipped to Nova Scotia (2012)
Opaque self-contained refrigerator	%
Transparent self-contained refrigerator	%
Opaque self-contained freezer	%
Transparent self-contained freezer	%
Opaque self-contained ice cream-type freezer	%
Transparent self-contained ice cream-type freezer	%

To your knowledge, in 2012, approximately which proportion of commercial self-contained refrigerators and freezers shipped to Nova Scotia was impacted by the new minimum energy efficiency standard? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Proportion Impacted by the New Standard
Opaque self-contained refrigerator	%
Transparent self-contained refrigerator	%
Opaque self-contained freezer	%
Transparent self-contained freezer	%
Opaque self-contained ice cream-type freezer	%
Transparent self-contained ice cream-type freezer	%

PROBE: The Office of Energy Efficiency has estimated that [...] would be impacted for the whole Canadian market. Do those proportions seem appropriate to you? Provide an explanation.

Products	Proportion Impacted by the New Standard
Opaque self-contained ice cream-type freezer	88.7%
Transparent self-contained ice cream-type freezer	75.4%

5. What sources of information do you use for market data regarding commercial refrigerators and freezers?

CONCLUSION

“Well, this completes our interview. Before we conclude, do you have any comments or suggestions or are there topics that we didn’t address that you would like to talk about?”

“Thank you very much for your time. Your participation was truly helpful. Thank you again and have a nice day!”

APPENDIX VI – INTERVIEW GUIDE WITH MANUFACTURERS/DISTRIBUTORS – LARGE AIR CONDITIONERS AND HEAT PUMPS AND SINGLE PACKAGE VERTICAL AIR CONDITIONERS AND HEAT PUMPS

INTRODUCTION (2 minutes)

- Thank the interviewee
- The interviewer introduces himself/herself
- The interviewer introduces the ENSC study

Goal: The objective consists in quantifying, in terms of savings, the impact of the introduction of 9 new standards in the Nova Scotian market. The main purpose of this interview is to validate our estimations regarding the Canadian and the Nova Scotian market size for **large air conditioners and heat pumps and single package vertical air conditioners and heat pumps**.

The interview should take about 10 minutes.

Answers: “There are no wrong answers. We just want you to answer the questions to the best of your knowledge.”

Before going to the next section: “Do you have any questions before we begin?”

[NOTE: EVEN IF THE PARTICIPANT CAN’T PROVIDE QUANTITATIVE DATA, MAKE SURE TO COLLECT ALL RELEVANT QUALITATIVE INFORMATION]

1. To your knowledge, since 2006, have shipments of large air conditioners and heat pumps and single package vertical air conditioners and heat pumps to Canada increased, decreased or remained about the same?

To what extent? [Try to obtain the most precise data available, number of units or percentages]

[Note: If the term “shipment” isn’t understood, use the expression “units sold”]

According to our research, there would be approximately [...] in 2012.

Products	Number of Shipments to Canada	Number of Shipments to Nova Scotia
Medium air conditioners (between 19.0 kW and 39.6 kW (between 65 kBtu/h and 135 kBtu/h))	15 600 shipments	180 shipments
Large air conditioners (between 39.6 kW and 70.3 kW (between 135 kBtu/h and 240 kBtu/h))	6000 shipments	150 shipments

Products	Number of Shipments to Canada	Number of Shipments to Nova Scotia
Very large air conditioners (between 70.3 kW and 223 kW (between 240 kBtu/h and 760 kBtu/h))	1300 shipments	15 shipments
Large heat pumps (with capacity equal to or greater than 65 kBtu/h (19.0 kW))	570 shipments	30 shipments
Single package vertical air conditioner	2400 shipments	65 shipments
Single package vertical heat pump	350 shipments	10 shipments

2. Does that information seem accurate to you?

If not, what numbers seem wrong to you? And why do you think so?

3. To your knowledge, the shipments to Nova Scotia represent what percentage of total shipments to Canada, in 2012? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Percentage of All Canadian Shipments Being Shipped to Nova Scotia (2012)
Medium air conditioners (between 19.0 kW and 39.6 kW (between 65 kBtu/h and 135 kBtu/h))	%
Large air conditioners (between 39.6 kW and 70.3 kW (between 135 kBtu/h and 240 kBtu/h))	%
Very large air conditioners (between 70.3 kW and 223 kW (between 240 kBtu/h and 760 kBtu/h))	%
Large heat pumps (with capacity equal to or greater than 65 kBtu/h (19.0 kW))	%
Single package vertical air conditioner	%
Single package vertical heat pump	%

