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Request IR-01:

Please provide anticipated energy savings, demand reductions and program administrator costs for all sub-components in the approved 2019 DSM Resource Plan.

Response IR-01:

Please refer to the table on the following page.

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1

2019 APPROVED DSM RESOURCE PLAN			
	Budget ($M)	GWh	MW
RESIDENTIAL DSM PROGRAMS			
EFFICIENT PRODUCT REBATES	**3.5**	**14.9**	**1.5**
Appliance Retirement	1.1	2.3	0.3
Instant Savings	2.4	12.6	1.2
EXISTING RESIDENTIAL	**8.6**	**31.0**	**7.0**
Home Energy Assessment	3.0	9.4	2.4
Green Heat	1.7	4.8	2.7
Efficient Product Installation	4.0	16.9	2.0
First Nations	-	-	-
Affordable Multifamily Housing	-	-	-
NEW RESIDENTIAL	**2.2**	**5.3**	**1.6**
New Home Construction	2.2	5.3	1.6
RESIDENTIAL TOTAL	14.2	51.2	10.0
BUSINESS, NONPROFIT AND INSTITUTIONAL PROGRAMS (BNI)			
EFFICIENT PRODUCT REBATES	**5.2**	**32.5**	**5.1**
Business Energy Rebates	5.2	32.5	5.1
CUSTOM INCENTIVES	**6.1**	**34.3**	**3.6**
Custom	5.3	30.1	3.2
EMIS	0.3	1.8	0.2
SEM	0.5	2.5	0.3
DIRECT INSTALLATION	**4.1**	**9.3**	**1.5**
SBES	4.1	9.3	1.5
BNI TOTAL	15.4	76.1	10.2
ENABLING STRATEGIES	**4.5**	-	-
Education & Outreach	1.6	-	-
Development & Research	2.2		
Other Enabling Strategies	0.7		
DSM TOTAL	**34.1**	**127.2**	**20.2**

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Request IR-02:

For the 2019 DSM Resource Plan and for the proposed 2020-2022 DSM Resource Plan:

(a) Please indicate which programs and sub-components receive funding from customers as well as the government or other entities. Please break out the division of funding by source and sub-component.

(b) Please list individually, the total costs for these programs and sub-components with and without non-customer funding sources.

Response IR-02:

a) All EfficiencyOne's DSM programs and program components receive funding from NS Power's customers or ratepayers for both the 2019 and the 2020-2022 DSM Resource Plan. In addition to this, EfficiencyOne also receives funding from the Province of Nova Scotia for non-electric energy efficiency in residential program components including: Instant Savings, Home Energy Assessment, Green Heat, Efficient Product Installation, First Nations and Affordable Multifamily Housing.

Costs directly incurred by each program component including incentives are attributed to the program before shared costs are allocated. Shared costs are allocated using the Nova Scotia Utility and Review Board approved Cost Allocation Methodology at the program component level between both the DSM and provincially program components.

b) For the 2019 DSM Resource Plan funding by NS Power customers for electric programs and program components, please refer to EfficiencyOne's response to NS Power IR-01.

For the 2020-2022 DSM Resource Plan proposed funding by NS Power customers for electric program and program components, please refer to the table below.

2020-2022 PROPOSED DSM RESOURCE PLAN			
	Budget ($M)	GWh	MW
RESIDENTIAL DSM PROGRAMS			
EFFICIENT PRODUCT REBATES	**10.5**	**41.5**	**4.3**
Appliance Retirement	4.5	7.7	1.1
Instant Savings	6.0	33.8	3.3
EXISTING RESIDENTIAL	**34.0**	**104.7**	**49.6**
Home Energy Assessment	10.2	23.1	8.1
Green Heat	9.5	39.3	35.9
Efficient Product Installation	6.8	34.7	4.0
First Nations	4.5	2.9	0.8
Affordable Multifamily Housing	3.0	4.8	0.8
NEW RESIDENTIAL	**9.0**	**17.0**	**4.8**
New Home Construction	9.0	17.0	4.8
RESIDENTIAL TOTAL	53.4	163.2	58.7
BUSINESS, NONPROFIT AND INSTITUTIONAL PROGRAMS (BNI)			
EFFICIENT PRODUCT REBATES	**22.6**	**125.7**	**26.2**
Business Energy Rebates	22.6	125.7	26.2
CUSTOM INCENTIVES	**27.8**	**102.6**	**27.2**
Custom	26.0	93.6	25.9
EMIS	0.8	4.5	0.8
SEM	1.0	4.5	0.5
DIRECT INSTALLATION	**13.9**	**30.2**	**8.0**
SBES	13.9	30.2	8.0
BNI TOTAL	64.2	258.5	61.4
ENABLING STRATEGIES	**11.5**	-	-
Education & Outreach	2.8	-	-
Development & Research	2.9	-	-
Other Enabling Strategies	5.8	-	-
DSM TOTAL	**129.1**	**421.7**	**120.0**

Columns may not add correctly, due to rounding.

As noted above, there is no portion of the electricity efficiency programs or program components which are funded with non-customer funding sources.

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Request IR-03:

Please provide the following information:

	Actual Program Spending including Full HST ($M)	Actual Program Spending with HST Adjusted for ICTs ($M)	Annual Energy Savings (GWH)	Annual Demand Reductions (MW)
2010				
2011				
2012				
2013				
2014				
2015				
2016				
2017				
2018				
2019 (Approved)				
2020 (Proposed by E1)				
2021 (Proposed by E1)				
2022 (Proposed by E1)				

Response IR-03:

Please refer to the table provided on the next page.

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1

	Program Expenses Reported Including HST ITCs ($M)	HST ITCs Included ($M)	Program Expenses Reported Excluding ITCs ($M)	Annual Energy Savings (GWH)	Annual Demand Reductions (MW)
2010 Actual*	24.0	1.0	23.0	82.5	15.9
2011 Actual*	40.7	3.7	37.0	141.8	28.9
2012 Actual*	48.0	4.2	43.8	158.1	33.8
2013 Actual*	43.4	3.6	39.8	163.2	34.1
2014 Actual*	38.9	1.6	37.3	151.9	27.1
2015 Actual**	34.5	2.3	32.2	137.9	22.7
2016 Actual	30.9	-	30.9	136.9	26.0
2017 Actual	30.3	-	30.3	130.7	23.7
2018 Actual	34.0	-	34.0	151.4	25.5
2019 Approved	34.1	-	34.1	127.2	20.2
2020 Proposed	41.9	-	41.9	140.2	38.7
2021 Proposed	43.3	-	43.3	141.3	40.3
2022 Proposed	43.9	-	43.9	140.2	41.1

*2011-2014 ITCs of $14.1M were under appeal with the Tax Court of Canada until the matter was settled in 2018. The Electricity and Efficiency Conservation and Restructuring (2014) Act, Section 8, states "any assets of the Corporation [ENSTC] acquired on or after the Implementation Date must be transferred to Nova Scotia Power Incorporated for the benefit of customer so Nova Scotia Power Incorporated as directed by the [Review] Board."

**2015 spending was reduced by $2.3M to cover the ITCs until EfficiencyOne had certainty about its ability to claim ITCs. The $2.3M was applied to as a credit to payments received from NS Power in 2017.

2

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Request IR-04:

Do any of EfficiencyOne's affiliates have any involvement, direct or indirect, in the execution of the Preferred Plan. If yes, please describe all such involvement in detail.

Response IR-04:

EfficiencyOne does not intend for any affiliate to be involved in the execution of the Preferred Plan.

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Request IR-05:

Please describe in detail all changes made to EfficiencyOne's Preferred Plan and Alternate Scenario as a result of comments received from DSMAG stakeholders regarding the 2020-2022 DSM Plan update EfficiencyOne provided to the DSMAG on December 7, 2018.

Response IR-05:

EfficiencyOne engaged stakeholders beginning in the fall of 2018 sharing both the Preferred Plan and Alternate Scenario to encourage input into the development of both these options. Engagement included stakeholder meetings, the DSM Advisory Group (DSMAG) meeting held December 7th, 2018, the 2020-2022 DSM Resource Plan Technical Conference held February 20th, 2019 and ongoing counsel to counsel communications. Discussions included savings and investment levels that were being considered throughout the engagement.

At the December 7, 2018 DSMAG meeting, EfficiencyOne provided an update on the development of the 2020-2022 DSM Resource Plan. The presentation included background information, development approach, guiding principles, preliminary energy savings, demand savings, and investment level. In addition, to the discussion held during the DSMAG meeting, EfficiencyOne invited written comments from stakeholders until December 21, 2018, specifically comments on the following two questions:

- What are you hearing from your clients?
- Is there anything we are missing?

EfficiencyOne received the following general comments:

- general support for increasing the emphasis on demand reduction; and
- general support with increasing focus on helping underserved markets realize the benefits of energy efficiency.

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The following table provides additional stakeholder comments and how EfficiencyOne has addressed these.

Stakeholder Comment	How comment was addressed	Reference
Consider additional alternate scenarios with lower investment levels (e.g. $34 million, $27 million).	EfficiencyOne did consider alternate scenarios with both a $34M and $27M annual investment.	Please refer to EfficiencyOne's response to NS Power IR-07 b).
Consider more ambitious Preferred Plan with energy savings at the 2014 Integrated Resource Plan (IRP) Preferred Resource Plan level.	In determining the appropriate level of energy savings for the Preferred Plan EfficiencyOne did rely on the 2014 IRP Preferred Resource Plan.	Please refer to the Evidence - Section 4.1 – The 2014 IRP and 4.2 – IRP Preferred Resource Plan Trend.
Consider proposed plans that achieve a first-year unit cost of no more than $0.24 /kWh.	Through the development of the Plan EfficiencyOne focused on the appropriate level of energy savings and the delivery approach to achieve these savings. As a consequence of this approach the unit cost of the Plan was higher than $0.24 / kWh.	Please refer to the Evidence Section 3.3 – Key Considerations that informed the Preferred Plan and Section 5 – Balanced Plan Approach.
Provide the basis of selecting the level of investment for the Preferred Plan and Alternate Scenario.	EfficiencyOne's basis for the development of both the Preferred Plan and Alternate Scenario was guided by three key considerations: • Maximizing energy savings; • Ensuring a balanced portfolio;	Please refer to the Evidence Section 4 - Determining the Appropriate Level of Energy Savings, Section 5 - Balanced Plan Approach, Section 6 -The Appropriate Investment Level, and

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Stakeholder Comment	How comment was addressed	Reference
	and • Establishing an appropriate investment level.	Section 8 -Alternate Scenario.
Provide comparison of Preferred Plan and Alternate Scenario.	A comparison of the Preferred Plan and Alternate Scenario at the program level is provided as part of Appendix A – 2020-2022 DSM Resource Plan.	Please refer to Appendix A-Program Alternatives in Section 4.1.9, 4.2.9, 4.3.8, 5.1.9, 5.2.9, and 5.3.9.
Provide data that show shifts in end uses and measures targeted in the portfolio, including non-lighting and lighting, and heat pumps.	Expert testimony was provided as part of the Application on the lighting transition and the need for diversification within energy efficiency portfolios.	Please refer to Appendix D - The Direct Evidence of Dr. David Hill.
Explain EfficiencyOne's shift in focus towards demand savings, describe how such savings would be achieved, and at what cost.	An explanation for the inclusion of demand reduction within the DSM Plan specifically related to why focus on demand reduction now and how EfficiencyOne plans to achieve this is included in the Evidence.	Please refer to the Evidence -Section 5.4 - Avoided Capacity Investments.

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Request IR-06:

(a) Please confirm the energy savings and the demand savings achieved by EfficiencyOne in 2018. To the extent such savings have not yet been confirmed by EfficiencyOne, please provide the most recent estimate available.

(b) Please confirm EfficiencyOne's cumulative energy savings and the cumulative demand savings achieved by EfficiencyOne over the 2016-2018 contract period. To the extent such savings have not yet been confirmed by EfficiencyOne, please provide the most recent estimate available.

(c) Please confirm the amount of surplus funds, if any, realized by EfficiencyOne at the end of the 2016-2018 contract period both by year and cumulatively. To the extent any amount has not yet been confirmed by EfficiencyOne, please provide the most recent estimate available.

Response IR-06:

a) In 2018, EfficiencyOne achieved 151.4 GWh of first-year energy savings, 1,778.6 GWh of lifetime energy savings, and 25.5 MW of peak demand savings. Additional detail is provided in EfficiencyOne's 2018 Evaluation Reports[1] and 2018 Annual Progress Report[2].

b) In 2016-2018, EfficiencyOne achieved 419.0 GWh of cumulative first-year energy savings, 5,371.8 GWh of cumulative lifetime energy savings, and 75.2 MW of cumulative

[1] 2018 DSM Evaluation Reports: Efficiency Nova Scotia, Final Report, 27 March 2019, p 15-16.
[2] 2018 DSM Annual Progress Report: EfficiencyOne, 29 March 2019, p 2.

peak demand savings. Additional detail is provided in EfficiencyOne's 2018 Evaluation Reports[3] and 2018 Annual Progress Report[4].

c) At the end of the 2016-2018 DSM Plan period, the cumulative underspend realized by EfficiencyOne was $7.1 million. The underspend realized in 2016, 2017 and 2018 is $2.4 million, $3.7 million, and $1 million respectively. Additional detail is provided in EfficiencyOne's 2018 Annual Progress Report[5].

[3] 2018 DSM Evaluation Reports: Efficiency Nova Scotia, Final Report, 27 March 2019, p 32.
[4] 2018 DSM Annual Progress Report: EfficiencyOne, 29 March 2019, p 40.
[5] 2018 DSM Annual Progress Report: EfficiencyOne, 29 March 2019.

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Request IR-07:

In the UARB's Order approving the 2016-2018 DSM Supply Agreement, the UARB directed as follows:

> **The Board directs E1, in future applications, to provide one or more alternate scenarios of DSM budgets for the Board to consider, and NSPI is to provide rate impact analysis on those scenarios.**

EfficiencyOne's application contains an alternate scenario of 125 GWh of incremental energy savings per year for an average annual investment of approximately $37 million.

(a) Please explain why EfficiencyOne provided only one alternate scenario of DSM budgets with its application.

(b) Please describe any other alternate scenarios of DSM budgets developed or considered by EfficiencyOne in preparing its Application other than its Alternate scenario of $37 million and provide copies of all documents in relation to such alternate scenarios.

(c) What level of consultation, if any, did EfficiencyOne engage in with stakeholders in deciding upon the number of alternative scenarios to present to the UARB in its Application?

(d) What level of consultation, if any, did EfficiencyOne engage in when creating the details of the alternate scenario(s), including but not limited to, spend level and energy and capacity savings?

(e) How were the investment level and savings determined for the Alternate scenario? Provide any data, reports or other evidence used to create the Alternate scenario? Was the ProCESS model run separately for the Preferred Plan and Alternate scenario?

(f) If the answer to (e) is 'yes', explain any differences in model inputs used to create the Alternate scenario compared with those used to create the Preferred Plan. If the answer to (e) is 'no', explain why EfficiencyOne did not run the ProCESS model to develop the Alternate scenario.

Response IR-07:

a) On October 7, 2015 the Nova Scotia Utility and Review Board ordered EfficiencyOne to provide one or more alternate scenarios of DSM budgets for the Board to consider in future DSM Applications. Early in the planning process EfficiencyOne considered the number of alternates to include in its 2020-2022 DSM Resource Plan Application. Having regard to the cost and time involved in the preparation of a fully modeled DSM Plan, the decision was made to focus on one fully developed alternate scenario. EfficiencyOne understood that the alternate scenario included in the Application was intended to represent a viable and deliverable DSM Plan, incorporating all of the requisite considerations that would inform the EfficiencyOne Preferred Plan and be developed using the same rigour as the Preferred Plan. EfficiencyOne does not believe the Board requirement to provide alternate budgets was intended to amount to a mathematical exercise of costing various investment levels without regard to considerations such as deliverability, balanced portfolio, short and long term affordability, and related factors considered in the development of an appropriate and deliverable DSM Plan.

b) EfficiencyOne produced tables from model outputs for three additional scenarios in response to stakeholder requests: one with a $34M annual investment without demand

reduction (please refer to Attachment 1 of this IR response), one with a $27M annual investment (please refer to Attachment 2 of this IR response) and one with a $34M annual investment inclusive of demand reduction (please refer to Attachment 3 of this IR response). These tables were not fully vetted to determine if they could be delivered as modelled. Although not fully vetted, EfficiencyOne did consider how these investment level tables aligned with the key considerations that guided the development of the 2020-2022 DSM Resource Plan:

- Maximizing Energy Savings (customer value);
- Ensuring a Balanced Portfolio (customer need); and
- Establishing an Appropriate Investment Level (customer affordability).

The $27M annual investment tables show this level of investment would result in less than 100 GWh of savings per year or a reduction of 25 percent from 2019. Directionally this moves Nova Scotians further away from the level of DSM in the 2014 Integrated Resource Plan (IRP) Preferred Resource Plan. EfficiencyOne would be challenged to design and deliver a program that aligns with the Balanced Plan approach outlined in the Standardized Framework within this investment level. The results do not include investment in demand reduction or underserved markets because these initiatives generate no or little energy savings as compared to the investment required. A $27M annual investment reduces EfficiencyOne's ability to overcome barriers through the introduction of enhancements.

The $34M annual investment with demand reduction tables show this level of investment would result in annual energy savings of approximately 118 GWh; this is less than the 2019 target of 127.2 GWh. This level of energy savings directionally moves Nova Scotians further away from the level of DSM in the 2014 IRP Preferred Resource Plan. The tables show that energy savings from existing programs may not be at the same level as 2019 and without the ability to increase the level of enhancements, progress to overcome barriers may become more challenging into the future.

Consequently, EfficiencyOne filed its Alternate Scenario with a $37M annual investment.

c) Please refer to EfficiencyOne's response to NS Power IR-05.

d) Please refer to EfficiencyOne's response to NS Power IR-05.

e) The process model was used to model both the Preferred Plan and Alternate Scenario. Please refer to EfficiencyOne's response to NS Power IR-30, part c) for a summary of measure-level ProCESS model outputs for the Alternate Scenario.

f) Please refer to EfficiencyOne's response to NS Power IR-67 for a description of how measure quantities were determined to generate the Alternate Scenario.

EfficiencyOne

2020-2022 DSM Resource Plan - $34M Investment - Requested by NSP

2020	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.3	7.7	13.9	99.6	1.5	1.2	2.3
Existing Residential	8.0	64.5	31.6	497.8	16.3	2.1	8.1
New Residential	2.6	12.5	5.4	162.5	1.5	1.6	4.9
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	6.2	41.9	33.7	483.5	6.7	2.1	6.8
Custom Incentives	6.5	33.5	29.6	408.2	4.9	2.2	5.2
Direct Installation	3.9	10.9	9.0	122.9	1.9	2.3	2.8
Enabling Strategies							
Education and Outreach	0.8	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.8	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.5	N/A	N/A	N/A	N/A	N/A	N/A
Total	**33.4**	**171.0**	**123.2**	**1774.5**	**32.8**	**2.0**	**5.1**

2021	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.2	6.6	12.3	82.4	1.3	1.1	2.1
Existing Residential	8.0	67.7	31.6	515.3	16.5	2.2	8.4
New Residential	2.7	13.4	5.6	168.2	1.6	1.6	4.9
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	6.2	45.7	34.8	503.1	7.1	2.2	7.3
Custom Incentives	6.7	36.1	30.5	421.5	5.0	2.3	5.4
Direct Installation	3.9	11.9	9.4	129.1	2.0	2.3	3.0
Enabling Strategies							
Education and Outreach	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.8	N/A	N/A	N/A	N/A	N/A	N/A
Total	**34.2**	**181.4**	**124.1**	**1819.6**	**33.5**	**2.1**	**5.3**

2022	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.0	5.9	10.5	71.9	1.0	1.0	1.9
Existing Residential	7.6	66.5	29.8	479.9	16.1	2.2	8.8
New Residential	2.9	14.3	5.7	173.8	1.6	1.7	5.0
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	6.5	49.2	35.9	521.3	7.4	2.3	7.6
Custom Incentives	6.9	39.0	31.4	434.9	5.2	2.4	5.7
Direct Installation	4.0	13.0	9.9	135.4	2.1	2.3	3.2
Enabling Strategies							
Education and Outreach	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.8	N/A	N/A	N/A	N/A	N/A	N/A
Total	**34.4**	**188.0**	**123.2**	**1817.1**	**33.3**	**2.1**	**5.5**

Year	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
2020	33.4	171.0	123.2	1774.5	32.8	2.0	5.1
2021	34.2	181.4	124.1	1819.6	33.5	2.1	5.3
2022	34.4	188.0	123.2	1817.1	33.3	2.1	5.5
Total	**102.0**	**540.3**	**370.5**	**5411.2**	**99.5**	**2.1**	**5.3**

[a]Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using utility WACC.

[b]TRC is a benefit/cost ratio of comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.

[c]PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

Note: These results have not subject to the rigour of E1's vetting process. These are not considered deliverable Plans by E1.