4. To your knowledge, in 2012, approximately which proportion of large air conditioners and heat pumps and single package vertical air conditioners and heat pumps shipped to Nova Scotia was impacted by the new minimum energy efficiency standard? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Proportion Impacted by the New Standard
Medium air conditioners (between 19.0 kW and 39.6 kW (between 65 kBtu/h and 135 kBtu/h))	%
Large air conditioners (between 39.6 kW and 70.3 kW (between 135 kBtu/h and 240 kBtu/h))	%
Very large air conditioners (between 70.3 kW and 223 kW (between 240 kBtu/h and 760 kBtu/h))	%
Large heat pumps (with capacity equal to or greater than 65 kBtu/h (19.0 kW))	%
Single package vertical air conditioner	%
Single package vertical heat pump	%

PROBE: The Office of Energy Efficiency has estimated that [...] would be impacted for the whole Canadian market. Do those proportions seem appropriate to you? Provide an explanation.

Products	Proportion Impacted by the New Standard
Medium air conditioners (between 19.0 kW and 39.6 kW (between 65 kBtu/h and 135 kBtu/h))	90%
Large air conditioners (between 39.6 kW and 70.3 kW (between 135 kBtu/h and 240 kBtu/h))	90%
Very large air conditioners (between 70.3 kW and 223 kW (between 240 kBtu/h and 760 kBtu/h))	90%
Large heat pumps (with capacity equal to or greater than 65 kBtu/h (19.0 kW))	90%
Single package vertical air conditioner	90%
Single package vertical heat pump	90%

5. What sources of information do you use for market data regarding air conditioners and heat pumps?

CONCLUSION

“Well, this completes our interview. Before we conclude do you have any comments or suggestions or are there topics that we didn’t address that you would like to talk about?”

“Thank you very much for your time. Your participation was truly helpful. Thank you again and have a nice day!”

APPENDIX VII – INTERVIEW GUIDE WITH MANUFACTURERS/DISTRIBUTORS – STANDBY POWER

INTRODUCTION (2 minutes)

- Thank the interviewee
- The interviewer introduces himself/herself
- The interviewer introduces the ENSC study

Goal: The objective consists in quantifying, in terms of savings, the impact of the introduction of 9 new standards in the Nova Scotian market. The main purpose of this interview is to validate our estimations regarding the Canadian and the Nova Scotian market size for **different electronic products which have a standby/sleep mode.**

The interview should take about 10 minutes.

Answers: “There are no wrong answers. We just want you to answer the questions to the best of your knowledge.”

Before going to the next section: “Do you have any questions before we begin?”

[NOTE: EVEN IF THE PARTICIPANT CAN’T PROVIDE QUANTITATIVE DATA, MAKE SURE TO COLLECT ALL RELEVANT QUALITATIVE INFORMATION]

A. Of the following products, which ones does your company produce/distribute?

Products	Produced/Distributed (Yes or No)
Integrated stereo	
Portable audio	
Televisions	
Non-recording video players (DVD players, Blu-ray disc players, etc.)	
Recording video players (DVD players with a DVR)	

[Description if needed]

Products	Description
Integrated stereo	An audio stereo device that can only be powered by mains, not batteries, and that can play compact disks, radio, tapes, and/or MP3s.
Portable audio	A portable audio stereo device that can be powered by batteries or mains and that can play compact disks, radio, tapes, and/or MP3s

[Ask the following questions only for the products produced/distributed by the enterprise of the interviewee.]

1. To your knowledge, since 2007, have shipments of [integrated stereo, portable audio, televisions, non-recording video players and/or recording video players] to Canada increased, decreased or remained about the same?

To what extent? [Try to obtain the most precise data available, number of units or percentages]

[Note: If the term “shipment” isn’t understood, use the expression “units sold”]

According to our research, there would be approximately [...] in 2012.

Products	Number of Shipments to Canada	Number of Shipments to Nova Scotia
Integrated stereo	360 000 shipments	9 900 shipments
Portable audio	600 000 shipments	16 500 shipments
Televisions	3 500 000 shipments	97 000 shipments
Non-recording video players	1 500 000 shipments	41 500 shipments
Recording video players	615 000 shipments	16 900 shipments

2. Does that information seem accurate to you?

If not, what numbers seem wrong to you? And why do you think so?

3. To your knowledge, the shipments to Nova Scotia represent what percentage of total shipments to Canada, in 2012? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Percentage of All Canadian Shipments Being Shipped to Nova Scotia (2012)
Integrated stereo	%
Portable audio	%
Televisions	%
Non-recording video players	%
Recording video players	%

4. To your knowledge, in 2012, approximately which proportion of [integrated stereo, portable audio, televisions, non-recording video players and/or recording video players] shipped to Nova Scotia was impacted by the new minimum energy efficiency standard? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Proportion Impacted by the New Standard
Integrated stereo	%
Portable audio	%
Televisions	%
Non-recording video players	%
Recording video players	%

PROBE: The Office of Energy Efficiency has estimated that [...] would be impacted for the whole Canadian market. Do those proportions seem appropriate to you? Provide an explanation.