EfficiencyOne
2020-2022 DSM Resource Plan - $27M Investment - Requested by NSP

2020	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	2.9	7.0	12.6	90.9	1.4	1.4	2.5
Existing Residential	6.4	40.2	23.8	378.0	8.6	2.4	6.3
New Residential	2.3	11.4	4.9	147.1	1.4	1.6	4.9
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	5.3	36.3	29.2	420.1	5.8	2.1	6.8
Custom Incentives	3.5	22.9	20.6	279.0	3.4	2.4	6.6
Direct Installation	3.7	10.5	8.6	117.9	1.8	2.3	2.8
Enabling Strategies							
Education and Outreach	0.8	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.8	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.5	N/A	N/A	N/A	N/A	N/A	N/A
Total	**27.1**	**128.2**	**99.8**	**1433.0**	**22.3**	**2.0**	**4.7**

2021	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	2.6	6.0	10.6	75.4	1.1	1.3	2.3
Existing Residential	6.3	41.5	23.8	379.3	8.6	2.5	6.6
New Residential	2.4	11.7	4.9	147.3	1.4	1.6	4.9
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	5.2	38.4	29.2	423.0	6.0	2.2	7.4
Custom Incentives	3.5	23.9	20.6	279.0	3.4	2.5	6.9
Direct Installation	3.6	10.9	8.6	118.0	1.8	2.3	3.1
Enabling Strategies							
Education and Outreach	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.8	N/A	N/A	N/A	N/A	N/A	N/A
Total	**27.1**	**132.4**	**97.8**	**1421.9**	**22.2**	**2.1**	**4.9**

2022	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	2.1	4.5	7.0	56.0	0.6	1.1	2.1
Existing Residential	6.3	42.2	23.8	372.7	8.5	2.5	6.7
New Residential	2.6	13.0	5.2	158.1	1.5	1.7	5.0
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	5.3	40.1	29.2	424.6	6.0	2.3	7.6
Custom Incentives	3.5	25.1	20.6	279.0	3.4	2.6	7.2
Direct Installation	3.5	11.4	8.6	118.1	1.8	2.4	3.3
Enabling Strategies							
Education and Outreach	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.8	N/A	N/A	N/A	N/A	N/A	N/A
Total	**26.8**	**136.2**	**94.5**	**1408.5**	**21.7**	**2.1**	**5.1**

Year	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
2020	27.1	128.2	99.8	1433.0	22.3	2.0	4.7
2021	27.1	132.4	97.8	1421.9	22.2	2.1	4.9
2022	26.8	136.2	94.5	1408.5	21.7	2.1	5.1
Total	**81.0**	**396.8**	**292.0**	**4263.4**	**66.2**	**2.1**	**4.9**

[a]Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using utility WACC.
[b]TRC is a benefit/cost ratio of comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.
[c]PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

Note: These results have not subject to the rigour of E1's vetting process. These are not considered deliverable Plans by E1.

EfficiencyOne

2020-2022 DSM Resource Plan - Status Quo $34M Investment Level

Year	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
2020	33.1	166.9	118.0	1702.9	32.7	2.0	5.0
2021	34.2	179.7	118.9	1745.9	34.6	2.1	5.3
2022	34.7	189.0	118.0	1743.6	35.7	2.1	5.4
Total	**102.1**	**535.6**	**354.9**	**5192.4**	**103.0**	**2.1**	**5.2**

2020	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.2	7.3	13.3	95.1	1.4	1.2	2.3
Existing Residential	8.5	63.4	30.6	484.6	16.1	2.1	7.5
New Residential	2.5	12.0	5.1	155.1	1.5	1.6	4.9
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	6.0	41.0	32.1	461.4	6.8	2.1	6.8
Custom Incentives	6.2	31.9	28.3	389.5	4.7	2.2	5.2
Direct Installation	3.9	11.2	8.6	117.2	2.2	2.4	2.9
Enabling Strategies							
Education and Outreach	0.8	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.8	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.5	N/A	N/A	N/A	N/A	N/A	N/A
Total	**33.1**	**166.9**	**118.0**	**1702.9**	**32.7**	**2.0**	**5.0**

2021	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	3.0	6.3	11.7	78.9	1.2	1.1	2.1
Existing Residential	8.6	66.8	30.5	501.3	16.5	2.2	7.8
New Residential	2.6	12.8	5.3	160.5	1.5	1.6	4.9
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	6.1	46.9	33.2	480.0	8.2	2.4	7.6
Custom Incentives	6.3	34.4	29.1	402.2	4.8	2.3	5.4
Direct Installation	4.0	12.5	9.0	123.2	2.4	2.4	3.2
Enabling Strategies							
Education and Outreach	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.8	N/A	N/A	N/A	N/A	N/A	N/A
Total	**34.2**	**179.7**	**118.9**	**1745.9**	**34.6**	**2.1**	**5.3**

2022	Investment ($ million)	Lifetime Benefits ($ million)[a]	Incremental Annual Net Energy Savings at Generator (GWh)	Lifetime Energy Savings at Generator (GWh)	Incremental Annual Net Demand Savings at Generator (MW)	Total Resource Cost Test (TRC)[b]	Program Administrator Cost Test (PAC)[c]
Residential DSM Programs							
Efficient Product Rebates	2.9	5.6	10.0	68.8	1.0	1.0	1.9
Existing Residential	8.4	66.5	28.8	467.5	16.4	2.2	7.9
New Residential	2.8	13.7	5.5	165.8	1.6	1.7	5.0
Business, Nonprofit and Institutional Programs							
Efficient Product Rebates	6.5	51.9	34.3	497.4	9.2	2.5	8.0
Custom Incentives	6.5	37.2	30.0	414.9	4.9	2.4	5.7
Direct Installation	4.2	14.1	9.4	129.2	2.7	2.5	3.4
Enabling Strategies							
Education and Outreach	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Development and Research	0.9	N/A	N/A	N/A	N/A	N/A	N/A
Other Enabling Strategies	1.8	N/A	N/A	N/A	N/A	N/A	N/A
Total	**34.7**	**189.0**	**118.0**	**1743.6**	**35.7**	**2.1**	**5.4**

[a]Lifetime benefits are expressed as the net present value of the avoided costs, including energy, capacity, transmission and distribution, over the life of the program measures, using utility WACC.

[b]TRC is a benefit/cost ratio of comparing lifetime benefits to the sum of EfficiencyOne's and participants' costs.

[c]PAC is a benefit/cost ratio comparing lifetime benefits to EfficiencyOne's costs.

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Request IR-08:

Reference: Appendix B, Forward Looking Rate & Bill Impact Analysis, page 8, lines 5-7.

EfficiencyOne states that "the 2020-2022 DSM Plan includes both a Preferred Plan and an Alternate scenario, which contain different investment levels and savings over the three years of DSM delivery." However, slide 4 of EfficiencyOne's December 7, 2018 presentation to the DSMAG titled "2020-2022 DSM Resource Plan" refers to an "alternate Plan."

(a) Please explain the difference between a plan and a scenario. Does EfficiencyOne use these terms synonymously?

(b) Explain why the alternate Plan in the DSMAG presentation is now referred to as an Alternate scenario.

Response IR-08:

a) During initial stakeholder meetings and at the December 7, 2018 DSM Advisory Group meeting (DSMAG), EfficiencyOne did refer to the 2020-2022 Alternate Scenario filed on February 28, 2019 as the Alternate Plan. Initially, EfficiencyOne referred to both the Preferred and the Alternate as Plans because the same level of rigour was applied during the development of both options. EfficiencyOne did not intend to file an Alternate that could not be delivered upon. Appendix A – 2020-2022 DSM Resource Plan, Section 4 - Residential Programs and Services and Section 5 – Business, Non-Profit and Institutional Programs and Services, includes a section "Program Alternative" for each program outlining the details of the Alternate Scenario. EfficiencyOne now refers to the Alternate as a scenario not a plan.

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b) In preparing the Application, EfficiencyOne followed the Standardized Filing Framework which was based upon the Nova Scotia Utility and Review Board's(NSUARB) October 7, 2015 Order that stated EfficiencyOne will "provide one or more alternate scenarios of DSM budgets for the Board to consider, and NSPI is to provide rate impact analysis on those scenarios." A scenario is required to be presented as a table including the following list of portfolio-level metrics including:

- Investment;
- Incremental net Energy Savings (First Year);
- Incremental net Demand Savings (First Year);
- Weighted-Average Measure Life;
- Lifetime Benefits;
- Incremental net Energy Savings (Lifetime);
- Incremental net Demand Savings (Lifetime); and
- NSUARB-Approved Cost-Effectiveness Testing.

All the information required by the Standardized Filing Framework for the Alternate has been included in Appendix A – 2020-2022 DSM Resource Plan Sections 4 and 5 and in Appendix C – Alternate Scenario.

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Request IR-09:

At NS Power's request, immediately prior to EfficiencyOne's technical conference on February 20, 2019, Navigant prepared scenarios for NS Power based on a $27 million DSM budget and a $34 million DSM budget.

(a) Please provide copies of each of $27 million and $34 million investment level scenarios produced by Navigant as well as copies of all supporting documents and underlying workings papers for each.

(b) Was the ProCESS model used to develop each of the $27 million and $34 million investment level scenarios?

(c) Are either of the $27 million or $34 million investment level scenarios achievable DSM Plans? If not, please provide details as to why not.

(d) If EfficiencyOne is unable to confirm whether the $27 million or $34 million scenarios are achievable DSM Plans in the same manner as it is the Preferred Plan, please undertake the analysis necessary to confirm and provide copies of all documents and working papers related to such analysis.

Response IR-09:

At the request of NS Power, EfficiencyOne coordinated a meeting involving Navigant, NS Power and EfficiencyOne to review the model inputs and to address questions regarding the functions of the model and its inputs. EfficiencyOne did prepare and share tables including a version of a $27M and $34M annual investment level. Please refer to EfficiencyOne's response to NS Power IR-07 b). The tables had not been subject to the complete vetting process to determine if the outputs could be developed into a deliverable DSM plan.

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In response to a request of NS Power, Navigant, through EfficiencyOne, offered to provide to NS Power a "static model" should NS Power wish to review it.

On February 6, 2019, Navigant provided the following details for the "static model":

- Term: License for 30 days, then return or destroy Model.
- Purpose: Only for use of Model for internal review of inputs and outputs.
- Model in a "read only" version.
- Navigant has no obligation to provide any support, maintenance, enhancements or updates to the current Model.
- Restrictions: May not: (i) modify or create any derivative works of all or any portion of the Model, including translation or localization; (ii) decompile, disassemble, reverse engineer, or otherwise attempt to derive the source code for the Model (except to the extent applicable laws specifically prohibit such restriction); (iii) redistribute, encumber, sell, rent, lease, sublicense, use the Model in a timesharing or service bureau arrangement, or otherwise transfer rights to all or any portion of the Model; (iv) copy all or any portion of the Model (except for an archival copy); (v) remove any trademark, logo, copyright, or other proprietary notices, legends, symbols, or labels in the Model; (vi) modify or create any header files, libraries, "sets" or "blocks" in the Model; (vii) remove or alter any trademark, logo, copyright, or other proprietary notices, legends, symbols, or labels in the Model; or (viii) use any related documentation provided for use with the Model except in connection with the Model.

In addition to the "static model" EfficiencyOne also offered to facilitate model runs for NS Power with Navigant. On February 15, 2019, NS Power provided their specifications to Navigant for four model runs. The outputs from the model runs requested were provided directly to NS Power from Navigant. NS Power did not request EfficiencyOne review or provide input into these model runs. Therefore, none of the NS Power model runs were subject to EfficiencyOne's full vetting process to determine if any of the model runs could be developed into deliverable DSM plans.

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a) In response to this IR, EfficiencyOne requested copies of the four model outputs for the $27M and $34M investment levels provided by Navigant to NS Power. Please refer to Attachments 1 – 4 of this IR response (filed electronically) for copies of the four model outputs provided.

b) Navigant has confirmed that the ProCESS model was used to develop each of the $27M and $34M investment level scenarios.

c) EfficiencyOne has not fully vetted the model outputs that were provided to NS Power to determine whether they could be deliverable DSM plans. Please refer to EfficiencyOne's response to NS Power IR-07 a).

d) EfficiencyOne, in response to NS Power's comments from the December 7, 2018 DSM Advisory Group, did provide tables for a $27 million and $34 million investment level. Please refer to EfficiencyOne's response to NS Power IR-07 b).

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Request IR-10:

Reference: Evidence, page 1, lines 9-11.

(a) Please explain how EfficiencyOne determined that price of the energy and savings in its Preferred Plan is an "affordable" investment level for Nova Scotians?

(b) Please provide the results of any surveys carried out by EfficiencyOne of Nova Scotians regarding the affordability of EfficiencyOne's proposed DSM budget for the 2020-2022 contract period.

Response IR-10:

a) Affordability is a key factor in DSM planning and is one criterion to be considered by the Nova Scotia Utility and Review Board in assessing and approving DSM plans. EfficiencyOne detailed its approach to the affordability consideration in its evidence (Evidence, pages 39 through 46).

EfficiencyOne considers the determination of affordability to be a balancing of short term and long term rate and bill impact considerations to electricity customers. DSM is affordable "when [its] acquisition is analyzed and is deemed to be worth the resources it takes to manage it".[1] In the context of the direct Preferred Plan costs – the three-year investment for Nova Scotians is $129.1M with corresponding lifetime energy savings yielding present value utility savings of $622.7M, or a return of $4.8 for every $1 of investment. In the context of bill impacts, rate increases, averaged over the life of measures, are 0.8 percent to 1.7 percent, with average bill savings for total customers

[1] Black's Law Dictionary – Online 2nd ed

between 1 percent and 4 percent, together with average Participants saving up to 11 percent[2].

The Preferred Plan directionally moves energy savings targets toward the Mid-Level DSM (identified by the IRP to yield the lowest long-term electricity cost to customers).

EfficiencyOne was guided in its assessment of Plan affordability by historical DSM Plan approved investment levels as presented in Table 1 below.

Table 1:

	Historical UARB Approved Investment ($M)
2011	41.90
2012	43.70
2013	46.25
2014	48.70
2015	39.00
2016	33.21
2017	34.02
2018	34.92
2019	34.05
5-year average	35.04
9- year average	**39.52**

Each of these approved Plans, and corresponding investment levels, was subject to rigorous stakeholder and regulatory review and ultimately determined to be in the best interest of NS Power ratepayers; and therefore affordable.

At an average annual investment of $43.0M, the EfficiencyOne's Preferred DSM Plan falls within the 9-year range of approved investments over Efficiency Nova Scotia's

[2] Evidence filed February 28, 2019, Appendix B, 2020 – 2022 Plan Rate and Bill Impact Analysis Report, page 36 of 37 at lines 18 – 21

history and is closer to the average $39.5M than the maximum approved to date of $48.7M.

Glenn Reed, in his Direct Evidence, Appendix E, page 16, of the Application, concludes his written testimony by answering the question "Given the analyses presented above, do you conclude that EfficiencyOne's proposed Preferred Plan is affordable?" by saying "Yes. EfficiencyOne is proposing to achieve its Plan savings at or below many of its peer PAs on a percentage spending basis and on an annual and lifetime cost rate basis."

Furthermore, EfficiencyOne's affordable $43.0M annual Preferred DSM Plan can be provided in a manner which requires ratepayer contributions that are lower than the historical average approved annual amount of $39.5M. EfficiencyOne has proposed in its Application that the HST settlement recovery received in 2018, be amortized across the 2020-2022 DSM Plan and used to offset the required investment level. This, together with the offset associated with the cumulative 2016-2018 DSM Plan underspend of $7.1M and interest earned of $0.4M for a total of $7.5M, will result in the Preferred DSM Plan being delivered to ratepayers at a level below the average historical approved investment levels as presented in Table 2 below.

Table 2:

	2020 ($M)	**2021 ($M)**	**2022 ($M)**
Preferred Plan Investment	41.9	43.3	43.9
2016-2018 Cumulative Underspend / Interest Earned	(2.5)	(2.5)	(2.5)
HST recovery	(5.0)	(5.0)	(5.0)
Net Ratepayer Contribution	**34.4**	**35.8**	**36.4**

The required investment, net of cumulative underspend and HST recovery, amounts to an annual average of $35.53M over the 3-year Preferred Plan. This represents a 1.4 percent increase over the 5-year historic rolling average and a 10.1 percent decrease from the 9-year historic average investment level, all previously determined by the Board to be in ratepayers' best interests. Notably, over the previous DSM Plan period of 2016 -2018, the Consumer Price Index rose at an annual average rate of 1.76 percent (2016 – 1.4 percent; 2017 – 1.6 percent; 2018 – 2.3 percent)[3].

Having regard to historical approved DSM investment levels and expert testimony – EfficiencyOne determined that its 2020-2022 Preferred DSM Plan is affordable.

b) EfficiencyOne did not conduct any surveys with Nova Scotians specifically related to the affordability of the Preferred Plan.

[3] Statistics Canada – Consumer Price Index – Annual Review 2018

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Request IR-11:

Reference: Evidence, page 7, lines 19-21.

EfficiencyOne states that the level of energy savings in the preferred plan was informed by the 2014 IRP and "re-inforced by trends in leading jurisdictions..."

(a) Please list the jurisdictions considered and the trends in each.

(b) Please explain how EfficiencyOne determined that each of the jurisdictions identified in (a) was a "leading jurisdiction".

Response IR-11:

a) Table 1 below identifies the jurisdictions considered, along with their energy savings trends (as a percentage of utility energy sales) for the years 2011 to 2017. Table 2 provides Efficiency Nova Scotia's energy savings for comparison. Figure 1 illustrates Efficiency Nova Scotia's trend compared to the average of the top 10 jurisdictions.

Table 1[1]:

Year	Top 10 jurisdictions energy savings (as % of Utility Energy Sales) from the 2018 ACEEE Scorecard (ACEEE Scorecards from previous years were used to populate trends over the years 2011 to 2017)										Top 10 Average
	Vermont	Rhode Island	Massachusetts	California	Connecticut	Michigan	Hawaii	Washington	Illinois	Arizona	(%)
2011	2.1%	1.3%	1.4%	1.4%	1.3%	1.0%	1.3%	0.9%	0.7%	1.4%	1.3%
2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	#N/A
2013	1.8%	2.1%	2.1%	1.3%	1.0%	1.5%	1.7%	1.4%	1.0%	1.7%	1.5%
2014	1.9%	3.5%	2.5%	1.6%	1.3%	1.4%	1.5%	1.0%	1.1%	1.6%	1.7%
2015	2.0%	2.9%	2.7%	2.0%	1.5%	1.2%	1.5%	1.4%	1.1%	1.2%	1.8%
2016	2.5%	2.9%	3.0%	1.5%	1.5%	1.2%	1.3%	1.5%	1.2%	1.4%	1.8%
2017	3.3%	3.1%	2.6%	2.0%	1.6%	1.5%	1.5%	1.4%	1.3%	1.3%	2.0%

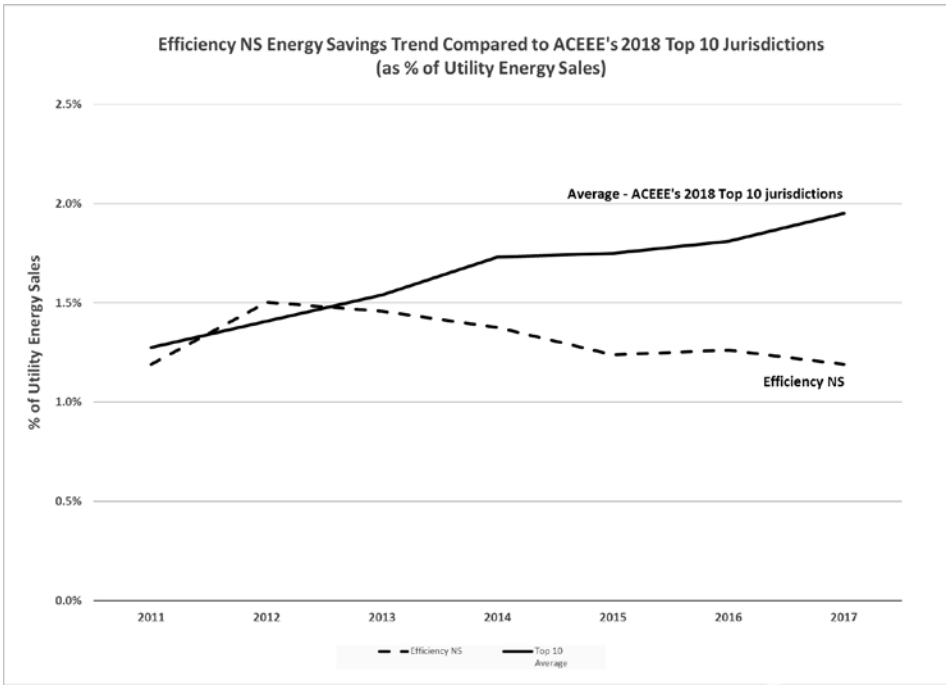
[1] Data is from ACEEE State Energy Efficiency Scorecards' (2012 through 2018) Tables of net incremental electricity savings by state.

Table 2:

	Effficiency NS	NS Power	Efficiency NS
Year	Energy Savings* at Generator (GWh)	Production** at Generator (GWh)	Energy Savings as % of Production (%)
2011	141.8	11,917	1.2%
2012	158.1	10,509	1.5%
2013	163.2	11,204	1.5%
2014	151.9	11,047	1.4%
2015	137.9	11,129	1.2%
2016	136.9	10,839	1.3%
2017	130.7	10,978	1.2%

* From Annual Evaluation & Verification Reports
** From Emera MD&As

Figure 1:



b) As provided in the 2018 ACEEE Scorecard, these are the top 10 jurisdictions that are leading in terms of energy savings as a percentage of utility sales.

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Request IR-12:

Reference: Evidence, page 20, Table 4.

(a) Please update Table 4 with information for years 2011 to 2014 and the unverified forecast for 2018.

(b) Please provide EfficiencyOne's total spend on lighting measures:

(i) in dollars; and

(ii) as a percentage of overall spend

for each of the years 2011 to 2014 and 2018 (budget).

(c) Please provide the market price of the most common residential lighting solution for each of the years 2011 to 2018.

(d) Please provide projected market prices of the same lighting solutions as set out in (c) over the next five years.

Response IR-12:

a) The Efficiency Nova Scotia Corporation data tracking system between 2011 and 2014 did not track energy savings by end use. This information is not available for the years 2011 - 2014.

Table 1 below provides an update to Table 4, with unverified 2018 forecast:

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Table 1: Historical percentages of lighting energy savings within each ENS program component (2015-2018)

Percent of Savings from Lighting					
Program	**Program Component**	**2015**	**2016**	**2017**	**2018**
BNI	Business Energy Rebates	84%	84%	86%	92%
	Small Business Energy Solutions	87%	73%	80%	86%
	Custom	20%	9%	14%	8%
	Energy Management Information Systems	0%	0%	0%	0%
	Strategic Energy Management	0%	0%	0%	0%
Residential	Appliance Retirement	0%	0%	0%	0%
	Instant Savings	82%	95%	92%	85%
	Efficient Products Installation	65%	64%	69%	63%
	Home Energy Assessment	0%	0%	0%	0%
	Green Heat	0%	0%	0%	0%
	New Home Construction	0%	0%	0%	0%

b) As per above, the data tracking system used between 2011 and 2014 did not allow for this level of detail to be provided. Following is the result for 2018:

(i) EfficiencyOne's total spending on lighting in 2018 was $15.71M.

(ii) EfficiencyOne's spending on lighting in 2018 was 51 percent of its total 2018 expenditure (excluding Enabling Strategies).

c) The most common residential lighting solution is LED A-Series lamps. EfficiencyOne is providing the average retail price of products receiving rebates through the Instant Savings program component. Retailers participating in Instant Savings may also stock and sell other A-Series lamps which do not receive a rebate (e.g. they do not meet program criteria such as Energy Star certification). Furthermore, retailers not participating in the program would have A-Series LEDs at prices not included below. Table 2 below provides the average LED price of A-Series lamp type for the years 2016 – 2018 included in the Instant Savings program component:

Table 2:

Year	**Price**
2016	$5.26
2017	$3.04
2018	$3.10

Prior to 2016, information on the average price of an A-Series LED is not available as details on average LED prices include all lamp types.

d) EfficiencyOne does not have the projected market price for A-Series LED lamps over the next five years. The incentives in retail stores for this measure have been discontinued as of 2019.

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Request IR-13:

Reference: Evidence, page 24, lines 5-6.

(a) Please describe the process by which EfficiencyOne identified underserved markets and barriers to assessing DSM activities in the Residential and BNI sectors and copies of any research, reports, surveys or other data relied upon by EfficiencyOne in identifying those markets and barriers.

(b) What barriers to participation in the Residential and BNI sectors were identified by EfficiencyOne at the time of the 2016-2018 DSM Plan and the 2019 DSM Plan.

(c) Did the barriers to participation identified in Tables 6 and 7 exist at the time of the 2016-2018 DSM Plan and the 2019 DSM Plan? If not, why not?

(d) Please describe the differences, if any, in the mitigation strategies to be used by EfficiencyOne to address barriers participation in the Residential and BNI sectors in its Preferred Plan compared to the mitigation strategies to barriers to participation used at the time of the 2016-2018 DSM Plan and EfficiencyOne's 2019 DSM Plan.

(e) Please provide a table similar to Table 6 showing the mitigation strategies used by EfficiencyOne in its 2016-2018 DSM Plan to barriers to participation in the Residential sector.

(f) Please provide a table similar to Table 6 showing the mitigation strategies used by EfficiencyOne in its 2019 DSM Plan to barriers to participation in the Residential sector.

(g) Please provide a table similar to Table 7 showing the mitigation strategies used by EfficiencyOne in its 2016-2018 DSM Plan to barriers to participation in the BNI sector.

(h) Please provide a table similar to Table 7 showing the mitigation strategies used by EfficiencyOne in its 2019 DSM Plan to barriers to participation in the BNI sector.

Response IR-13:

a) EfficiencyOne, through the administration of the HomeWarming program and engagement with the Affordable Energy Coalition, identified that there were limited services accessible for low-income renters that included deep energy retrofits, for example insulation. This in addition to the 2017 agreement with the Province of Nova Scotia to offer these services to non-electrically heated buildings informed the inclusion of these services in the 2020-2022 DSM Resource Plan for electrically heated buildings.

EfficiencyOne, through the same 2017 agreement with the Province, initiated a pilot for First Nation communities offering deep energy retrofits for non-electrically heated homes. It was identified by this work there existed an opportunity to expand this pilot into the electrically heated homes in these communities. For this reason, EfficiencyOne has included these services.

b) EfficiencyOne has made continuous progress in reducing barriers to participation in both the Residential and BNI sectors since 2016. The participation barriers identified in the 2020-2022 DSM Resource Plan are similar to the barriers identified over the periods of the 2016-2018 DSM Resource Plan and 2019 DSM Resource Plan.

c) Please refer to part b).

d) The 2020-2022 DSM Resource Plan introduces the following specific program enhancements to further overcome participation barriers:

- New service:
  - Appliance replacement: full-service appliance replacement package to Nova Scotians at a cost to participants (provides removal and recycling of old, inefficient appliances, and the installation of new efficient replacement appliances).
  - Small commercial new construction: offers financial and technical assistance to small commercial buildings.
- New measures:
  - electric thermal storage units (for both Residential and BNI);
  - efficient clothes dryers;
  - drain water heat recovery units; and
  - domestic water heater timers.
- New program components:
  - Affordable Multi-Family and Non-Profit Organizations: program component offers project management support to participants combined with technical and financial assistance to help building owners make energy efficient upgrades.
  - First Nations Home Energy Efficiency: a whole home service offering deep energy retrofits to participants.
- New approach:
  - Mid-stream delivery approach for cold climate ductless heat pumps: instant rebate rather than after purchase application.
  - Home Energy Assessment project management support.
- Increased financial support:
  - heat pump water heaters;
  - drain water heat recovery units; and
  - deep energy retrofits in Home Energy Assessment.
- Focused engagement:

- additional engagement with plumbers and plumbing contractors; and
- additional engagement with residential home heating distributors.

In addition to the enhancements listed above, EfficiencyOne will build upon the successful strategies used in 2016 through 2019. These include:

- New activities to cross-promote ENS programs and program components to potential participants;
- Continuing to launch new products and services;
- Evolving program design to adapt to changing marketing conditions;
- Continuing to offer financial incentives in the form of rebates or financing;
- Additional technical and project management support on Residential and BNI projects;
- Continued accessibility of Residential and BNI services across Nova Scotia;
- Researching and piloting new products and services;
- Increased collaboration with Efficiency Trade Network members and program delivery agents to reach target markets and deliver messaging and education effectively;
- Increased engagement with builders and permit offices to reach target markets and deliver messaging effectively;
- Additional education and training for Efficiency Trade Network members and program delivery agents;
- Additional promotion at industry events, home shows, trade shows, and community events;
- Additional community outreach;
- Additional outreach activities with industry and trade associations;
- Developing new strategic partnerships;
- Increased use of data analytics to enhance messaging and reach target markets;
- New partner recognition activities;
- New enhancements to the ENS website; and
- Additional activities as opportunities arise.

e) Information on participation barriers and mitigation strategies employed by EfficiencyOne in 2016-2018 are included in evaluation reports, Annual Progress Reports and Quarterly Reports filed with the Nova Scotia Utility and Review Board. This information will continue to be included in these reports on the 2019 DSM Plan activity.

f) Please refer to part e).

g) Please refer to part e).

h) Please refer to part e).

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Request IR-14:

Reference: Evidence, page 27, lines 14-15.

(a) Please describe in detail all changes to the financial and technical assistance provided to customers under the Preferred Plan compared to both the 2016-2018 DSM Plan and the 2019 DSM Plan.

(b) Please provide a breakdown of the costs of the financial and technical assistance provided to customers in the Residential Sector under:

(i) the Preferred Plan;

(ii) the 2019 DSM Plan; and

(iii) the 2016-2018 DSM Plan.

(c) Please provide a breakdown of the costs of the financial and technical assistance provided to customers in the BNI Sector under:

(i) the Preferred Plan;

(ii) the 2019 DSM Plan; and

(iii) the 2016-2018 DSM Plan.

Response IR-14:

a) The 2019 DSM Plan is a continuation of the 2016-2018 DSM Plan and therefore, with the exception of the new demand reduction pilot, does not differ materially from the 2016-2018 DSM Plan. In the Preferred Plan, as compared to 2019, changes or enhancements are summarized for the Residential Sector in Appendix A – Table 6, Page 19-20 and for the BNI Sector in Appendix A – Table 15, Page 53. Residential Sector enhancements are detailed in Appendix A – Section 4 on a program by program basis and BNI Sector enhancements detailed in Appendix A – Section 5 on a program by program basis.

NON-CONFIDENTIAL

b) The table below provides a breakdown of total costs, which includes technical assistance, financial assistance, and administrative cost (i.e. all cost except enabling strategies). This information is provided by program and by sector for 2016-2018, 2019 and 2020-2022.

	Investment ($M)		
	2016-2018 (Approved)	**2019 (Approved)**	**2020-2022 (Preferred Plan)**
Efficient Product Rebates	9.9	3.5	10.5
Existing Residential	31.2	8.6	34.0
New Residential	3.8	2.2	9.0
Residential Total	**45.0**	**14.2**	**53.4**
Efficient Product Rebates	17.2	5.2	22.6
Custom Incentives	19.8	6.1	27.8
Direct Installation	11.0	4.1	13.9
BNI Total	**48.0**	**15.4**	**64.2**

c) Please refer to part b).

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Request IR-15:

Reference: Evidence, page 35, lines 4-25.

(a) Please confirm when EfficiencyOne "implemented" each of the cost management strategies identified.

(b) In addition to those identified, what other cost management strategies has EfficiencyOne implemented and when?

(c) Please provide copies of any benchmarking, market research and market comparisons EfficiencyOne has to confirm that costs in the Preferred Plan are aligned with other similar industries and organizations. 7

(d) Please provide a copy of any written procurement policies followed by EfficiencyOne.

(e) Please provide copies of the reports from any independent audits or reviews relied on by EfficiencyOne as part of its cost management strategy.

Response IR-15:

a) EfficiencyOne has implemented each of the cost management strategies as follows:

- Benchmarking – The practice of using third parties for market research and market comparison have been in place since 2011.
- Competitive Procurement – The Board of Directors approved EfficiencyOne's first Procurement Policy in 2010.

- Independent Reviews – The evaluation of energy savings and the audit of financial statements have been conducted since 2010. The internal audit function was introduced in 2013.
- Process Improvement – The introduction of the LEAN approach to guide process improvement within the organization was in 2016.

b) The list in a) is all the cost management strategies EfficiencyOne has implemented to date.

c) In Appendix E – Evidence of Glenn Reed, page 9, line 13, Mr. Reed discusses the result of the benchmarking he performed as it related to the EfficiencyOne Preferred Plan. On page 14, lines 1 - 2, Mr. Reed draws the following conclusion, "Based on the available 2020-2021 data, EfficiencyOne's DSM savings and budget expenditures are projected to largely be at or below its North American peer group."

In addition to the evidence provided by Glenn Reed, EfficiencyOne does rely on benchmarking, market research and market comparisons to ensure its costs are aligned with the other similar industries and organizations. These would include the following:

- CLEAResult - Incentive setting methodology – Please refer to Attachment 1 of this IR response.
- Research into Action - Marketing Evaluation – Please refer to Attachment 2 of this IR response.
- Research into Action - Incentive Setting Practices and Procedure and Business Development Practices and Procedures – Please refer to Attachment 3 of this IR response.
- Annual compensation market data sources such as Mercer Compensation Planning Survey (primary); Conference Board of Canada Compensation Planning Outlook (secondary); and Morneau Shepell Human Resources Trends Report (secondary)

- Every 3 to 5 years EfficiencyOne carries out primary market research to ensure the organization's compensation framework is aligned with the Nova Scotia labour market.

d) Please refer to Attachment 4 of this IR response for a copy of EfficiencyOne's Procurement Policy.

e) All copies of the reports from any independent audit or review are filed with the Nova Scotia Utility and Review Board. This includes all evaluation reports, internal audit reports and externally audited financial statements.

EfficiencyOne

IN THE MATTER OF *The Public Utilities Act*, R.S.N.S. 1989, c.380, as amended.

- and -

IN THE MATTER OF An Application pursuant to Subsection 79J(3) of the *Public Utilities Act* for Approval of the 2016-2018 Supply Agreement for Electricity Efficiency and Conservation Activities.

Incentive Setting Methodology: CLEAResult Report & EfficiencyOne Implementation Plan

FILED
June 30, 2016

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TABLE OF CONTENTS

1. INTRODUCTION 1
1.1 Background 1
2. SUMMARY OF RECOMMENDATIONS 4
3. EFFICIENCYONE'S IMPLEMENTATION PLAN 6
3.1 Recommendation 1 7
3.2 Recommendation 2 8
3.2.1 Recommendation 2 a) 8
3.2.2 Recommendation 2 b) 9
3.2.3 Recommendation 2 c) 9
3.3 Recommendation 3 9
4. ONGOING REPORTING ON IMPLEMENTATION PROGRESS 11
5. CONCLUSION 12
APPENDIX A: CLEARESULT REPORT 13

1. INTRODUCTION

The purpose of this Implementation Plan (the "Plan") is to provide EfficiencyOne's response to the three main recommendations contained within CLEAResult's Incentive Setting Methodology Report (the "Report", attached as Appendix A) and to provide EfficiencyOne's proposed integration of the Report's recommendations into its business practises.[1] As the implementation process will guide and inform detailed changes to business practises, this Plan focuses on high level requirements for implementation.

The following pages provide:

i) a brief background of the genesis of the Report and the stakeholder consultation process followed throughout the project's scoping, procurement and review stages;
ii) a summary of the Report's three main recommendations;
iii) EfficiencyOne's Implementation Plan; and
iv) EfficiencyOne's commitment to provide ongoing updates on its implementation of the Report's recommendations.

EfficiencyOne concludes that this Report provides the tools and methodology to complement and enhance the process for setting incentives, and asks the Nova Scotia Utility and Review Board ("UARB" or "Board") to accept the Report and EfficiencyOne's Implementation Plan.

1.1 Background

During the 2016-2018 DSM Resource Plan regulatory process, Intervenor discussion emerged on the appropriateness of EfficiencyOne's incentive levels for Efficiency Nova Scotia electricity efficiency programs. As a consequence, the Board's Order stated:

[1] The Report presents several ancillary and program-specific recommendations. EfficiencyOne is in the process of considering these recommendations through discussions with program management, the Executive Leadership Team, and other internal stakeholders.

> The Board directs E1 to undertake research and make recommendations on a more rigorous program for determining incentives, which is to be filed by June 30, 2016, provided that any revisions can be implemented shortly thereafter and any long-term contracts with embedded incentives preserve the right to vary such incentives.[2]

In accordance with the Board's Order, EfficiencyOne developed a Scope of Work for the project in November, 2015. This Scope of Work was shared with the DSM Advisory Group (DSMAG) for comments and revised to reflect the Group's feedback. A request for proposals (RFP) procurement process was initiated in late November 2015. Final RFP submissions were received on December 18, 2015, and CLEAResult was selected as the successful proponent on January 8th, 2016.

CLEAResult's approach was consistent with EfficiencyOne's Scope of Work, and included the following major activities:

1. A jurisdictional review of incentive setting methodologies across North American jurisdictions, including staff interviews.
2. A characterisation of Nova Scotia's electricity market, and the regulatory environment in which DSM operates in Nova Scotia.
3. Interviews with EfficiencyOne employees to better understand EfficiencyOne's current incentive setting practices.
4. Application of CLEAResult's findings, in a detailed quantitative manner, to two Efficiency Nova Scotia programs: Custom Retrofit and Instant Savings.

[2] M06733, NSUARB Order, *The Public Utilities Act and An Application for Approval of a Supply Agreement for electricity efficiency and conservation activities between EfficiencyOne and Nova Scotia Power Incorporated, the establishment of a final agreement between the parties, and approval of a 2016-2018 Demand Side Management Resource Plan* (7 Oct 2015), at p 2, item 9.

EfficiencyOne shared a preliminary draft report with the DSMAG on April 11, 2016. This draft report provided CLEAResult's detailed research methodology, but did not provide recommendations for EfficiencyOne. Very limited DSMAG feedback was obtained during this comment period and stakeholders indicated they required a more detailed report to provide comments.

A complete draft report was shared with the DSMAG, on April 29, 2016. EfficiencyOne received feedback from three DSMAG members as part of the final draft report review.[3] Most of the feedback was of a technical nature and resulted in improvements to the Report.

A final report was shared with DSMAG members on June 10, 2016, seeking comments by June 15th, 2016. Consideration of these comments resulted in additional changes to the Report.[4]

[3] Feedback was provided from the Affordable Energy Coalition, the Small Business Advocate, and Nova Scotia Power Inc.

[4] Comments were received from the Affordable Energy Coalition and Nova Scotia Power Inc. by June 16th, 2016. The Small Business Advocate provided comments on June 22nd, 2016.

2. SUMMARY OF CLEARESULT'S RECOMMENDATIONS

CLEAResult's findings indicate that EfficiencyOne's incentive setting methodology is well aligned with other surveyed jurisdictions, and follows recommended principles of incentive design.[5] CLEAResult has proposed three main areas of improvement for EfficiencyOne as presented in their general recommendations.

CLEAResult's general recommendations are:[6]

1. **It is recommended that EfficiencyOne consider all of the general principles for incorporation into an incentive setting process.**

   CLEAResult has provided a documented, incentive setting process (that incorporates these general principles) that can be leveraged by EfficiencyOne, along with the required template documents and tools.

2. **In addition, through recommending the general principles be followed in any incentive setting methodology that EfficiencyOne implements, there are several supporting requirements:**

   a) ***Ensure assumptions for residential and commercial LEDs, residential HVAC technology, commercial fluorescent technology and commercial Variable Frequency Drive (VFD) technology are kept up to date by conducting customer and technology research.***

   b) ***Further support technology research by implementing a TRM approach. The energy savings and cost effectiveness metrics of the measures provide several reference points for setting incentive levels.***

[5] CLEAResult, *EfficiencyOne: Incentive Setting Methodology* (June 29, 2016) [unpublished], at page 7.
[6] *Ibid*, at page 39.

c) Develop a consolidated calculator that can conduct the analysis that supports the incentive-level setting process. The calculator should have the following functionality:

i. Capture and store measure-level information obtained from the recommended research activities and TRM process
ii. Perform short-term program design or incentive-level cost effectiveness screening
iii. Integrate the review protocol that has been provided in the Excel-based tool.

3. Through adopting an incentive setting methodology that follows the general principles, conduct a program financial simulation of all of the current incentives in the programs to evaluate their current levels.[7]

[7] *Ibid.*

3. EFFICIENCYONE'S IMPLEMENTATION PLAN

EfficiencyOne agrees with CLEAResult's three recommendations.

The five general principles CLEAResult suggests for incentive setting are:

1. Customer motivations and barriers for participation;
2. Technology savings, price and market penetration;
3. Supply chain and service provider considerations;
4. Financial impacts; and
5. Jurisdictional benchmarking (for new incentives).[8]

These principles have factored into previous business and research activities within EfficiencyOne when designing and updating incentives.

EfficiencyOne acknowledges and supports the need for timely implementation of the Report's recommendations. EfficiencyOne intends to implement the majority of recommendations by December 31st, 2016, and the remaining by June 30th, 2017.

EfficiencyOne plans to complete the following actions within 2016:

- Development of an incentive setting manual;
- Completion of LED A-Lamp market penetration research for Residential customers;
- Completion of a two-year research plan for market and technology research; and
- The development of a consolidated calculator for incentive setting.

All other indicated actions are planned to be completed prior to June 30th, 2017.

[8] *Ibid*, at page 40.

3.1 Recommendation 1

EfficiencyOne agrees with having a well-defined and transparent process for setting and defining incentive levels. Using the process flowcharts, review templates and other materials CLEAResult provided in the Report, EfficiencyOne will codify the Report's recommended practices into an Incentive Setting Manual. This manual will form the basis of mandatory practises for the development and revision of incentives.

The incentive setting manual will provide the following key features:

- Definition of roles and responsibilities with respect to incentive design and revision;
- Definition of requisite approval levels for making incentive changes for various types of measures;
- Practices and processes to be followed when designing or revising incentives;
- Required documentation with respect to incentive revision;
- Storage of incentive documentation;
- Internal controls and monitoring of practise and process compliance; and
- Roles and responsibilities with respect to the administration and updating of the incentive manual and associated practises.

EfficiencyOne will complete the incentive setting manual by December 31st, 2016. Associated staff training and implementation of all practices and process will occur prior to June 30th, 2017.

EfficiencyOne suggests that the Evaluation and Verification process is the appropriate vehicle to ensure external oversight of EfficiencyOne's compliance with the practices and processes developed as part of this aspect of implementation.

3.2 Recommendation 2

3.2.1 Recommendation 2 a)

EfficiencyOne is supportive of maintaining up-to-date customer and technology research for its energy efficiency measures, especially those with high levels of annual expenditure.

EfficiencyOne is cognisant of the financial and resource challenges that the recommended frequency of customer and technology research could bring to the organization. Prior to September 31st, 2016, EfficiencyOne will endeavour to quantify the budget and resource impacts of such research frequencies and scope. EfficiencyOne will report on the results of these preliminary scoping activities in its Q3 Report, accompanied by a recommendation on the appropriate levels of research.

EfficiencyOne is committed to increasing the frequency of customer research with respect to perceived value, as well the current and forecast state of energy efficient technologies within the province.

Due to previous budget commitments it is not feasible to complete a large amount of the recommended customer and technology research in 2016. EfficiencyOne commits to perform market penetration research for LED A-lamps for Residential customers in 2016. Aspects of this research will be performed by EfficiencyOne's Evaluator as well as market research firms.

EfficiencyOne commits to developing a market research plan for 2017-2018 prior to the end of the 2016 calendar year to address CLEAResult's recommendations.

EfficiencyOne is currently determining the best approach for conducting technology and market penetration research. Potential options include:

- Frequent research conducted by market research agencies; or
- More frequent baseline studies (i.e. biannual studies) similar to those conducted within the development of DSM Potential Studies.

3.2.2 Recommendation 2 b)

EfficiencyOne agrees that a TRM is a valuable tool for a program administrator when deploying energy efficiency measures and programs.

EfficiencyOne is currently developing an electronic TRM for use in its new central data tracking and customer relationship management system. This electronic TRM is expected to be completed prior to June 30th, 2017. EfficiencyOne is also working to develop a print version of a TRM, which is better suited for regulatory and external uses. EfficiencyOne plans to file the completed print TRM, taking into account CLEAResult's recommended inclusions, prior to June 30th, 2017.

3.2.3 Recommendation 2 c)

EfficiencyOne acknowledges the utility of a consolidated calculator for incentive design purposes.[9]

EfficiencyOne will develop a consolidated calculator, per CLEAResult's recommendation. EfficiencyOne will leverage an existing program-specific cost-effectiveness calculator currently in use by the Custom Incentives program to expedite the development process. EfficiencyOne will develop this calculator prior to the end of the 2016 calendar year.

3.3 Recommendation 3

EfficiencyOne agrees that conducting a financial simulation on existing incentive levels, using CLEAResult's six financial simulation metrics, is a

[9] The Custom Incentives Program already uses elements of such a tool on a project-by-project basis.

valuable exercise. This exercise will be useful in determining potential revisions to current incentive levels, based on the results of the simulation. In addition, this process will be useful as a formalized starting point against which future incentive levels can be evaluated (so long as data is still reliable and valid).