Products	Proportion Impacted by the New Standard
Integrated stereo	51%
Portable audio	5%
Televisions	7%
Non-recording video players	17%
Recording video players	48%

5. What sources of information do you use for market data regarding [integrated stereo, portable audio, televisions, non-recording video players and/or recording video players]?

CONCLUSION

“Well, this completes our interview. Before we conclude do you have any comments or suggestions or are there topics that we didn’t address that you would like to talk about?”

“Thank you very much for your time. Your participation was truly helpful. Thank you again and have a nice day!”

APPENDIX VIII – INTERVIEW GUIDE WITH MANUFACTURERS/DISTRIBUTORS – EXTERNAL POWER SUPPLIES

INTRODUCTION (2 minutes)

- Thank the interviewee
- The interviewer introduces himself/herself
- The interviewer introduces the ENSC study

Goal: The objective consists in quantifying, in terms of savings, the impact of the introduction of 9 new standards in the Nova Scotian market. The main purpose of this interview is to validate our estimations regarding the Canadian and the Nova Scotian market size for **different electronic products which use external power supplies**.

The interview should take about 10 minutes.

Answers: “There are no wrong answers. We just want you to answer the questions to the best of your knowledge.”

Before going to the next section: “Do you have any questions before we begin?”

[NOTE: EVEN IF THE PARTICIPANT CAN’T PROVIDE QUANTITATIVE DATA, MAKE SURE TO COLLECT ALL RELEVANT QUALITATIVE INFORMATION]

A. Of the following products, which ones does your company produce/distribute?

Products	Produced/Distributed (Yes or No)
Mobile phones (5 watts or less)	
Small flat panel TV/monitors (21 to 50 watts)	
Flat panel monitors (51 to 100 watts)	
Notebooks (51 to 100 watts)	
High wattage notebooks (greater than 100 watts)	

[Ask the following questions only for the products produced/distributed by the enterprise of the interviewee.]

1. To your knowledge, since 2007, have the shipments of [mobile phones, flat panel TV/monitors and/or notebooks] to Canada increased, decreased or remained about the same?
 To what extent? [Try to obtain the most precise data available, number of units or percentages]
[Note: If the term “shipment” isn’t understood, use the expression “units sold”]
2. Approximately how many units of [mobile phones, flat panel TV/monitors and/or notebooks] did your enterprise produce/distribute for the Canadian market in 2012?
 And would you have that information specifically for Nova Scotia (or the Maritimes)?

3. What share of the Canadian market does your enterprise hold for [mobile phones, flat panel TV/monitors and/or notebooks]? And what is its share of the market in Nova Scotia?
4. To your knowledge, the shipments to Nova Scotia represent what percentage of total shipments to Canada, in 2012? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Percentage of All Canadian Shipments Being Shipped to Nova Scotia (2012)
Mobile phones (5 watts or less)	%
Small flat panel TV/monitors (21 to 50 watts)	%
Flat panel monitors (51 to 100 watts)	%
Notebooks (51 to 100 watts)	%
High wattage notebooks (greater than 100 watts)	%

5. To your knowledge, in 2012, approximately which proportion of [mobile phones, flat panel TV/monitors and/or notebooks] shipped to Nova Scotia was impacted by the new minimum energy efficiency standard? [Try to obtain a percentage for each type of product if possible. If not, just ask for a percentage for all products of the same category]

Products	Proportion Impacted by the New Standard
Mobile phones (5 watts or less)	%
Small flat panel TV/monitors (21 to 50 watts)	%
Flat panel monitors (51 to 100 watts)	%
Notebooks (51 to 100 watts)	%
High wattage notebooks (greater than 100 watts)	%

PROBE: The Office of Energy Efficiency has estimated that [...] would be impacted for the whole Canadian market. Do those proportions seem appropriate to you? Provide an explanation.

Products	Proportion Impacted by the New Standard
Small flat panel TV/monitors (21 to 50 watts)	80%
Flat panel monitors (51 to 100 watts)	63%
Notebooks (51 to 100 watts)	63%
High wattage notebooks (greater than 100 watts)	83%

6. What sources of information do you use for market data regarding [mobile phones, flat panel TV/monitors and/or notebooks]?

CONCLUSION

“Well, this completes our interview. Before we conclude do you have any comments or suggestions or are there topics that we didn’t address that you would like to talk about?”

“Thank you very much for your time. Your participation was truly helpful. Thank you again and have a nice day!”