Conducting a full financial simulation, per CLEAResult's recommendation, requires up-to-date customer and technology research for each technology within the portfolio. Consistent with Section 3.2.1, data quality and availability for all technologies in EfficiencyOne's portfolio is expected to improve as a two-year research plan is implemented through 2017 and 2018.

In spite of the potential improvements possible (i.e. enhanced customer and technology research intelligence) when conducting a financial simulation, EfficiencyOne does commit to conducting an initial financial simulation prior to March 31st, 2017.

4. ONGOING REPORTING ON IMPLEMENTATION PROGRESS

EfficiencyOne is committed to keeping the Board and stakeholders informed of ongoing progress on the implementation of CLEAResult's recommendations. To this end, EfficiencyOne proposes the following reporting mechanisms:

- Quarterly Reports: EfficiencyOne will include an update on its progress implementing CLEAResult's recommendations in its quarterly reports, beginning with its 2016 Q3 Report and continuing until such time as implementation has been completed.
- Annual Progress Report: EfficiencyOne will include an update within its 2017 Annual Progress Report.
- Evaluation and Verification: EfficiencyOne will arrange for an external review of its progress implementing the Report's recommendations via its 2016 Evaluation and Verification process.

5. CONCLUSION

EfficiencyOne is satisfied with the recommendations and conclusions presented by CLEAResult. The work of further optimizing EfficiencyOne's incentives is a work in progress, and to a degree will always remain so, due to the continuous improvement aspects of incentive design and revision. EfficiencyOne believes this Report provides the tools and methodology to enhance EfficiencyOne's incentive setting practices.

EfficiencyOne requests that the Board accept the recommendations and conclusions of the Report, EfficiencyOne's Implementation Plan and the ongoing reporting mechanisms proposed.

APPENDIX A: CLEARESULT REPORT

CLEAResult

EfficiencyOne: Incentive Setting Methodology

June 29, 2016

PREPARED BY CLEAResult

PREPARED FOR EfficiencyOne

Disclaimer & Limitations

This final document was prepared by CLEAResult for the private and confidential information of the client for whom it was prepared and for the particular purpose previously advised in writing by the client to CLEAResult.

This document was prepared based on information available to CLEAResult at the time of preparation, and is subject to all limitations, assumptions and qualifications contained herein. In addition, financial or other projections contained herein are based upon assumptions concerning future events and circumstances over which CLEAResult has no control.

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- Ellen Pfeiffer – National Grid

Table of Contents

Disclaimer & Limitations 2

Acknowledgements 3

Executive Summary 7

Project Scope and Background 10

Project Methodology 11

Incentive Setting for Energy Efficiency Programs 13
- Market Transformation 14
- Incentive Setting Theory 15
- Application to Energy Efficiency Programs 16

Jurisdictional Research 22
- Jurisdiction Identification and Selection 22
- Findings and Identified Best Practices 23
- Nova Scotia's Electricity System 29
- Nova Scotia Market Characteristics 29

Efficiency Nova Scotia – Policy, Performance and Programs 32
- Historical Results and Comparison to Other Jurisdictions 32
- Efficiency Goals 33
- Policy Considerations 34
- Efficiency Nova Scotia's Program Portfolio 36

Incentive Setting Methodology Analysis and Recommendations 39
- Summary of Recommendations 39
- General Principles For Incentive Rate Setting 40
- Formal & Documented Incentive Setting Process 50
- Instant Savings Program Summary for Current and Recommended Activites 55
- Custom Program Summary for Current and Recommended Activities 58
- Business Energy Rebates Current and Recommended Activities 63
- Home Energy Assessment Current and Recommended Activities 66

Incentive Level-Setting Excel-Based Tool for Review Protocol 69

Program Financial Simulation Analysis 71
- Instant Savings Program Financial Simulation 71
- Custom Program Financial Simulation 78

Appendix A – Jurisdictional Scans 81
- Appendix A-1: Ontario Electricity 84
- Appendix A-2: Ontario Gas (Union Gas) 94
- Appendix A-3: British Columbia (BC Hydro) 105
- Appendix A-4: California (PG&E) 113
- Appendix A-5: Oregon & Washington (Energy Trust of Oregon) 124

Appendix A-6: New York (Consolidated Edison) 137
Appendix A-7: New York (NYSERDA) 147
Appendix A-8: Vermont (Efficiency Vermont) 151
Appendix A-9: Maine (Efficiency Maine) 165
Appendix A-10: Massachusetts (National Grid) 180

Appendix B – Consolidated Calculator/Tool Requirements 189

Tables

Table 1: EfficiencyOne Targets and Budgets 10
Table 2: Summary of Influences on Incentive Rates 20
Table 3: Research Engagement Phase 26
Table 4: Data Analysis Phase 27
Table 5: Model Incentive Rates 28
Table 6: NS Power Customer Accounts by Rate Class 30
Table 7: ENS Historical Performance 32
Table 8: Unit Cost, Energy Savings, and Residential Rate from Different Jurisdictions 33
Table 9: ENS's Targets and Budgets 33
Table 10: Nova Scotia Achievable Potential Summary 34
Table 11: ENS Program Overview 37
Table 12: Barriers and Incentive Strategy for EfficiencyOne Programs Studied 38
Table 13: Basis for Cost to Customer Incentive Threshold 44
Table 14: Basis for Program Budget Incentive Threshold 45
Table 15: General Portfolio Summary Table Recommendations 49
Table 16: Instant Savings Program Recommendations 56
Table 17: Custom Program Recommendations 58
Table 18: Business Energy Rebates Program Recommendations 65
Table 19: Home Energy Assessment Program Recommendations 68
Table 20: Instant Savings Measure Parameters 71
Table 21: Market Penetration of Instant Savings Measures 72
Table 22: Cost to Customer Incentive Threshold for Instant Savings Measures 73
Table 23: Program Budget Incentive Level Threshold for Instant Savings Program 74
Table 24: Program Budget Incentive Level Threshold for Instant Savings Measures 75
Table 25: Cost Effectiveness Incentive Level Threshold for Instant Savings Measures 76
Table 26: Comparison of Current Incentive to Incentive Level Thresholds for Instant Savings Measures 77
Table 27: Parameters for Average Custom Retrofit Project 78
Table 28: Cost to Customer Incentive Level Threshold for Average Project in Custom Retrofit 78
Table 29: Program Budget Incentive Level Threshold for Average Project in Custom Retrofit 79

Table 30: Cost Effectiveness Incentive Level Threshold for Average Project in Custom Retrofit 79
Table 31: Comparison of Current Incentive Level to Incentive Level Thresholds for Average Project in Custom Retrofit 79
Table 32: Jurisdiction Overview 82
Table 33: Jurisdiction Savings Targets and Budgets 83

Figures

Figure 1: Technology Adoption Process 14
Figure 2: Balance of Price Setting Influences 15
Figure 3: Uptake-Incentive Relationship 16
Figure 4: Theoretical Limits for Incentives 19
Figure 5: ACEEE State Energy Efficiency Scorecard 23
Figure 6: Identified Incentive Setting Best Practices Methodology 24
Figure 7: Van Westerndorp's Price Sensitivity Meter 41
Figure 8: Example of Conjoint Analysis Choice Task 42
Figure 9: Incentive Thresholds used in Financial Impact Analysis 43
Figure 10: Initial Process for Incentive Setting 51
Figure 11: Existing Incentive Development Process 52
Figure 12: New Incentive Development Process 53
Figure 13: Excel-Based Tool for Review Protocol 70

Executive Summary

As a result of the regulatory process for the 2016-2018 Demand Side Management (DSM) Resource Plan, EfficiencyOne was asked to review its current incentive level setting methodology. The Nova Scotia Utility and Review Board (UARB) recognized that optimizing incentive structures and levels is difficult, but direction was provided to explore an approach that would assess whether incentive levels are being set at an appropriate minimum level while still resulting in program participation. The UARB requested that a quantitative analysis be considered in the methodology.

In response to the direction provided by the UARB, EfficiencyOne retained CLEAResult to investigate ratepayer-funded energy efficiency program incentive-setting methodologies from other jurisdictions, identify best practices and assess the implications of applying them to Efficiency Nova Scotia's portfolio of programs. The objective was to develop a comprehensive incentive-setting methodology approach.

Incentive setting is not an exact science. It has evolved through experience, and is often part of a broader program design framework. This report aims to distill the key components of incentive setting for EfficiencyOne's use.

The methodology provides incentive setting considerations for all of the programs in Efficiency Nova Scotia's (ENS) portfolio, as well as specific considerations for four specific energy efficiency programs. In developing the recommendations, CLEAResult considered Nova Scotia's market characteristics, the maturity of the programs in its portfolio, and other program design characteristics. The recommendations also included an incentive update protocol (as supported by flow charts, a documentation template and an Excel-based tool) that prescribes both frequency and methodology of updates. The scope of the project focused on financial incentives, though the other types of incentives were discussed.

The jurisdictional research involved primary and secondary research. The required background was developed by examining publically available reference material, while insight was gained directly from program design, program evaluation or program management staff for each of the different jurisdictions to gain specific insight on the incentive setting process.

From reviewing the portfolio performance across the multiple jurisdictions studied, as well as comparing ENS's performance against Nova Scotia's Achievable Potential study[1], it is apparent that the ENS portfolio is performing at a level comparable to, or better than the other jurisdictions studied. The unit costs of conservation, along with the portfolio targets align favorably with the other jurisdictions.

One of the initial and most evident findings of the jurisdictional research is that there is minimal formalized and/or publically documented information on incentive design. Although many of the jurisdictions studied have applied best practices and documented approaches for program design, developed Technical Reference Manuals (TRMs) and performed market research, no consolidated document for incentive setting alone was found. However, through the interviews and research conducted, and by leveraging CLEAResult's experience across more than 900 active programs across North America, major themes and principles could be identified that were employed by all jurisdictions in their incentive level setting processes.

These principles include:

1. Assess and account for customer motivations and barriers to participation;
2. Determine technology savings, price and market penetration;
3. Assess and account for supply chain and service provider considerations;
4. Determine financial impacts; and
5. Undertake jurisdictional benchmarking (for new incentives).

Against these general principles, EfficiencyOne's current incentive setting approach was reviewed and Nova Scotia's specific market characteristics were taken into consideration. The analysis covered both the general portfolio and four specific programs:

1. Instant Savings
2. Custom
3. Business Energy Rebates
4. Home Energy Assessment

It is important to note that our research indicates that EfficiencyOne conducts incentive setting according to these principles at a high-level. Supported by technology and market research and designed around financial parameters, EfficiencyOne's

[1] Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study – Navigant Consulting

approach is well aligned to other comparable jurisdictions. Activities performed to-date, such as the recent price sensitivity research in the Instant Savings Program and features such as the flexibility to negotiate incentives individually with customers for the Custom Program, support these principles, but there is room for improvement. Our recommendations provided later in this document focus on continuing the current activities, but improving specific areas. In an effort to further refine and develop the incentive setting methodology, CLEAResult identified the following areas for improvement:

1. Lack of a formal and documented incentive-setting process across all measures and programs;
2. The application of older market penetration analysis for important and rapidly changing measures;
3. Lack of a TRM or similar documents for all measure assumptions to be consolidated; and
4. Absence of readily available tools to perform short-term cost effectiveness calculations.

CLEAResult is providing the following recommendations for the identified areas of improvement:

1. Formally establish, document and use a consistent incentive setting process that incorporates the identified general principles.

   Like most other jurisdictions, EfficiencyOne has not yet established a well-documented incentive level development process. EfficiencyOne would benefit as a peer leader by having a documented framework to ensure consistency in delivery and continuous refinement of the incentive setting process.

2. Conduct ongoing customer and technology research for identified technologies including residential and commercial LEDs, residential HVAC technology, commercial fluorescent technology and commercial Variable Frequency Drive (VFD) technology.
   - There are varying levels of rigour and different approaches to conducting this research depending on the jurisdiction reviewed. EfficiencyOne should conduct an assessment of their current research and identify if the required documentation requirements in the incentive level development process justify additional rigor. In some cases, existing research activities and data sources can be leveraged.

3. Ensure that the process used for determining energy savings and other measure assumptions provides the required information for incentive setting.
   - The energy savings and cost effectiveness metrics of the measures provide several reference points for setting the incentive level. EfficiencyOne should follow a TRM approach to support technology research, which will assist in gathering this information.

4. Develop a consolidated calculator/tool for short-term incentive setting and program design exercises, with the following functionality:
   - Capture and store measure-level information obtained from the recommended research activities and TRM process
   - Perform short-term program design or incentive-level cost effectiveness screening
   - Integrate the review protocol that has been provided in the Excel-based tool.

The consolidated calculator will allow EfficiencyOne to better conduct the analysis that supports incentive setting.

To support recommendation (1), CLEAResult developed an incentive setting process that uses these general principles that EfficiencyOne can use for incentive setting exercises. To complement the developed process, CLEAResult also created a documentation template that will ensure that the required analysis and documentation is considered for updating current incentive levels and for new incentives.

CLEAResult also developed an Excel-based tool that EfficiencyOne can use to identify specific incentive level setting considerations for different customer, program, technology and financial impact combinations. The model provides frequency recommendations for the incentive review process.

Finally, CLEAResult conducted a financial simulation for two programs:

1. Instant Savings
2. Custom

The purpose of this simulation was to evaluate EfficiencyOne's current incentive levels. To support this exercise, a financial analysis was conducted to evaluate the current incentive levels versus the three incentive level thresholds:

1. Cost to Customer
2. Program Budget
3. Cost Effectiveness

For Instant Savings, most of the incentive levels were within an appropriate range, but EfficiencyOne may wish to further investigate the current incentives for the heavy-duty timer and outdoor clotheslines in the Instant Savings program. The heavy-duty timer incentive level should be reviewed because the cost to the customer has reached the suggested boundary. For outdoor clotheslines, the market penetration analysis indicates that the product may be standard practice in Nova Scotia homes.

For the Custom Program, EfficiencyOne should give careful consideration to project incentives for projects with energy savings persistence of less than seventeen years. This is to ensure projects stay within their cost effectiveness incentive threshold. The incentive needs to be justified by the value of the lifetime energy savings.

It is recommended that the financial simulation be conducted for all of EfficiencyOne's programs.

Overall, it is recommended that EfficiencyOne continue to conduct the required supporting research and develop the supporting tools and processes that provide a platform for the incentive setting process. It is also recommended that EfficiencyOne leverage the proposed incentive setting process and the documentation template, or a variation thereof that encompasses all of the recommended content and functionality. Ideally, all of the required analysis and related activities would be consolidated into one exercise that is followed consistently and at the required intervals.

If EfficiencyOne pursues these recommendations, the implemented incentive setting process will be a market leader in North America.

Project Scope and Background

The UARB directed EfficiencyOne to present these recommendations as a result of the regulatory process for the proposed 2016-2018 Demand Side Management (DSM) Resource Plan. In its August 12, 2015 Decision, the UARB directed a budget of $102.15 million for the 2016-2018 DSM Plan period[2]. This direction occurred after the proposed budget adjustment in the Quantum Agreement. The initial energy and demand savings targets remained unchanged.

	Budget ($)	Energy Savings Target (GWh)	Demand Savings Target (MW)
Initial Filing	$121.5 million	405.9	62.5
Quantum Agreement	$113.5 million	405.9	62.5
Final Order	**$102.15 million**	**405.9**	**62.5**

Table 1: EfficiencyOne Targets and Budgets

Between the Quantum Agreement and the Decision, there was a regulatory hearing to address a number of issues that the UARB had identified in its Final Issues List.[3]

During the hearing, EfficiencyOne argued that, "incentive levels are determined by various factors including comparison to other jurisdictions, market knowledge gained through historical program operation, market research and consumer pricing information."[4]

The UARB provided the following direction to EfficiencyOne regarding incentive setting, which was the catalyst for this research:

> "E1 is directed to undertake research and make recommendations on a more rigorous program for determining incentives…The Board recognizes that optimizing incentives is difficult; however a guiding principle should be that incentives are designed at the minimum levels required to induce participation and employ some quantitative analysis."[5]

Accordingly, EfficiencyOne secured the services of CLEAResult to undertake a study to identify incentive setting best practices and recommend changes to EfficiencyOne's incentive setting process.

[2] Decision 2015 NSUARB 204 M06733, Nova Scotia Utility and Review Board, August 12, 2015, Available: https://nsuarb.novascotia.ca/sites/default/files/M06733%20Board%20Decision.pdf

[3] M06733, In the Matter of An Application by EfficiencyOne for Approval of a Supply Agreement for Electricity Efficiency and Conservation Activities between EfficiencyOne ("E1") and Nova Scotia Power Inc.("NSPI"), the establishment of a final agreement between the parties, and approval of a 2016-2018 Demand Side Management ("DSM") Resource Plan, Final Issues List (16 April 2016).

[4] Decision 2015 NSUARB 204 M06733, Nova Scotia Utility and Review Board, August 12, 2015, Available: https://nsuarb.novascotia.ca/sites/default/files/M06733%20Board%20Decision.pdf

[5] Decision 2015 NSUARB 204 M06733, Nova Scotia Utility and Review Board, August 12, 2015, Available: https://nsuarb.novascotia.ca/sites/default/files/M06733%20Board%20Decision.pdf

Project Methodology

To produce recommendations for an incentive level setting methodology based on industry best practices, CLEAResult undertook the following steps:

Jurisdictional Scans

CLEAResult undertook jurisdictional scans of various provincial and state utilities and energy efficiency agencies to:

1) identify the incentive level setting methodologies and best practices in other jurisdictions; and
2) account for multiple possible approaches and methodologies that can be used when setting incentive levels.

The jurisdictions were chosen based on the following considerations:

- geographical similarity to Nova Scotia;
- portfolio maturity;
- recognized market leadership by American Council for an Energy-Efficient Economy (ACEEE);
- applicable incentive setting methodology; and
- energy efficiency program delivery mechanism (e.g., electric or natural gas utility vs. public agency vs. energy efficiency utility).

To complete the jurisdictional scans, CLEAResult used a combination of primary and secondary research. The secondary research was used to compile market characteristics and quantitative metrics for the selected jurisdictions (e.g., total energy efficiency program budgets and targets, etc.). The primary research was used to confirm the findings of the secondary research and to gain deeper insight into the specific incentive setting methodologies and other considerations and processes used by the jurisdictions, which may not be available in public documents.

The best practices were reviewed by the CLEAResult Subject Matter Expert (SME) team, which has significant experience in program design, delivery and evaluation.

The result of the jurisdictional scans, contained in Appendix A, are presented as comparative metrics which can be used to benchmark ENS's program incentives expenditure and total portfolio performance. The scans revealed multiple considerations and criteria that are used by other jurisdictions in setting incentives. As appropriate, these elements were integrated into the recommendations below.

Study of Nova Scotia's Market

To tailor the final findings to Nova Scotia's market, efforts were taken to understand the current landscape of energy efficiency programming, from both the perspective of EfficiencyOne and other major stakeholders in Nova Scotia. Secondary research was conducted to understand the electricity market in Nova Scotia. A review of Nova Scotia's current and forecasted electricity supply and demand was undertaken as well as a review of the population, building and load demographics. These factors are accounted for in our recommendations. Lastly, Nova Scotia's energy efficiency policies and the associated regulatory structure were also studied to fully understand how they currently drive incentive setting for ENS's programs.

Review of Efficiency Nova Scotia's Historical Performance

A review of ENS's historical program performance was undertaken to determine the success of the current programs in market. To obtain detailed information on select programs and their incentive setting methodologies, interviews were performed with selected program managers and staff. Lastly, program manuals and program evaluation reports were reviewed to gain insight into program operations, program maturity, success factors and recommended program modifications.

Analysis and Recommendations

The final analysis included a review of the theoretical underpinnings of incentive setting methodologies and established a framework, informed by jurisdictional best practices, on which CLEAResult's recommendations are based. This incentive setting framework is broadly presented and is applicable to setting incentives for any energy efficiency measure, program or portfolio.

The current incentive setting methodology for four of ENS's programs (Instant Savings, Custom, Business Energy Rebates, and Home Energy Assessment) were then compared against our recommended incentive setting methodology to identify any existing gaps. Nova Scotia's unique market characteristics were accounted for in the recommended incentive setting methodologies.

To assist EfficiencyOne in setting new, or modifying existing incentive rates, an Excel-based tool was created to provide considerations that should be used in the incentive setting process.

Program Financial Simulation

To test the recommendations, a program financial simulation was conducted for both the Instant Savings and Custom programs. The current incentives were evaluated against multiple criteria, with a recommendation provided for the “appropriateness” of each incentive.

Incentive Setting for Energy Efficiency Programs

Energy conservation programs feature different types of incentives to attract participation. The underlying theory behind the design of energy conservation programs is that some energy efficient options are difficult to reach and are surrounded by barriers that need to be overcome in order for that option to become a feasible choice.

The three main types of barriers that most programs aim to address are cost, time and lack of knowledge.[6] The efficient option or choice is either too costly, is inconvenient, or the customer is not aware of it. Often, multiple barriers can be present. In order to address these barriers, programs use three main types of incentives:

1. Financial
2. Convenience
3. Educational/Technical Assistance

These incentives can be used in isolation, or in combination with each other, depending on the specific barriers present. All three types of incentives should aim to alleviate barriers to participation.

Often, the main component of utility or government sponsored energy conservation programs are financial incentives for residential and business customers to encourage them to make an energy-efficient choice. Financial incentives address the cost barrier. The jurisdictions investigated in this project feature financial incentives as a key component of their program strategy.

Depending on the program and jurisdiction, financial incentives were found to be as high as 75-80 percent of the total efficiency program portfolio expenditure. For example, National Grid has incentive expenditures in this range for their entire portfolio of electricity conservation programs. This level of magnitude indicates that financial incentives are a significant portion of any energy efficiency program or portfolio budget, which emphasizes their influence. Some jurisdictions, such as Massachusetts and Oregon, feature requirements that program administration costs be minimized as a portion of the total program delivery budget to ensure participants receive the majority of financial benefit from the programs.

Often, direct financial incentives to program participants are supported with convenience incentives. These types of incentives exist to address the time barrier; they are composed of mechanisms or structures that make participation easier. Convenience incentives are sometimes quantified financially as incentives, and at other times they have ancillary benefits that are captured under program administration costs. It should be noted that there is a cost associated with providing the convenience incentive, regardless of whether they are accounted for as financial incentives or fall under other program administration costs, and that these costs should be tracked. For example, appliance retirement programs often leverage convenience incentives by offering in-home pick up of old appliances. Small business and low income programs often feature direct install components, where a pre-qualified contractor performs the work for the customer. Direct install is another example of a convenience incentive. In these programs, there are financial and convenience incentives that are often combined.

The costs associated with providing convenience in both appliance retirement and direct install programs are often quantified financially as incentives. These programs in the ENS portfolio account for these costs as financial incentives. In some cases, items that make customer participation easier are not considered convenience incentives since they are categorized as part of good customer service or optimal program delivery. For example, an online incentive submission system that is developed to maximize the user experience may make participation easier, but the development and operational costs are not considered incentives. This is due to the service not directly being related to energy efficiency and the ancillary benefits to the program administrator, such as improved application review, reporting and incentive payment processes.

The final type of incentives that are common in energy conservation programs are educational and technical assistance incentives. These incentives address the lack of knowledge barrier. From posting energy savings tips and a home energy assessment tool on a public website to providing residential and commercial on-site energy assessments or large industrial energy management labor resources, educational and technical assistance incentives can cover the entire spectrum of customers. Depending on the type of activity, these incentives may be quantified as a financial incentive if they are tied to specific energy efficiency projects and are associated directly with energy savings. For the programs in the ENS portfolio, educational incentives are not quantified as financial incentives.

Incentives are critical to achieving program success by removing barriers to participation. The ultimate goal of energy conservation programs is to achieve market transformation, which is outlined in the section below. This ensures that the efficient

[6] Canadian Energy Efficiency Alliance, “CEEA 2014 Survey: Canadian Business Attitudes on Energy Efficiency,” http://energyefficiency.org/wp-content/uploads/2014/05/CEEA-Survey-2014-Final.pdf, (2014).

behaviour becomes standard practice, and savings can be attributed to Codes and Standards rather than claimed through incentive programs. This is considered sustainable success, since the market then leads the way on making the energy-efficient choice. However, it can take multiple years for any given technology or behaviour to achieve market transformation, and there may always be new efficiency levels or best practices for that technology or behaviour.[7]

MARKET TRANSFORMATION

The ACEEE defines market transformation as the "strategic process of intervening in a market to create lasting change in market behaviour by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice."[8] Standard practice refers to the state where incentives are no longer necessary; the energy efficient behaviour becomes the norm and the market naturally gravitates towards that option without the need for intervention. The market transformation process can be illustrated using the following technology adoption curve:

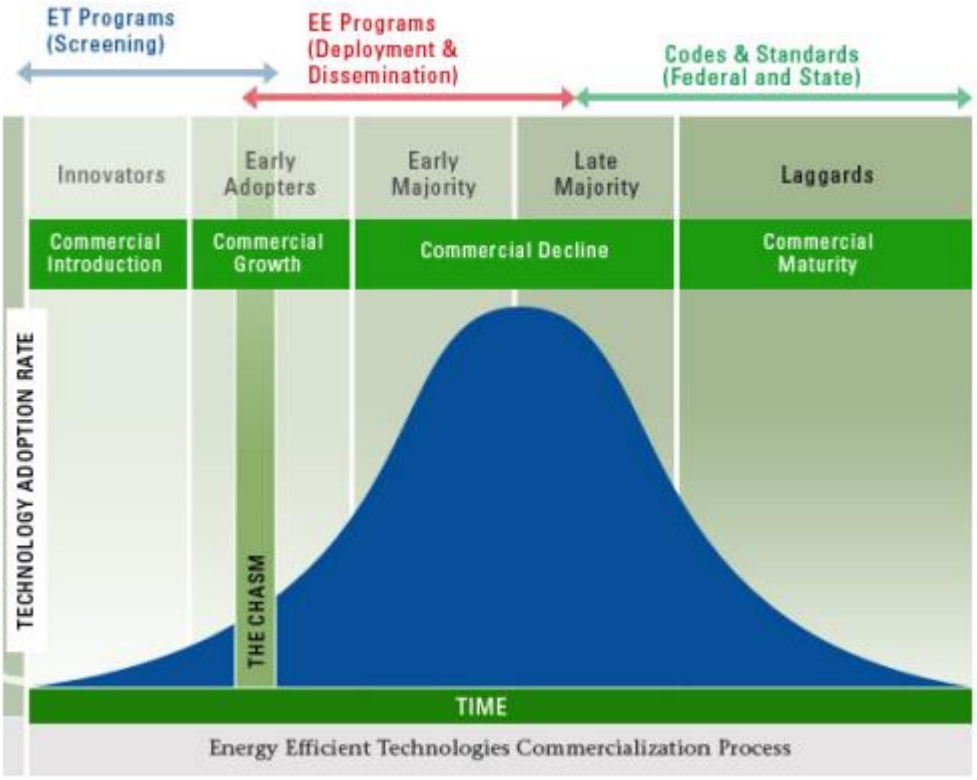


Figure 1: Technology Adoption Process [9]

For utility or government-sponsored energy efficiency programs, it is important to consider a technology's maturity when determining the best time to begin providing financial incentives to drive the market uptake of that technology. As identified in Figure 1 above, "The Chasm" is typically a time when a technology is sufficiently market ready yet requires financial assistance to begin market transformation at a large scale. Incentives are usually offered until the start of the late majority period. Usually, adjustments to baselines and energy savings persistence numbers need to be considered as the early majority period begins. Once the late majority period is reached, a program administrator must consider whether financial incentives are still required to drive additional market transformation. Quantitative indicators of this point will vary depending on the market and technology. Accordingly, during the early adopter to late majority period where energy efficiency programs are active, incentive setting and

[7] ACEEE, http://aceee.org/files/proceedings/2008/data/papers/10_56.pdf. Adapted from SoCal Edison
[8] ACEEE, http://aceee.org/portal/market-transformation
[9] ACEEE, http://aceee.org/files/proceedings/2008/data/papers/10_56.pdf. Adapted from SoCal Edison

review is very important to program success. Program and technology maturity is a critical consideration during the incentive setting process.

INCENTIVE SETTING THEORY

Incentive setting for energy efficiency programs is a form of price setting, with some unique characteristics. The discussed theory is based on CLEAResult's knowledge and experience with conducting program design and incentive setting exercises, as well as our ongoing discussions with the energy efficiency industry.

Due to a general lack of competing incentives from other utilities or agencies, program administrators encounter less immediate, natural compliance (checks and balances) in terms of price setting rigor, other than for budget and reputational risks. In the private sector, an inappropriate price can lead to immediate failure; this risk is only present for program administrators for incentives that are substantially incorrect. It is important to account for this systemic problem in setting incentives, using a variety of methods.

Price Setting

Price setting is the process of coming up with the cost of a good or service for a consumer. With price setting, there are two influences:

1. The value a consumer is willing to pay (perceived value)
2. The production and distribution costs plus the required premium (return on investment)

The first influence is based on the perceived value for the product or service. This is defined as the value the consumer is willing to pay for a product or service. The second influence is based on the associated return on investment criteria. These two influences must be balanced during any price setting process, as illustrated in Figure 2.

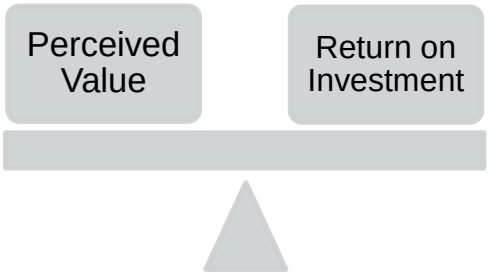


Figure 2: Balance of Price Setting Influences

The return on investment criteria, in most cases, can be quantified and precisely calculated; however, the perceived value to a consumer can only be measured on an individual basis. These individual values can potentially be aggregated, and a representative number for value established, but it is an imprecise exercise, affected both by sample size and the variable nature of a survey response. Additionally, what constitutes value will vary by consumer, depending on their priorities. The value to a consumer can never be known exactly; there is no mathematical formula that can be used to get a precise number. This makes establishing an exact minimum or maximum price extremely difficult.

Perceived value curves for sales will typically follow a sigmoid relationship, based on the price elasticity of demand. This relationship is shown in Figure 3, though it is meant to be illustrative. While uptake and incentives generally follow these relationships, it is difficult to quantify precisely. Energy efficient product uptake typically does not increase linearly with increased incentive levels until a critical value is reached.

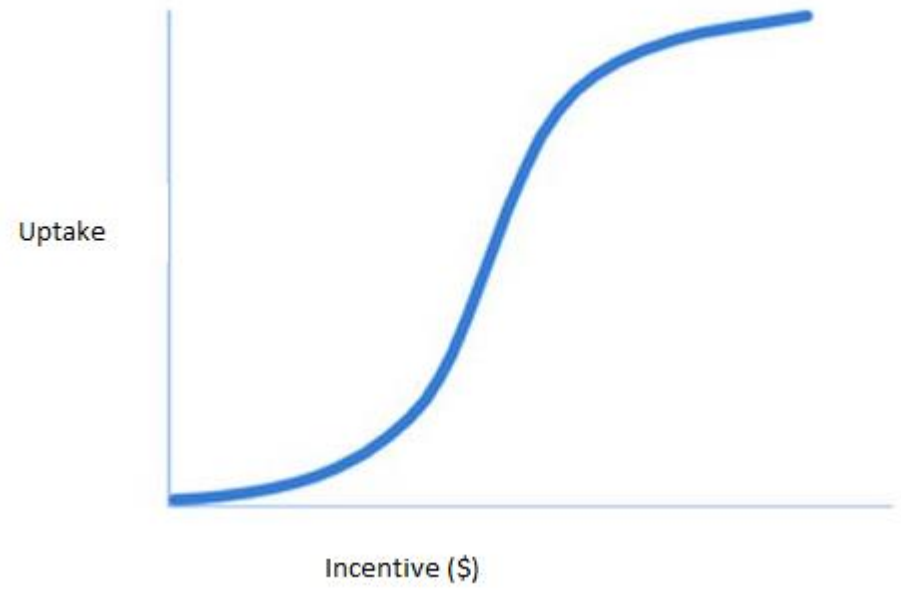


Figure 3: Uptake-Incentive Relationship[10]

Therefore, to identify perceived value to better understand how to characterize the curve, firms use several strategies for triangulation.

1. Consumer Surveys
    - Price Sensitivity
    - Conjoint Analysis
2. Research Competitive Products
3. Supply Chain Discussion
4. Jurisdictional Benchmarking
5. Historical Experience

APPLICATION TO ENERGY EFFICIENCY PROGRAMS

As mentioned, incentive setting in energy efficiency programs is a unique form of price setting. For incentive setting, the perceived value to the customer is the driving influence, while the return on investment can assist with setting target expenditure amounts. It should be highlighted that using the analysis from investigating these two influences to set incentives is not a precise exercise.

Within the incentive setting process, there can be the potential for less rigour by program managers/implementers due to the lack of competition and other actors. This systemic problem can be guarded against through applying an incentive setting methodology that features best practices in determining the two key influences to price: return on investment and perceived value. Finally, there needs to be a review protocol, which specifies how incentive levels should be reviewed, and if necessary, updated.

[10] "The 3 Charts That Will Teach You Everything You Need to Know About Business," Business Insider, Available: http://www.businessinsider.com/the-3-charts-that-will-teach-you-everything-you-need-to-know-about-business-2010-7?op=1

RETURN ON INVESTMENT

For efficiency programs, return on investment is based on two general considerations: cost effectiveness and budget impact.

Cost Effectiveness

Cost effectiveness is usually determined using a benefit-cost analysis which explicitly or implicitly compares the cost of energy efficiency to other electricity or natural gas supply resources and may include other considerations (e.g., environmental benefits). The two common explicit cost effectiveness tests are the Total Resource Cost (TRC) and the Program Administrator Cost (PAC) tests.

Budget Impact

Program administrators are not only affected by cost effectiveness concerns when determining their return on investment. From CLEAResult's experience, in several jurisdictions, the program budget is usually the limiting factor for expenditure; not cost effectiveness. These budget-limited programs by default are cost effective if they generate the required lifetime net energy savings within the assigned budget.

An incentive may be cost effective, but may not fit within a program budget. Therefore, the budget impact needs to be considered in addition to cost effectiveness as the budget may set the financial ceiling.

The budget impact should be considered not only on a per unit savings basis, but also on a per participant basis and on a total budget impact basis. An incentive may be considered great value for money on a per unit savings basis, but due to high potential uptake, it may not make sense for the program budget.

Return on investment criteria typically set ceilings for incentives in energy efficiency programs. They ensure a minimum return for both the program administrator and society. However, incentives are often set at values below the return on investment ceiling, since the considerations involved in determining perceived value triangulate an incentive at a lower value.

PERCEIVED VALUE

For energy efficiency programs, perceived value leads to the motivation to participate. As discussed earlier, energy efficiency programs feature options that are not standard practice. Therefore, an incentive needs to be deployed to match the customer's perceived value of the energy efficient product or service. Depending on the customer's motivations and barriers, either upfront costs, annual bill savings and paybacks, or a combination of both can be important considerations.

In the real world, determining perceived value during price-setting should not be thought of as a precise science. The same holds true for incentive setting with energy efficiency programs However, there are some key considerations and processes that should be used when conducting incentive-setting exercises to determine the value of a potential incentive.

Customer Research

A critical component of determining perceived value is actually asking potential customers what they would pay for a product or service, and what their price points are for difficult technology options. This work can be done directly through focus groups and surveys. With any incentive-setting exercise, it is important to get customer input frequently. It is also important to understand the greater picture surrounding the customer's purchase decisions. This perspective can often be answered by asking the following questions:

- What is their value proposition for moving forward?
- What do they think of their options?
- What are their primary barriers to moving forward?
- What are their challenges with the existing standard option?

This research is especially important when there are multiple potential customers/stakeholders for an efficiency project, and they have different motivations and barriers. This is often called the principal-agent problem and is most commonly encountered in rental units, where tenants and landlords have different motivations, based on:

- which party is responsible for paying the energy bills;
- the structure for how the bill is determined and who makes the spending decisions for new equipment; and
- who has the right to upgrade that equipment.

Incentives and their associated delivery strategies need to be considered carefully in attempting to solve barriers in these situations.

Technology Research

Technology research is essential when identifying perceived value. The three forecasts that need to be developed are:

- market price;
- technology penetration; and
- technology performance.

It is important to know the price points for the different technologies and options. Additionally, understanding current and future market pricing and the impact on incremental equipment costs is essential in developing an incentive strategy. Pricing considerations can include upfront capital costs, labour costs for installation, operations and maintenance costs, etc.

Finally, it is important to consider limitations and how the technology is expected to evolve over the short to long-term (next few months to a one to two year) period. This analysis is critical for technology performance and setting baselines, energy persistence values and incremental equipment costs. All of these factors are usually analyzed during the review and update of the TRM, which typically contains measure assumptions.

Supply Chain and Stakeholder Discussion

In designing and delivering any best-in-class energy efficiency program, it is important to involve the supply chain and key stakeholders such as industry associations, other government agencies and community groups. Often, they can help with both customer and technology research, especially with providing supporting information and access to their contacts. They can also provide insight into their costs which can help shape the incentive-setting analysis.

For optimal program delivery, the supply chain and stakeholders should also review potential incentive changes and be provided notice to prepare for those changes. Additionally, if the supply chain will be a critical component of a program's go-to-market strategy, it is important to determine the supply chain's barriers to participation. For example, if the program is a midstream lighting program delivered by distributors, it is important to know what the distributors' barriers are and what incentive will be required for them to stock, promote and sell the efficient products.

Another important element to the supply chain and stakeholder discussion is to determine if there are other incentives in the market that are not offered by program administrators. It is likely that the supply chain and stakeholders will be aware of these incentives, since they are a common vehicle for customers to learn about the incentives and take advantage of them. Examples of other incentives for energy efficiency programs can be things like tax rebates, government incentives through other vehicles or other offers such as low cost financing on certain purchases.

Benchmarking

If an incentive or technology is new, there may not be any historical data to assist with forecasting price and penetration curves in a utility's local market. Benchmarking incentive rates against similar technologies or programs in other jurisdictions can mitigate this lack of local data. Not including the disparity between the Canadian and U.S. dollar, some products and services have significantly different costs due to regulatory, infrastructure, supply chain, environmental and demographic factors.

To address these issues, incentives in one jurisdiction can be established by referring to the incentives in another comparable jurisdiction (direct benchmarking). A second option to address these issues involves explicitly accounting for these factors. An important element of benchmarking is to open up a dialogue with the other jurisdictions, if possible, to understand the nuances in the market and program delivery structure and how they may affect incentives. Any benchmarking exercise should consider these factors.

Program Evaluation Review and Historical Experience

The final consideration in determining perceived value is reviewing previous evaluation reports and accounting for historical experience. Program evaluations typically include an analysis of barriers, customer and supply chain insight and recommendations for improvement. They also provide quantitative performance information regarding participation, savings and, depending on the jurisdiction, expenditure. Historical experience allows program administrators to understand the uptake implications of previous incentives. For example, if an incentive for an individual LED A Lamp was $8.00, and the measure uptake was significantly above the forecasted participation rates and allocated budget, the historical experience may indicate the need to lower the incentive rate.

THEORETICAL LIMITS FOR INCENTIVES

Based on the return on investment criteria as well as perceived value considerations, there are three theoretical limits for incentives.

1. Percentage of Customer Cost
2. PAC Benefits
3. Budget

Incentives can exceed these limits (and often do), but the limits provide a reference point that can be used during the design process. The limits are independent of one another. They can all contribute to the concept of a maximum eligible incentive for a measure that program designers can use during the incentive setting process.

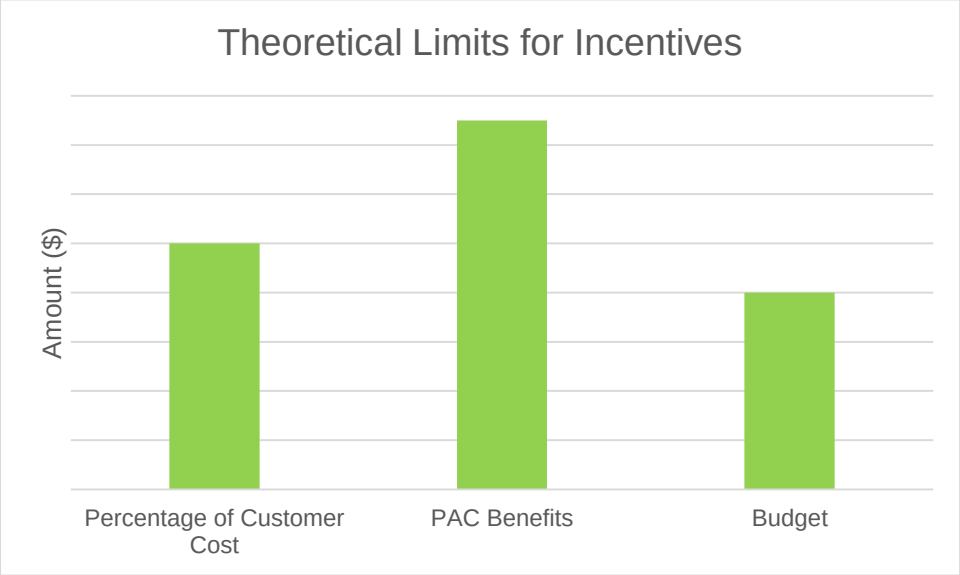


Figure 4: Theoretical Limits for Incentives

For any particular measure, any one of the theoretical limits can be the lowest or highest value. Depending on the program and the target consumer, the customer cost limit may consider the retail price/project cost, the incremental cost or the project payback in the calculation. The PAC is used for this activity since it captures incentive costs; unlike the TRC.

SUMMARY OF INFLUENCES ON INCENTIVE RATES

The different components involved in incentive setting are listed below in Table 2. The table lists how a change in each component can influence measure level incentives. This highlights the multiple considerations that must be taken by program administrators when setting or altering incentives. In some cases, factors can create either upward pressure or downward pressure on incentives, depending on the specific situation. The considerations lend credence to the feedback obtained from many of the interviewees during the jurisdictional scans who echoed that setting incentive is “as much art as science.”

Incentive Setting Component	Factors that can Place Upwards Pressure on Incentive Rates	Factors that can Place Downwards Pressure on Incentive Rates
Budget Impact	• Reduction in administration costs, leaving additional space in the budget. If there is a need to increase participation, increasing incentives may be an option	• If the budget is at risk of being exceeded, lower incentives may be required • Budget impact considerations can set ceilings on incentive levels

Incentive Setting Component	Factors that can Place Upwards Pressure on Incentive Rates	Factors that can Place Downwards Pressure on Incentive Rates
Customer Research	• Customers indicate that the incentive is not sufficient to motivate them to participate • There may be a lack of awareness of the technology, program or measure	• Customers indicate that the incentive offer is very attractive, and they may have participated even if the incentive was lower
Technology Research	• The technology has a forecasted increase in costs within the next program period	• The technology has a forecasted drop in costs or increase in market penetration within the next program period • Technology baselines are adjusted such that the incremental cost of the incented measure is lower, thus supporting the reduction in incentive
Supply Chain and Stakeholder Discussion	• Additional barriers are identified, which require more or increased incentives to address (e.g., distributors are unwilling to stock efficient products due to lack of perceived market demand)	• The program delivery structure may leverage cheaper supply chain costs, resulting in a reduction in the incremental equipment cost which may justify a smaller incentive
Benchmarking	• Comparable jurisdictions offer a significantly higher incentive drawing investment and supply chain participation to their market	• Should the majority of other comparable jurisdictions have significantly lower incentive rates for specific measures, it may indicate a change in market conditions which can support a reduced incentive rate
Program Evaluation Review and Historical Experience	• Program evaluation suggests poor program and market performance due to lack of financial incentive	• Program evaluation suggests customers are motivated by other influences outside of the financial incentive

Table 2: **Summary of Influences on Incentive Rates**

INCENTIVE RATE REVIEW PROTOCOL

After determining incentive values by analyzing the considerations that determine the two influences (perceived value, return on investment) of incentive setting, the final requirement is to establish and follow a review protocol.

In some commercial environments, the review protocol is ongoing. For energy efficiency programs, it is best to review incentives on a periodic basis (ranging from quarterly to every two years). Periodic review is needed because, while certain elements can be ongoing, such as continuing customer and technology research, there are also standing engagement mechanisms that involve the supply chain and key stakeholders. The review frequency is determined by the program delivery structure, the rate of market transformation and the incentive expenditure. It is acceptable to have different review frequencies for different technologies and programs.

Ideally, if there is budget and resources to conduct reviews, each incentive level should be reviewed annually at minimum. However, in some cases, a two year review process may be justifiable. Even if incentive levels cannot be reviewed comprehensively every year, the market price of the measure should always be updated. For certain technologies that either have high participation, are quickly evolving or both, it is important to assess incentive levels more frequently. For example, a quarterly assessment may be appropriate, but it can be a light touch assessment, provided that key metrics are tracked during the program record keeping process. For technologies that are either more mature, do not naturally have a high uptake due to niche application or both, there is less risk in having an annual incentive review process.

The other element of the review protocol is to list the factors for consideration, and how each factor will be assessed. These factors include:

- the price a customer will pay for the product;
- the price and penetration curve of the technology;
- the forecasted change in savings over time;
- the supply chain and stakeholder discussion;
- benchmarking;
- program evaluation;
- historical program performance review; and
- the financial impacts.

In some cases, certain factors will be clear regarding analysis and recommendations, and in other cases, there will be additional work required. It is important to establish and understand the tolerance for these factors.

Jurisdictional Research

JURISDICTION IDENTIFICATION AND SELECTION

The selected jurisdictions were as follows:

- Ontario (IESO);
- Ontario (Union Gas);
- British Columbia (BC Hydro);
- California (PG&E);
- Oregon (Energy Trust of Oregon);
- Washington (Energy Trust of Oregon);
- New York (Con Ed);
- New York (NYSERDA);
- Vermont (Efficiency Vermont);
- Maine (Efficiency Maine); and
- Massachusetts (National Grid).

The jurisdictions were chosen for one or more of the following reasons:

- considered best-in-class;
- similar size to Nova Scotia;
- similar market structure, energy efficiency policy environment and energy efficiency program delivery structure to Nova Scotia; and
- similar climate to Nova Scotia.

BEST-IN-CLASS

In Canada, Ontario and British Columbia have the largest energy efficiency budgets and the longest history of designing and delivering energy conservation programs. They are also usually considered the leading provinces for promoting energy efficiency.

In the United States, the American Council for an Energy-Efficient Economy (ACEEE) 2015 State Efficiency Scorecard had the following results:[11]

[11] The 2015 State Energy Efficiency Scorecard, ACEEE, October 2015, Available: http://aceee.org/sites/default/files/publications/researchreports/u1509.pdf

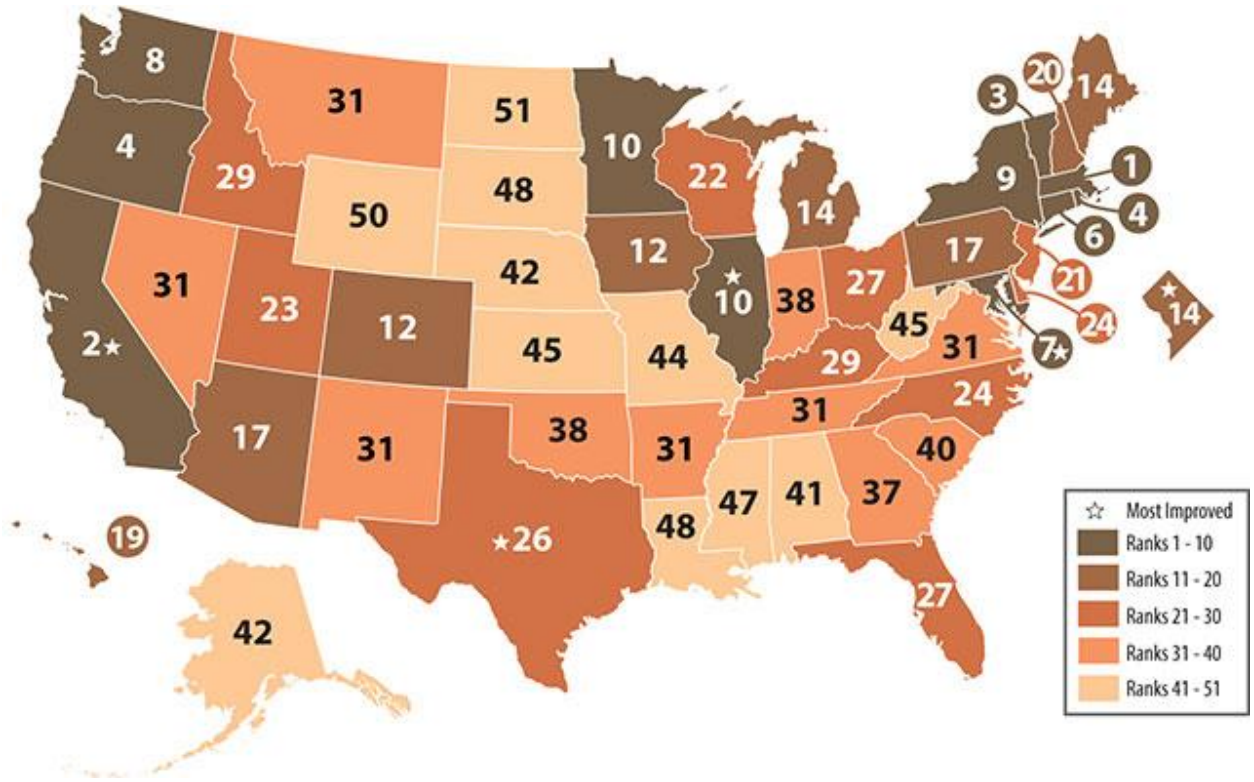


Figure 5: ACEEE State Energy Efficiency Scorecard

The American jurisdictions scanned in this report all rank in the top ten of the 2015 edition of the ACEEE scorecard, other than Maine, which is ranked at 14 out of 51 jurisdictions. The scorecard ranks the states based on criteria that reviews their policy and program efforts, their recent performance, identified best practices and leadership. All of the American jurisdictions selected have long-term Energy Efficiency Resource Standards (EERS), which demonstrate their commitment to energy efficiency as a sustainable form of electricity supply.

SIZE, STRUCTURE AND CLIMATE

Vermont, Maine and National Grid in Massachusetts all serve a similar population to ENS's programs. In terms of budget magnitudes, stock and sales data, and electricity savings targets, their similarity in size allows for comparative analysis. Efficiency Maine and Efficiency Vermont have very similar market structures to ENS, with all three serving as energy efficiency utilities.

Jurisdictions such as BC Hydro, IESO in the Ontario electricity sector, NYSERDA and the three utility companies in National Grid, New York Con Ed and PG&E, all have very different electricity systems, policy goals and oversight structures. They were selected to obtain the full spectrum of environments for which incentives can be set and offered. Union Gas was selected to offer a strictly natural gas energy efficiency perspective. Finally, jurisdictions in Maine, Vermont and Massachusetts were chosen as they have similar climates to Nova Scotia, so the types of efficiency technologies in the market, especially for HVAC and building envelope, are similar.

FINDINGS AND IDENTIFIED BEST PRACTICES

Our jurisdictional research has shown that the majority of jurisdictions employ similar methodologies and approaches to setting incentives. All of the jurisdictions have broad program design, TRM and/or market research processes, but there was not a consolidated, specific process on incentive-setting alone. While there are many detailed nuances which differ from jurisdiction to jurisdiction (e.g., how they conduct supply chain research), our research has shown that the general framework and best

practices for setting incentive rates follow the workflow highlighted below. It is important to note that the workflow does not necessarily represent concrete, sequential steps, as setting incentives is typically a process which incorporates all of the considerations described with analysis performed in parallel.

It is important to note that our research indicates that EfficiencyOne also performs many of these steps at a high-level; as such, our recommendations provided later in this document are focused on the details and nuances.

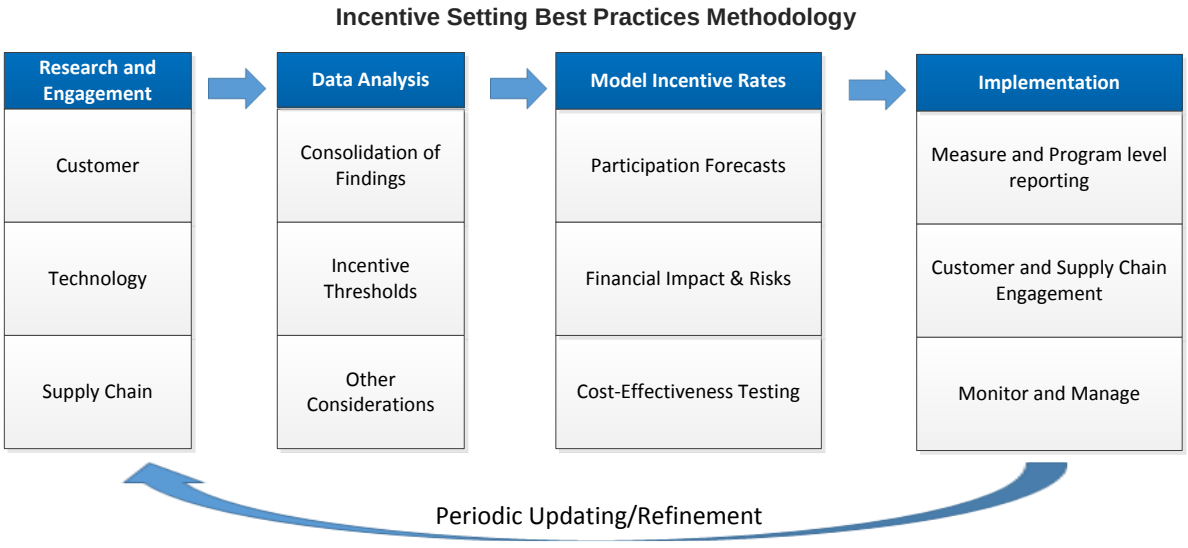


Figure 6: Identified Incentive Setting Best Practices Methodology

Research and Engagement Phase			
General Principle	Definition	Examples	Identified Best Practice
Customer Research	Most jurisdictions studied undertake customer research (either primary or secondary) to identify the motivations to participate in energy efficiency programs and the barriers preventing participation in specific programs or generally in energy efficiency initiatives.	PG&E holds periodic non-residential focus groups used to gather customer barriers and required incentives for moving forward. The Energy Trust of Oregon is mindful of the impact of incentive rates on the market barriers identified during its structured measure and incentive development process. Efficiency Vermont performs market analysis to assess market drivers and barriers as well as the customer value proposition. Efficiency Vermont outlines this information in the Draft Product Brief document. BC Hydro conducts primary research such as one-on-one consultations for larger customers. The objective is to determine awareness, barriers and purchase decisions.	Program administrators perform periodic studies with key participant groups to determine the following: • How customer motivations to participate have changed • How customer barriers to participation have evolved • The impact of existing incentives on participant behaviour The program evaluation process can be an appropriate means to perform this research. For new measures, this process should be undertaken at the outset of incentive development.
Technology Research	This research is conducted with the goal of understanding the savings opportunity for the technology, and to establish a range for the incentive level. All of the jurisdictions investigated identified this as a key element of their incentive setting practices. This phase can include benchmarking to obtain the required data from comparable jurisdictions.	PG&E will perform primary and secondary market research to determine measure performance and metrics. National Grid contributes to the Massachusetts Technical Advisory Committee (MTAC). The Committee reviews new energy efficiency technologies and publishes threshold technical requirements for qualifying products or processes to enable them to become eligible for incentives. Multiple jurisdictions create documents similar to TRMs. For example: Efficiency Maine's Residential and Commercial TRM provides documentation for energy and demand savings calculation of measures and operates as a common point of reference for the methods, formulas, assumptions and sources used. The Commission of Con Ed New York's market approves of technical manuals to provide a uniform, measure-specific approach to estimate the energy and demand savings for measures.	Program administrators maintain a resource similar to a TRM which contains the following information: • Measure savings vs. baseline • Assumptions and calculations used in calculating savings • Current status of baseline and efficiency technology in market

Research and Engagement Phase			
General Principle	Definition	Examples	Identified Best Practice
		The Energy Trust of Oregon will examine other jurisdictions' incentive rates when introducing new measures to its portfolio. For weather sensitive measures, it will examine jurisdictions which experience similar annual weather conditions.	
Supply Chain Research	Surveying the supply chain and service providers is extremely valuable during the incentive setting process. They can provide additional insight into customer barriers and motivations. Through product price research, they can assist in providing a point of reference to update or create incentive levels. Lastly, their feedback can be used to improve program delivery.	PG&E will hold on-camera interviews with distributors and manufacturers to determine measure price points and incremental costs as well as verify measure performance. The Energy Trust of Oregon is mindful of how incentive levels will influence the stocking levels of suppliers and distributors. Efficiency Vermont conducts market testing during the New Product Development process (their process for new program design). This involves testing the product prototype with customers and key stakeholders before launch.	Program administrators perform research in supply chains for their key measures to determine: • Baseline and efficient measure costs • Highlight the major barriers to participation found through customers interactions • Provide feedback on program delivery strategies • Determine how incentive rates in market will alter their business strategies

Table 3: Research Engagement Phase

Data Analysis Phase			
General Principle	Definition	Examples	Identified Best Practice
Consolidation of Findings	Once the research and engagement phase is completed, findings must be compiled to be analyzed and weighed against each other. This sets the first stage for setting incentive rates.	The Energy Trust of Oregon undertakes this exercise during the Preliminary Measure Development stage of its Measure Development and Revision Process.	Program administrators include in their TRM (recommended above) or in separate documentation the major barriers identified in market and the potential means to address them.
Incentive Threshold Setting	Through the supply chain and customer research, the thresholds of incremental cost and the customer's willingness to pay can be determined to act as points of reference for further stages in the incentive development process.	PG&E will set a maximum incentive rate which is roughly 75-100% of incremental cost identified in the Research Phase.	Program administrators: • Capture incremental costs • Capture desired incentive rates from market participants

Data Analysis Phase			
General Principle	Definition	Examples	Identified Best Practice
			• Capture incentive rates used in benchmark jurisdictions (for new incentives) • Develop target budget and cost effectiveness thresholds
Other Considerations	When considering the inclusion of a measure in programs, efficiency administrators may include other considerations aside from the measure savings potential and the measure costs. These varied by jurisdiction but were driven by factors such as policy goals, supply chain availability, market readiness, go-to-market strategy, etc.	While NYSERDA will typically cap commercial incentive rates at 50% of project costs, it allows up to 70% of project cost to be incented for agricultural customers in order to promote energy efficiency in that sector.	Program administrators identify the key driving considerations related to individual measures and ensure that they are addressed in the Incentive Rate Modelling Phase as much as other constraints allow.

Table 4: Data Analysis Phase

Model Incentive Rates			
General Principle	Definition	Examples	Identified Best Practice
Participation Forecasts	To determine the impact of the measure on the total savings target and budget, it is critical to create a participation forecast.	In Ontario, the IESO requires that any new program or measure be approved through a formal business case submission process which includes a program participation forecast. Efficiency Vermont, through the new product development process, will estimate the total size of the market for that measure in order to forecast potential measure uptake.	A measure forecast should be created in order to determine the required program delivery approach and total budget impact. The best practices for determining participation forecasts are using historical experience and the total and achievable market size as indicators. If there other available incentives for ratepayers, or a bundling incentive option being considered, they should be noted and the participation forecast adjusted accordingly.
Financial Impacts & Risks	Using preliminary incentive rates identified in the previous phase and participation forecast, the impact on the aggregate administrator budget and the program budget can be determined. This	The Energy Trust of Oregon is mindful of the impact of incentive rates on the market barriers identified during its structured measure and incentive development process. Accordingly, it seeks to properly balance the needs for	Program administrators should undertake the following activities to identify financial impacts:

Model Incentive Rates			
General Principle	Definition	Examples	Identified Best Practice
	can set the stage for incentive adjustments in order to properly balance the incentive rate vs. the identified market barriers and the requirements to adequately deliver the program to meet savings goals. Many jurisdictions' studies weigh the impact of incentive rates on total program budgets.	administration and incentive funding in its programs required to overcome the identified market barriers. NYSERDA conducts financial forecasting as part of their incentive setting process in order to determine the impact on program budgets.	• Determine the impact of incentives on program budgets • Determine the volumetric risk impacts on program budgets • Identify where/how budget constraints may hinder the desired program delivery strategies to overcome customer barriers
Cost Effectiveness Testing	The cost effectiveness of measures, programs and portfolios should be tested to determine whether a modification in incentive or administration expenses is required to deliver the programs in a manner which meets the cost effectiveness standards set by regulators. All jurisdictions studied perform cost effectiveness testing and certain jurisdictions will perform it at the measure level when setting incentives. Typically, the jurisdictions used variants of the TRC and the PAC as the main tests. It is also important to note that many jurisdictions included other benefits aside from avoided capacity and energy when determining avoided costs.	PG&E performs streamlined cost effectiveness testing at every stage of the product development process in order to determine preliminary incentive rates to ensure that the incentive will allow for the proper market transformation goals to be achieved. There is no obligation for every measure to be cost-effective in PG&E's portfolio. The Energy Trust of Oregon measures cost effectiveness at both the measure and portfolio level using the TRC and the UCT. Yet, the Oregon Public Utilities Commission (PUC) has allowed for non-cost effective measures to be included in the portfolio if it meets certain criteria. This has been very beneficial in maintaining market momentum of measures and programs in a market where natural gas wholesale prices have fallen. Measure level testing excludes administration and delivery costs as these can vary greatly based on the go-to-market approach of the program. For incentives that are increasing, NYSERDA conducts cost effectiveness analysis for the TRC and PAC, and as required, presents it to New York PUC.	The following cost effectiveness testing best practices should be adopted by program administrators: • Measure level screening and either program or portfolio-level cost effectiveness testing • The allowance for non-cost effective measures to be included in portfolios should the measure require temporary cost effectiveness relief, should it be an emerging measure which aligns with policy goals or should the measures be targeted for a specific priority sector (e.g., low income) • The use of appropriate cost effectiveness tests for screening and threshold setting • The use of the average or weighted average costs of energy to determine avoided costs

Table 5: Model Incentive Rates

Review of Nova Scotia's Electricity System and Market

NOVA SCOTIA'S ELECTRICITY SYSTEM

In 2015, Nova Scotia had an annual electricity consumption of 10,400 GWh. The residential sector accounts for 45 percent of consumption, the commercial sector uses about 32 percent, and the industrial sector uses 23 percent. Nova Scotia's industrial load has been significantly reduced over the past few years. The loss of industrial load, the effort to bring renewables into the supply mix and increased fuel costs have all contributed to a 70 percent increase in Nova Scotia's retail electricity rate over the past 10 years.

Nova Scotia Power Inc. (NS Power) owns about 95 percent of Nova Scotia's infrastructure for generating and delivery electricity. NS Power is a private corporation (wholly owned by a public company) that is regulated by the UARB. The other five percent is owned by six municipal electric utilities that can generate their own power or purchase it from NS Power or independent power producers.

Nova Scotia is transitioning away from coal supply.[12] The 2014 supply mix was dominated by coal, accounting for 60 percent of generation. Domestic renewables (wind, hydro and tidal) accounted for more than 15 percent, more than 10 percent coming from natural gas and imported renewables at more than five percent. Efficiency and conservation activities currently contribute about eight percent of total generation.

By 2020, the province aims to dramatically reduce the coal contribution to the supply mix to between 20-35 percent, while increasing the domestic renewables share to 27 percent and the imported renewables share to 23 percent. The key themes that Nova Scotians want followed for the electricity system are:

- accountability;
- market competition;
- stable power rates in an accountable and transparent electricity system; and
- support for innovation, but not at any cost.

Provincial legislation also requires that, by 2020, 40 percent of Nova Scotia's electricity supply must come from renewable sources. Similarly, in 2020, the provincial cap on greenhouse gas emissions will be lowered by 25 percent to 7.5 million tonnes in 2020; this will be further reduced to 4.5 million tonnes by 2030.[13]

Nova Scotia is a winter peaking province with a very diverse load. The 2015 peak was just over 2,100 MW. During the shoulder seasons, loads can be as low as 700 MW. Therefore, the system needs to manage variable loads throughout the year, while maintaining price certainty for customers.

Projects such as the Maritime Link, allowing for a direct renewable to retail market, and expanding conservation efforts to offset load growth are critical.

NOVA SCOTIA MARKET CHARACTERISTICS

Nova Scotia has a population of approximately 950,000 people. There are just under 500,000 residential, commercial and industrial electricity accounts for NS Power.

[12] Our Electricity Future: Nova Scotia's Energy Plan 2015-2020, Nova Scotia Department of Energy, Available: http://energy.novascotia.ca/sites/default/files/Our-Electricity-Future.pdf

[13] Our Electricity Future: Nova Scotia's Energy Plan 2015-2020, Nova Scotia Department of Energy, Available: http://energy.novascotia.ca/sites/default/files/Our-Electricity-Future.pdf

Rate Class	Number of Customer Accounts *
Residential	456,991
Small General Business	24,109
General Business	11,349
Large General Business	19
Small Industrial	2,221
Medium Industrial	198
Large Industrial	32
Municipal	8
Total	**494,927**

*This does not include the customer accounts from the six municipal electric utilities.

Table 6: **NS Power Customer Accounts by Rate Class**

The following information was obtained from the Nova Scotia 2015-2040 DSM Potential Study, authored by Navigant Consulting in 2014,[14] from information obtained from EfficiencyOne employees and from other industry data sources such as Stats Canada and ElectroFed.

RESIDENTIAL SECTOR

There are more than 390,280 residential households in Nova Scotia.[15] The majority of customers are on flat-billing residential electricity purchase agreements. Only 1,000 customers are on residential time-of-use pricing, which minimizes the ability to include messaging and incentives that reduce peak consumption in the residential sector. Of these homes, 75 percent are single family dwellings, both detached and attached. Residential new construction has been relatively consistent the past 35 years, with each six year period since 1980 contributing an average of 6-8 percent of the current residential housing stock. The average size of the homes is between 1,550-1,765 square feet, with 75 percent of homes being between 1,000 and 3,500 square feet.[16]

The potential study indicated that 51 percent of all installed lamps were incandescent, with LEDs only making up four percent of the installed base.[17] When comparing these stock numbers to 2015 residential sales data for Atlantic Canada, incandescent technology still dominates the market with the largest contribution in A lamps and decorative lamps, and the second largest share in reflector lamps. LEDs sales are increasing, especially in the reflector lamp category, but the total installed base indicates that significant efforts are still required to achieve market transformation in the residential lighting space.

In Nova Scotia, 31 percent of all primary heating systems in homes are electric.[18] The dominant heating technology is fuel oil, with a 46 percent share. Secondary heating systems are found in 59 percent of Nova Scotia's homes, and of these, 32 percent are electric. This leads to an estimate of 225,000 electric heating systems in Nova Scotia, of which 140,000 are primary and 85,000 are secondary.

EfficiencyOne assumes that primary heating systems have 2,750 operating hours, while secondary heating systems are used a variable amount that is less than the primary hours of operation. This leads to a significant opportunity to pursue electricity savings in residential space heating, since substantial savings can be obtained in one home. Additionally, due to the average housing size (leading to lower heating requirements), there are more options for electricity-efficient heating systems.

[14] Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study – Navigant Consulting
[15] http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/famil55a-eng.htm
[16] Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study – Navigant Consulting
[17] Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study – Navigant Consulting
[18] Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study – Navigant Consulting

Nova Scotia homes do not have a large space cooling load. The primary cooling system is an electric fan, while only three percent of homes have central air conditioning, and 18 percent have portable air conditioning units (room or window air conditioners). Nova Scotia is a winter peaking province, therefore electricity savings targeted at off-peak periods may not help with capacity management. Additionally, space cooling savings usually have higher unit costs ($/kWh) for electricity conservation programs due to the limited hours of operation.

Finally, Nova Scotia homes have a high proportion (61 percent) of electric water heaters. This majority also presents efficiency opportunities for larger savings coming from individual projects.

BUSINESS, NOT-FOR PROFIT AND INSTITUTIONAL SECTOR

The commercial sector accounts for businesses, not-for-profits and institutional customers. In Nova Scotia, there are 37,679 accounts that are represented by the Small Business Advocate. These accounts cover three rate classes (small general business, general business and small industrial). Of the 37,679 accounts, 24,109 are small business accounts. Not all of the 37,679 accounts are eligible for the Small Business Energy Solutions program, where annual consumption has to be less than 350,000 kWh.

In addition to the accounts represented by the Small Business Advocate, there are 19 large general business accounts, 32 large industrial accounts and 238 other business and industrial accounts.

Weekly operating hours for the different commercial customers are split relatively evenly between the different categories:

- 37-48 hours/week (22 percent) – 2100 hours annually;
- 49-72 hours/week (17 percent) – 3100 hours annually;
- 73-96 hours/week (14 percent) – 4400 hours annually;
- 97-120 hours/week (8 percent) – 5700 hours annually;
- 121-168 hours/week (34 percent) – 7500 hours annually and
- Other (5 percent).

Where possible, project applications should try and capture operating hours, either directly or through a proxy. An example of a proxy could be a listing of the assumed hours of operation for a specific business segment or business type. This is included in the incentive level setting recommendations.

Indoor lighting accounts for 60 percent of lighting energy consumption within the commercial sector. Fluorescent technology dominates indoor lighting in the commercial sector with 94 percent of the installed lamp base. The average lamp wattage is 36W, which indicates that the commercial lighting market is close to market transformation from the T12 to the efficient T8. Engineering estimates lead to the conclusion that total conversion of T12 to efficient T8 annual sales would only yield about 15 percent of the annual target. Tubular LEDs have a limited presence in Nova Scotia, so there may be an opportunity to drive future savings. There is also a large opportunity for lighting controls in indoor applications. As indicated, Nova Scotia commercial facilities are typically average, running 12 hours a day, with limited lighting controls penetration (32 percent of indoor lighting is continuous with no control features, while 58 percent only features on/off control).

Unlike the residential sector, the commercial sector features space cooling systems, with 60 percent penetration. The majority of the space cooling systems are direct expansion, meaning there is not a significant chilled water load. There may be an opportunity for rooftop unit equipment upgrades and maintenance incentives to drive savings. Currently, ENS offers financial incentives for rooftop unit equipment upgrades, but not maintenance work.

Finally, unlike the residential sector, the majority of heating systems in commercial buildings are electric, with baseboard heating as the dominant technology.

Efficiency Nova Scotia – Policy, Performance and Programs

Efficiency Nova Scotia Corporation (ENSC) commenced operations in 2010 after the enactment of the *Efficiency Nova Scotia Corporation Act* in 2009. Revisions to the *Public Utilities Act*, introduced through the *Electricity Efficiency and Conservation Restructuring (2014) Act*, pronounced a structural change for energy efficiency and conservation activities in Nova Scotia in 2015.

ENSC ceased to exist as Nova Scotia's DSM provider on January 1, 2015. In its place, the Minister of Energy created and awarded the ENS franchise. The first franchise holder is EfficiencyOne, an organization incorporated on July 8, 2014 under the *Canada Not-for-profit Corporations Act*. EfficiencyOne is a public utility pursuant to the *Public Utilities Act.*

HISTORICAL RESULTS AND COMPARISON TO OTHER JURISDICTIONS

We provide ENSC's historical portfolio savings from 2010-2014 below, along with a unit cost (first year energy savings), scale of relative effort, and a proxy for "residential customer motivation" comparison to the other jurisdictions:

Year	Residential Energy Savings (GWh)	Business, Not for Profit and Institutional Savings (GWh)	Residential Demand Reduction (MW)	Business, Not for Profit and Institutional Demand Reduction (MW)	Fully Allocated Residential Expenditure ($ million)	Fully Allocated Business. Not for Profit and Institutional Expenditure ($ million)	Fully Allocated Enabling Strategies ($ million)
2010	22	60	5.89	9.96	7.49	11.82	3.39
2011	44	98	12.11	16.75	19.71	13.12	2.96
2012	70	88	17.71	16.08	18.74	20.49	4.44
2013	80	84	16.80	17.30	17.68	18.09	3.85
2014	80	71	15.51	11.57	17.35	16.46	3.30
Total	**297.15**	**401.30**	**68.02**	**71.65**	**80.97**	**79.98**	**17.94**

Table 7: **ENS Historical Performance**

Utility/Agency	Unit Cost of Conservation	Annual Energy Savings as % of Retail Sales (2014)	Residential Electricity Rate (2014)
Nova Scotia	$0.25/kWh	1.3%	$0.148/kWh
Ontario (IESO)	$0.25/kWh	1.3%	$0.10-$0.124/kWh
British Columbia (B.C Hydro)	N/A	N/A	$0.10-$0.12/kWh
California (PG&E)*	$0.43/kWh	1%	$0.1625/kWh
Energy Trust of Oregon*	N/A	N/A	$0.11/kWh
New York (ConEd)*	$0.48/kWh	≈1%	$0.2885 cents/kWh
New York (NYSERDA)*	N/A	≈1%	$0.2005/kWh
Vermont*	$0.40/kWh	2%	$0.125-$0.195/kWh
Maine (Efficiency Maine)*	$0.20/kWh (Electric Base) $0.30/kWh (MACE Low Cost) $0.35/kWh (MACE High Cost)	1.6%	$0.1567/kWh
Massachusetts (National Grid)*	$0.46/kWh	2.94%	$0.165-$0.185/kWh

**The dollar amounts for these jurisdictions are quoted in US dollars.*

Table 8: Unit Cost, Energy Savings, and Residential Rate from Different Jurisdictions

As can be seen from Table 8, the portfolio performance achieved by EfficiencyOne and the current energy efficiency targets in Nova Scotia are comparable to the other jurisdictions studied. The numbers support, at a portfolio level, that that there isn't a significant variation in ENS spending, especially with regards to incentive spending, compared to the other jurisdictions.

EFFICIENCY GOALS

As per the *Electricity Efficiency and Conservation Restructuring (2014) Act*, "Nova Scotia Power Incorporated shall undertake cost-effective electricity efficiency and conservation activities that are reasonably available in an effort to reduce costs for its customers."[19]

After the end of the most recent DSM planning process, ENS's 2016-2018 savings targets and budgets are as follows:

Year	Savings (GWh)	Expenditure ($ million)	Unit Cost ($/kWh)
2016	133.1	$33.21	$0.25/kWh
2017	136.5	$34.02	$0.25/kWh
2018	136.3	$34.92	$0.26/kWh
Total	405.9	$102.15	$0.25/kWh

Table 9: ENS's Targets and Budgets

From a total consumption perspective, ENS's annual target for 2015 is 1.3 percent of electricity sales for that year, which is comparable to other jurisdictions as seen in Table 8.

[19] *Electricity Efficiency and Conservation Restructuring (2014) Act - http://nslegislature.ca/legc/bills/62nd_1st/1st_read/b041.htm*

POLICY CONSIDERATIONS

ACHIEVABLE POTENTIAL

In 2014, Navigant Consulting conducted an achievable potential study for Nova Scotia, (Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study)[20]. It indicated that the achievable potential and required expenditure for 2016, 2017, and 2018 were as follows:

Year	Annual Savings (GWh)	Expenditure ($ million)	Unit Cost ($/kWh)
2016	139.9	$50.5	$0.36/kWh
2017	141.7	$50.0	$0.35/kWh
2018	136.2	$52.4	$0.38/kWh
Total	417.8	$152.9	$0.37/kWh

Table 10: **Nova Scotia Achievable Potential Summary**

The numbers presented are for the base scenario, where the incentives do not change over time. This suggests that ENS's current savings targets are almost 100 percent of the achievable potential. However, the approved budget by the UARB is only between 50-70 percent of the forecasted required budget set forth in the Achievable Potential Study, depending on the year and the scenario.

This leads to the conclusion that ENS is running its portfolio efficiently, and is optimizing its savings for expenditure. The best practices identified earlier will be applied to ENS's portfolio and specific improvements will be suggested, but it should be clear that quantitatively, the performance of the portfolio from an expenditure to annual savings basis is good compared to the available achievable potential. The historical performance has also been good compared to other jurisdictions as shown in the historical results analysis above.

CLEAResult used the data from the *Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study* to provide background and context in terms of understanding the housing, commercial building and equipment stock in Nova Scotia, and the achievable savings potential through the current programs.

COST EFFECTIVENESS AND AVOIDED COSTS

At the portfolio level, cost effectiveness is guaranteed since the combination of savings targets and budget is lower than the cost effectiveness threshold (provided that the persistence of the energy savings is equal to or better than the forecast). However, during each program planning phase, ENS internally sets a cutoff of a TRC of 1.0 for each program. The TRC benefits include any potential impacts from wood or water consumption or savings (which are about 1 percent of the DSM Resource Plan portfolio benefits). The PAC is used for informational purposes, but is not part of the review protocol.

All program measures are tested at the measure level for TRC, and non-compliant measures can be removed. Occasionally, measures that do not pass the measure level TRC are included in programs due to other considerations, such as market transformation or program delivery strategy. Similar strategies are applied to non-cost effective measures in other jurisdictions to maintain market momentum and adapt to sudden changes in avoided costs (e.g., Energy Trust of Oregon). At the measure level, program administration costs are included in the TRC screening.

The program administration costs are allocated based on a unit program administration costs/kWh savings adder. This is an interesting approach since, for TRC screening, the only cost parameter that ENS controls is the program administration costs

[20] *Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study – Navigant Consulting*

(incentives are not directly included in the TRC). Other jurisdictions have applied different approaches for measure level testing, choosing to exclude administration costs as these can vary greatly depending on the maturity of the measure in the market.

In conducting cost effectiveness screening, ENS uses the Energy Efficiency Resource Assessment Model (EERAM), developed by Navigant. This model is typically targeted for long-term (20-25 years) energy savings potential and planning purposes. It is not used for incentive setting.

Avoided costs are updated every three to four years with the filing of the Integrated Resource Plan (IRP). Nova Scotia Power Inc. provides the avoided costs.

The current methodology has conservation activity competing with the lowest cost of supply. This is different to many other jurisdictions where avoided costs are typically calculated using either the average or marginal cost of supply and potentially other costs, such as renewable standards. Nova Scotia is forecasted to have excess electric generation capacity until 2019. Therefore, current avoided costs for capacity are set at $0/kW for any demand savings occurring up to that time. Because of this, measures and projects that pass the TRC and PAC are only able to claim the benefit of avoided energy costs until 2020. After 2020, they can claim both avoided energy and capacity benefits.

This can be a challenge since momentum through awareness and a continued presence in the market is required for long-term efficiency program success. It is difficult to modify energy efficiency program performance and the measure portfolio (both selection and incentive levels) to adjust for annual variations in the avoided costs. Deployment of specific programs or measures can take advantage of annual variations, but it is difficult to apply this approach to an entire portfolio. Other jurisdictions, such as Oregon, have addressed this issue by providing relief from a cost effectiveness perspective when there needs to be alignment with energy efficiency policy and portfolio savings goals.

The avoided costs of energy are the same across all time periods in the year. This means that the benefits derived from energy savings do not depend on the time that the energy savings occur. There is not a premium for measures that contribute energy savings coincidently with peak periods, outside of avoided capacity savings during system peak.

CLEAResult understands that ENS is currently investigating the opportunity to recognize local avoided costs, and to consider discount and premium zones for electricity conservation. This position will be considered in any incentive methodology recommendations.

OTHER CONSIDERATIONS

Through the most recent program evaluation process, ENS has identified that some educational initiatives are incurring savings attribution issues, and have received tentative disallowance. This specifically was the case for the Home Energy Reports (HER) program. In the future, this may lead to additional difficultly minimizing expenditure by moving funding from financial incentives to educational incentives. This issue must be considered if an eventual goal is to ultimately eliminate financial incentives from programs, and reach market transformation of an energy efficient culture.

Finally, ENS does not use dual baselines in their energy savings estimates for measures for operational tracking. Dual baselines involve assuming a set baseline for a number of years, and then another baseline for the remaining number of years assumed in the energy savings persistence. Instead, they use an average wattage/consumption approach. This may be acceptable for determining annual energy savings, but may present challenges when determining lifetime energy savings. An approach should be considered for tracking lifetime energy savings through program management.

EFFICIENCY NOVA SCOTIA'S PROGRAM PORTFOLIO

The following table contains a summary of ENS's current programs, target market and incentive structure.

Commercial customers are defined as businesses, not-for-profits and institutional customers.

Current Programs

Program Name	Program Offer and Incentive Structure
Residential Profile	An online assessment tool is provided for customers to enter information about their home and receive energy savings tips and information regarding options and incentives. The online assessment tool is provided free of charge. The expenditure for this effort is not included as an incentive, and savings are not attributed to its use.
Instant Savings	Residential customers receive instant discounts at the point of purchase for qualifying products at participating retailers. Incentives are offered on lighting and lighting control products, power bars, outdoor timers, programmable thermostats, outdoor clothesline kits and qualifying refrigerators and clothes washers. A delivery agent is involved to coordinate retailer efforts, provide the required training and manage compliance issues.
Appliance Retirement	Residential customers receive a financial incentive for the old equipment that is being provided to the program, free equipment pickup, and environmentally friendly decommissioning.
Home Energy Assessment	Residential customers that are electrically heated receive a subsidized home energy assessment ($99 to the customer) which provides recommendations for energy efficiency upgrades with costs, savings and incentive options. The energy assessment is conducted by service organizations that are procured by EfficiencyOne. As desired, customers complete the upgrades, have a follow-up assessment to evaluate installed projects and savings, and confirm the appropriate incentive.
Residential Direct Install and Rental Properties and Condos	Residential customers receive products directly installed at no cost by qualified partners. These products include lighting measures, domestic water heating measures (where electric water heating) and power strips.
Green Heat	Residential customers that are electrically heated receive incentives or low cost financing for the installation of qualifying heating technologies. Pre-approval for installation must be granted for rebate eligibility or low cost financing. A final application/documentation review is required after installation to confirm the rebate payment or access to low cost financing.
New Home Construction	Residential customers that are planning to build electrically heated homes can have a Certified Energy Advisor review the building plans, and provide customized recommendations to improve the energy efficiency of the design. The review by the Certified Energy Advisor costs $99, and based on changes to the design, the customer can receive up to $2,000 in rebates. The rebate is paid after the Certified Energy Advisor conducts a follow-up assessment to evaluate the new energy performance of the home, either through the ENERGY STAR®, EnerGuide, or R2000 rating systems.
Business Energy Rebates	This incentive offer for commercial and industrial customers is offered through a midstream with participating distributors, or downstream using an application process. Qualifying equipment is provided with a prescriptive incentive. Alternatively, qualifying customers are offered interest-free financing for 24 months instead of the prescriptive incentives.
Small Business Energy Solutions (SBES)	Qualifying small commercial and industrial customers (with an annual consumption under 350,000 kWh) receive qualifying products installed with up to 60 percent of the costs covered. Customers are also offered interest-free financing for 24 months in addition to the rebates.

Program Name	Program Offer and Incentive Structure
Custom	Commercial, institutional and industrial customers are eligible to apply to the Custom Program for measures or projects that do not fit under a prescriptive project stream. Scoping and/or Feasibility studies have to be conducted before the project is approved to proceed. The incentive is calculated based on multiple factors (total cost, cost per kWh, simple payback and percentage of project cost), and is individually negotiated with each customer. Interest-free, multi-year financing is available for the remaining project costs. There is also a compressed air-focused component where customers can have a no-cost targeted study performed to investigate compressed air energy efficiency opportunities. Additionally, there is a leak fixing incentive. For larger commercial and industrial customers, recommissioning specialists will review the building's original operating documents, equipment, temperature settings and scheduling to ensure everything is working properly and set for optimal efficiency. The specialists provide the customers with a report outlining the enhancements made, and other areas for energy savings. The work conducted by the recommissioning specialists is partially covered (depending on cost, payback, and unit cost), up to a maximum of $25,000 per building. Customers can access other programs for the other energy savings opportunities. For commercial and industrial customers planning a new build, a building expansion or a major renovation, the program provides assistance with design through energy modeling assistance, fully covered up to $15,000. Customers can apply for prescriptive incentives for qualifying equipment, as well as access to additional incentives or interest-free, multi-year financing for the remaining incremental measure costs.
Energy Management Information Systems (EMIS)	For larger commercial and industrial customers, the EMIS program offers access to a performance management system to monitor and analyze energy usage in the facility. The program provides funding and facilitates the installation, training for, and evaluation of the installed equipment. The decision to maintain the system at the customer's facility is made annually.
Strategic Energy Management (SEM)	For larger commercial and industrial customers, SEM provides a comprehensive approach to energy management that results in sustainable energy and cost savings over the long-term. ENS provides support for implementing the SEM approach by facilitating energy mapping, monitoring and reporting, employee training, and support for employee engagement activities.

Table 11: **ENS Program Overview**

Low Income Program Plans

ENS's DSM portfolio currently does not feature an electricity DSM program exclusively directed towards the low income sector. However, there are plans for an energy efficiency incentive offering to this sector. CLEAResult has included a summary of the plans below:

> *Market analysis performed by Efficiency Nova Scotia in 2015 identified an opportunity to evaluate and begin development of a pilot program specifically designed to support efficiency improvements in low income multi-unit buildings. The pilot program would deliver building-wide upgrades that reduce electricity consumption in eligible properties. It is expected that the pilot program would provide 100 percent coverage for an energy audit to identify all opportunities. Additional rebates would be available for measures such as: insulation; air sealing; efficient heating systems; heat recovery systems; pipe insulation; sensors and timers; and Heating, Ventilation and Air Conditioning (HVAC) controls.*
>
> *The pilot program delivery is intended to be modeled after the SBES delivery model and unit cost, and will support all providers of affordable rental housing. The pilot aims to remove the 350,000 kWh cap currently established under SBES so that larger, affordable housing properties are not arbitrarily neglected. Due to the limited budget of the pilot, considerations on funding caps will also be developed at both the owner and project levels (i.e. restricting the amount of funding for any one landlord or project).*[21]

[21] Email Communication from EfficiencyOne Program Management Staff – May 25, 2016

Programs Studied in Recommendations

The following table contains an analysis of the barriers and the associated incentive strategy for the four investigated programs.

Program	Identified Barriers	Incentive Strategy
Instant Savings	1) Residential customers worry about upfront costs. For example, LED penetration, despite dropping upfront costs from 2013-2015, LEDs still account for less than 10 percent of A Lamp sales due to their retail price compared to incandescent lamps. Appliances are large budget items, and features are prioritized over efficiency. 2) Residential customers need simplicity; submitting incentive applications is a barrier to participation. 3) Retailers and their employees show varying degrees of awareness, engagement and knowledge of the program.	1) Residential customers receive incentives at the point of sale. The incentives are typically between 15-50 percent, but may be higher for some measures. 2) Residential customers receive instant discounts at the point of purchase for qualifying products at participating retailers. Receiving the discount at the point of purchase prevents the need for an incentive application. 3) A delivery agent is involved to coordinate retailer efforts, provide the required training and manage compliance issues. Additionally, strategies, tactics and campaigns are used to promote participation through improving customer awareness and education, while also conducting retailer training to improve engagement and program knowledge.
Home Energy Assessment	1) Residential customers lack knowledge about the potential for savings in their homes. 2) Residential customers worry about upfront costs.	1) Residential customers receive a subsidized energy assessment to learn about the energy efficiency opportunities in their homes, and the potential costs, savings, and incentive options. They also have access to a personal energy planning service for additional support. 2) Residential customers receive incentives for installing eligible measures. The incentive is typically 15-25 percent of the project costs.
Business Energy Rebates	1) For efficiency projects, commercial and industrial customers are concerned about upfront capital. 2) Commercial and industrial customers have a lack of education about energy efficient projects. 3) Commercial and industrial customers show an unwillingness to change their practices.	1) Commercial and industrial customers receive prescriptive incentives for purchased products. Incentives are capped at 50 percent of project costs, but usually do not reach this amount. 2) Through the midstream application, the distributors are engaged to educate the contractors. The contractors are one of the major points of influence for customers, and through this educational effort, awareness for energy efficiency grows. 3) Through the midstream application, in addition to the contractor education benefit that will pass down to the customers, the distributors are encouraged to stock more efficient products, forcing the market to change in terms of the options available.
Custom Program	1) Commercial and industrial customers have measures that are not included in the prescriptive programs. This includes the new construction, recommissioning and compressed air project streams that fall within the Custom Program.	1) The program allows projects that do not fit into the prescriptive incentive programs, provided they meet eligibility criteria, and undergo studies to verify their energy savings and costs.

Table 12: Barriers and Incentive Strategy for EfficiencyOne Programs Studied

Incentive Setting Methodology Analysis and Recommendations

CLEAResult's analysis and recommendations for incentive level setting methodology will focus on the following areas:

1. General Principles;
2. Formal and Documented Incentive Setting Process;
3. Program-Specific Recommendations;
    - Instant Savings Program;
    - Custom Program;
    - Business Energy Rebates Program; and
    - Home Energy Assessment Program.
4. Complementary Excel Tool for Review Protocol Considerations;
5. Program Financial Simulation;
    - Instant Savings Program; and
    - Custom Program.

SUMMARY OF RECOMMENDATIONS

1. **It is recommended that EfficiencyOne consider all of the general principles for incorporation into an incentive setting process.**

   CLEAResult has provided a documented, incentive setting process (that incorporates these general principles) that can be leveraged by EfficiencyOne, along with the required template documents and tools.

2. **In addition, through recommending the general principles be followed in any incentive setting methodology that EfficiencyOne implements, there are several supporting requirements:**

   a) Ensure assumptions for residential and commercial LEDs, residential HVAC technology, commercial fluorescent technology and commercial Variable Frequency Drive (VFD) technology are kept up to date by conducting customer and technology research.

   b) Further support technology research by implementing a TRM approach. The energy savings and cost effectiveness metrics of the measures provide several reference points for setting incentive levels.

   c) Develop a consolidated calculator that can conduct the analysis that supports the incentive-level setting process. The calculator should have the following functionality:

      i. Capture and store measure-level information obtained from the recommended research activities and TRM process
      ii. Perform short-term program design or incentive-level cost effectiveness screening
      iii. Integrate the review protocol that has been provided in the Excel-based tool.

3. **Through adopting an incentive setting methodology that follows the general principles, conduct a program financial simulation of all of the current incentives in the programs to evaluate their current levels.**

GENERAL PRINCIPLES FOR INCENTIVE RATE SETTING

Based on CLEAResult's experience and research on best practices, it is recommended that any incentive level setting methodology should include the following general principles to understand:

1. Customer motivations and barriers for participation;
2. Technology savings, price and market penetration;
3. Supply chain and service provider considerations;
4. Financial impacts; and
5. Jurisdictional benchmarking (for new incentives).

CUSTOMER MOTIVATIONS AND BARRIERS

As discussed, understanding customer motivations and barriers to participation are important. This customer research can be performed in numerous ways; it is often done through surveys of both randomly selected participants and non-participants, for specific research projects, ongoing program management activity or program evaluations.

For incentive setting and general program design purposes, there are two types of market research that can be used to provide comprehensive incentive modelling assistance.

1. Price Sensitivity Research
2. Conjoint Analysis

These types of research can be expensive, and it is advised that they are only used for high-value incentive expenditure for individual measures (greater than $400,000 in annual expenditure over multiple (2+) years). The $400,000 value was obtained from a high-level evaluation of ENS's current individual incentive expenditure compared to the total portfolio expenditure.

Price Sensitivity Research

Price sensitivity is usually defined as the affect the price for a product or service has on the consumers' motivation to purchase it. For incentive setting in energy efficiency and conservation programs, it is important to understand what is required to move the market and encourage participation, while also ensuring the ratepayer's interests are protected.

Price sensitivity is also known in economic terms as the price elasticity of demand. It is important to note that consumers are not a homogenous group for most energy efficiency purchasing decisions, so it is practically impossible to get an exact answer for optimal pricing, and the associated price elasticity. However, by conducting this research, indications of general accuracy can be obtained, which help support other analyses and historical experience.

A popular price sensitivity analysis is Van Westendorp's Price Sensitivity Meter.[22] A wide variety of researchers prefer this technique since it can apply to multiple industries and it is simple to understand. The technique involves asking four price-related questions, which are then evaluated as a series of cumulative distributions, a distribution for each question. The four questions are:

1. At what price would you consider the product to be so expensive that you would not consider buying it? (Too Expensive)
2. At what price would you consider the product to be priced so low that you would feel the quality could not be very good? (Too Cheap)
3. At what price would you consider the product to be starting to get expensive, so that it is not out of the question, but you would have to give some thought to buying it? (Expensive)
4. At what price would you consider the product to be a bargain – a great buy for the money? (Cheap)

Since consumers are not a homogenous group, the distributions are needed with a significant sample size. The intersection of the cumulative distribution curves indicate what could be acceptable pricing levels for consumers for a particular product or service. For example, the intersections of the curves for Too Cheap and Cheap (questions (2) and (4)) predict the price of marginal cheapness, and can set the lower boundary of an acceptable price range for consumers. Similarly, the intersections of

[22] Roll et al. Innovative Approaches to Analyzing the Price Sensitivity Meter: Results of an International Comparative Study - https://www.researchgate.net/profile/Heidi_Korhonen3/publication/48330473_Determinants_to_Service_Innovation_Success_an_Organizational_Orientation_Perspective/links/0046353c383c558013000000.pdf#page=182

the curves for Too Expensive and Expensive (questions (1) and (3)) predict the price of marginal expensiveness, and can set the upper boundary of an acceptable price range for consumers.

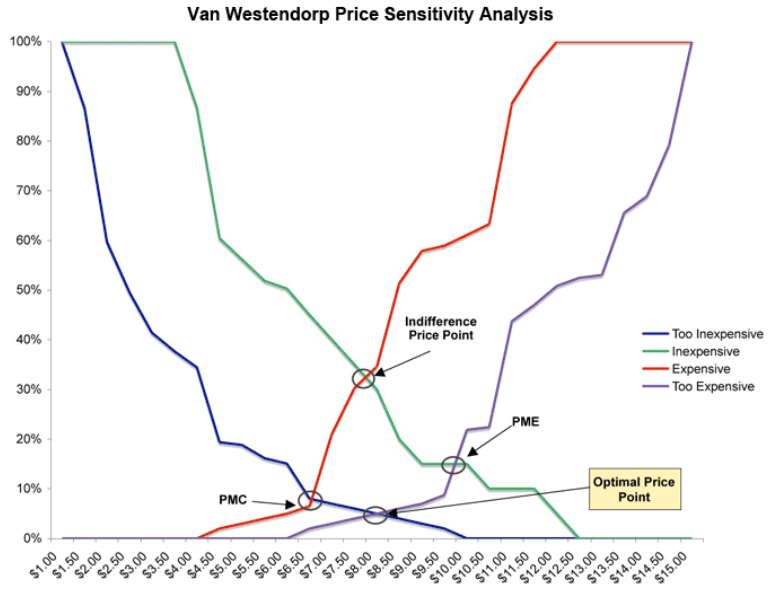


Figure 7: Van Westerndorp's Price Sensitivity Meter[23]

While this analysis is not exact, it provides a useful reference point for setting incentives at one point in time. The Price of Marginal Expensiveness (PME) establishes the upper boundary of acceptable consumer pricing, while the Price of Marginal Cheapness/Inexpensiveness (PMI) establishes the lower boundary.

As the technology and consumer motivations for purchase evolve, the cumulative distribution curves will change, accordingly.

Conjoint Analysis

Conjoint analysis can be used to evaluate how individual attributes contribute to consumers' value of a product or service. With many efficiency programs and incentive offers, there can be multiple benefits to the consumer including financial, educational and convenience. All of these benefits increase consumer value, and it may be possible to understand how much of a customer's value is financially driven. If this can be understood, there is a platform to understand what should be an acceptable incentive level.

Conjoint analysis is based on asking consumers to make a series of trade-offs regarding individual product or service attributes. When these trade-offs are analyzed, the relative importance of each benefit can be observed. The trade-offs are usually conducted based on a ranking or rating system that categorizes individual benefits. To better understand the data, consumers should be segmented as much as possible, so that the analysis can be conducted by different consumer segments.

[23] https://rmsbunkerblog.wordpress.com/2010/09/09/understanding-the-van-westendorp-pricing-model-market-research-in-central-ny-syracuse-upstate-new_york-surveys/

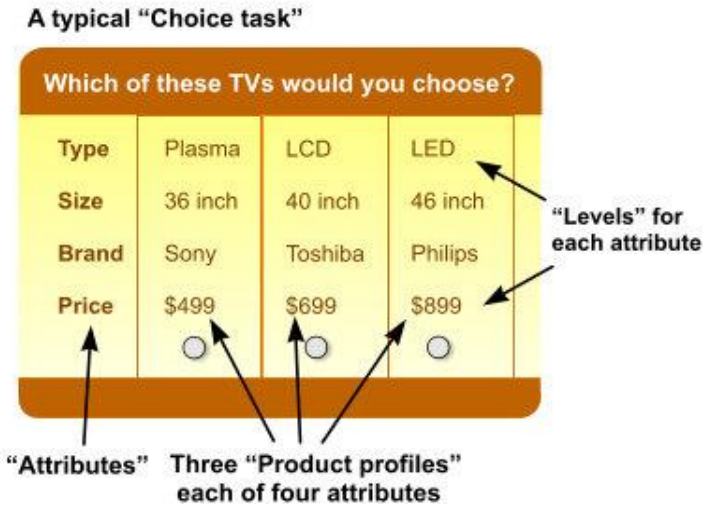


Figure 8: Example of Conjoint Analysis Choice Task[24]

CLEAResult recommends using both Price Sensitivity Research and Conjoint Analysis for individual measure incentives but only for incentive expenditure over $400,000 annually over multiple (2+) years. Otherwise, it is not needed to have research of this level of sophistication.

EfficiencyOne already conducts a lot of the customer (and technology) research required for the incentive level setting process. In evaluating future research requirements, it is advisable that EfficiencyOne review its currently available research, compare it to the documentation requirements in the proposed incentive level setting process, and identify if additional efforts are required. In many cases, the existing research efforts can be leveraged for both customer and technology research.

TECHNOLOGY RESEARCH

Technology research can provide both the basis for the value of the incentive investment through understanding the energy savings and it can provide insight into how often the incentive should be reviewed. It is very important to maintain a continued understanding of the following parameters for incentivized measures:

- Efficient Technology Name;
- Efficient Technology Description;
- Efficient Technology Wattage (if available);
- Efficient Technology Penetration Estimate;
- Forecast Efficient Technology Penetration Estimate (in 1 year);
- Efficient Technology Retail Price;
- Forecast Efficient Technology Retail Price (in 1 year);
- Sector;
- Customer;
- Application(s);
- Operating Hours;
- Base Case Technology Name(s);
- Base Case Technology Description(s);
- Base Case Technology Penetration(s);
- Forecast Base Case Technology Penetration(s) (in 1 year);
- Forecast Base Case Technology Retail Price(s) (in 1 year);

[24] http://www.dobney.com/Conjoint/Conjoint_analysis.htm

- Current Incremental Equipment Cost;
- Forecast Incremental Equipment Cost (in 1 year);
- Energy Savings;
- Expected Energy Savings Persistence;
- Any Program Dependent Parameters (*Should be clearly identified*);
    - Net-to-Gross (NTG) Ratio
- Incentive screening threshold in terms of cost to the customer (discussed in financial impact analysis);
- Incentive screening threshold in terms of the program budget (discussed in financial impact analysis); and
- Maximum incentive in terms of cost effectiveness (discussed in financial impact analysis).

Understanding these parameters provides another analysis point for setting incentive levels. For example, if the market penetration of the efficient technology is estimated to be higher than 50 percent, it may be time to consider reducing or eliminating the associated incentive. The above analysis is often performed through a measure assumptions review or TRM update process.

Through the TRM process and from Program Evaluations, this information for prescriptive measures can be reviewed and updated annually or bi-annually as required. During these review, all parameters listed can be updated accordingly.

SUPPLY CHAIN AND SERVICE PROVIDER RESEARCH

The supply chain and service providers should be engaged to support the customer and technology research efforts.

It can be difficult to get firsthand information about customer motivations, price elasticity and the parameters associated with technology. In these situations, it is important to involve the supply chain to obtain additional insight. Also, the supply chain can provide another point of reference for incentive setting analyses by providing reference data (sales, shipments, installations etc.), as well as offering their insight for whether the incentive is appropriate, and if it will motivate customers as desired.

Having regular interactions with the supply chain and service providers is important for incentive setting activities, and for broader program design and management. Many jurisdictions feature standing panels and/or scheduled discussions with the supply chain, service providers and key stakeholders to obtain this insight.

FINANCIAL IMPACT ANALYSIS

Any incentive setting exercise needs to incorporate the financial impacts into the analysis. It is important to understand how changes in incentives could affect the financial performance of a program.

There are six main components to understanding the financial impact of changing incentive levels.

1. **What is the current incentive, forecasted participation and forecasted incentive expenditure?**
2. **What is the market penetration?**

The incentive thresholds discussed in Figure 9 can be used to provide three points of reference for the incentive setting process.

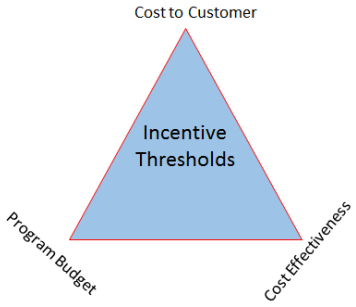


Figure 9: Incentive Thresholds used in Financial Impact Analysis

3. What is the acceptable incentive threshold in terms of cost to the customer?

With respect to cost to the customer, there may be an acceptable incentive level threshold that is based on the retail price, incremental cost or simple payback. For certain programs, this threshold is often set at 50-70 percent of retail price or project costs, or a minimum of a one year payback period. This does not mean the incentive should be 50-70 percent of the retail price or project costs or that projects should have a minimum of one year payback. Recommendations for an Absolute Limit could be 100 percent of retail price or project cost, or to obtain a one year payback. The Absolute Limit should not be breached for any situation. However, for most incentives, there is not a need to approach the Absolute Limit. Therefore, it is important to define a Suggested Boundary/Ceiling. This lower value can be used as the guideline for checking whether incentive pricing is too high. **In some cases, it may be required to exceed the Suggested Boundary/Ceiling. These values are guidelines only, and should not be implemented as a hard limit or cap.**

There may be an acceptable compensation level threshold in terms of cost to the customer that is based on the retail price, incremental cost or simple payback. The threshold is defined for design purposes, and is not a target; it serves as a ceiling.

The values for the Absolute Limit and the Suggested Boundary/Ceiling are derived from the jurisdictional studies and CLEAResult's experience from program design and incentive setting activities.

Customer and Decision	Basis for Cost to Customer Incentive Threshold		
	Basis	Absolute Limit	Suggested Boundary/Ceiling
Low Income Customer, Direct Install Model	Project Cost	100%	100%
Residential Customer, Small Purchase at Retailer	Retail Price	100%	50%
Residential Customer, Direct Install	Project Cost	100%	100%
Residential Customer, Large Capital Equipment Purchase	Incremental Cost	100%	50%
Residential Customer, Large Purchase	Project Cost	100%	50%
Commercial and Industrial Small Business Customer, Direct Install	Project Cost	100%	70%-100%
Commercial and Industrial Customer, Small Purchase at Distributor	Retail Price	100%	50%
Commercial and Industrial Customer, Large Capital Equipment Purchase	Incremental Cost, Simple Payback	100%, ≥ 1 Year	50%, ≥ 1 Year
Commercial and Industrial Customer, Large Purchase	Project Cost, Simple Payback	100%, ≥ 1 Year	50%, ≥ 1 Year

Table 13: Basis for Cost to Customer Incentive Threshold

4. What is the acceptable incentive threshold in terms of program budget?

With respect to program budgets, there may be an acceptable incentive level threshold that is based on total expenditure or unit costs. For certain programs, this threshold is often set at a maximum incentive for a project, or on some kind of unit cost

parameter such as $/kWh. Recommendations for an Absolute Limit or a Suggested Boundary/Ceiling should be based on the forecasted program expenditure net of any expected program administration costs.

Customer and Decision	Basis for Program Budget Incentive Threshold		
	Basis	Absolute Limit	Suggested Boundary/Ceiling
Low Income Customer, Direct Install Model	$/kWh	$1.50/kWh	$1.20/kWh
Residential Customer, Small Purchase at Retailer	$/kWh	$1.00/kWh	$0.50/kWh
Residential Customer, Direct Install	$/kWh, Total Incentive	$1.00/kWh, $25,000	$0.75/kWh, $15,000
Residential Customer, Large Capital Equipment Purchase	$/kWh	$1.00/kWh	$0.50/kWh
Residential Customer, Large Purchase	$/kWh	$1.00/kWh	$0.50/kWh
Commercial and Industrial Small Business Customer, Direct Install	$/kWh, Total Incentive	$1.00/kWh	$0.75/kWh
Commercial Customer, Small Purchase at Distributor	$/kWh	$0.50/kWh	$0.25/kWh
Commercial Customer, Large Capital Equipment Purchase	$/kWh, Total Incentive	$0.50/kWh, $1,000,000	$0.25/kWh, $500,000
Commercial Customer, Large Purchase	$/kWh, Total Incentive	$0.50/kWh, $1,000,000	$0.25/kWh, $500,000

Table 14: Basis for Program Budget Incentive Threshold

5. What is the acceptable incentive threshold in terms of cost effectiveness?

With respect to cost effectiveness, there may be an acceptable incentive level threshold that is based on measure, program or portfolio cost effectiveness targets for the PAC. Suggestions for an absolute limit or boundary/ceiling could be based on the forecasted PAC benefits net of any expected program administration costs. This approach is similar to using a lifetime energy savings approach. Lifetime energy savings will have an associated cost effectiveness benefit, and as long as spending is under that amount, the cost effectiveness is not threatened. The lifetime energy savings approach won't include the capacity benefits that the cost effectiveness approach includes in the calculation.

It should be emphasized that cost effectiveness considerations can set ceilings for incentives, but they shouldn't be the driver for the amount of the proposed incentive.

It is recommended that EfficiencyOne develop a consolidated calculator, where one of the functionality elements is to be able to determine the individual cost effectiveness incentive level thresholds for each measure. The data points and functionality needed to build an appropriate consolidated calculator are listed in Appendix B.

6. What is the proposed incentive, forecasted participation and forecasted incentive expenditure?

Ideally, the proposed incentive is supported by the customer and technology research, and is within the incentive screening thresholds identified above. When the proposed incentive and forecasted participation are determined, the total forecasted incentive expenditure can be found, and compared to the current incentive's forecasted incentive expenditure (Component 1). This allows program administrators to understand the macro-level budget impact for any incentive changes. The historical performance would be one of the main factors in determining the forecasted participation.

Beyond using the lifetime energy savings to quantify the overall PAC cost effectiveness benefit of the measure and using it to document the cost effectiveness incentive level threshold, cost effectiveness screening is not being explicitly recommended as a part of the financial impact analysis.

JURISDICTIONAL BENCHMARKING

Jurisdictional benchmarking is not essential for existing incentives. The current program performance, historical experience and recommended research should provide a comprehensive analysis for incentive setting. It is recommended as best practice to check in periodically with other jurisdictions regarding their programs and incentive levels.

For new incentives, jurisdictional benchmarking should be included due to the absence of current program performance and historical experience. It is important to understand what other jurisdictions offer as incentives, and what nuances and factors may affect these incentive levels due to market size, delivery approach and other influences.

GENERAL PORTFOLIO SUMMARY FOR CURRENT AND RECOMMENDED ACTIVITIES

General Principle	Current Activities	Recommended Activities
Understand Customer Motivation and Barriers for Participation	Currently, EfficiencyOne uses four different methods to understand customer motivation and barriers to participation: 1. Market research to assess customer awareness of programs and reasons for participation/non-participation; 2. Annual surveys through program evaluation process; 3. Active program management which involves customer feedback and CSAT/QA surveys; and 4. Specialized research engagements such as program design or achievable potential study.	• EfficiencyOne should continue these current activities. • An annual survey on key customer and technology combinations should be introduced to provide trending data going forward. It is suggested that the following technology portfolios be studied as they show the highest current participation/savings or future potential (key measures): o Residential LED Lighting Technology; o Residential HVAC Technology; o Commercial Fluorescent Lighting Technology; o Commercial LED Lighting Technology; and o Commercial Variable Frequency Drive Technology. • If any measures or technologies could lead to a large annual incentive expenditure (over $400,000 over multiple years), it may be worth conducting some price sensitivity or conjoint analyses. *Since the retail price of electricity has increased 70 percent in the past ten years, it is important to understand customer's affordability concerns and enhance their understanding of available options for reducing their electricity bill. This has been indicated as a consideration in Nova Scotia's electricity system planning[25]. A consistent, multi-pronged market research effort to understand customer motivation and barriers can aid in these efforts. Any existing research activities or data sources can be leveraged to support the recommended research efforts.*

[25] Our Electricity Future: Nova Scotia's Energy Plan 2015-2020, Nova Scotia Department of Energy, Available: http://energy.novascotia.ca/sites/default/files/Our-Electricity-Future.pdf

General Principle	Current Activities	Recommended Activities
Understand Technology Savings, Price and Market Penetration	EfficiencyOne currently understands technology savings, price and market penetration through three different avenues: 1. Annual review through program evaluation process; 2. Specialized research engagements for program design; and 3. Collecting cost/price information, where possible, through program delivery.	• EfficiencyOne's ability to collect cost/price information through program delivery and account management activities should be commended and continued. • EfficiencyOne should continue these current activities. • EfficiencyOne should introduce a formal measures assumption validation process and summary manual. Many other jurisdictions refer to the manual as the TRM and have formal processes for introducing and updating the assumptions for the measure savings and cost information. ○ The parameters should be supported by appropriate primary or secondary research and calculations and these metrics should be reviewed on a periodic basis to confirm they are still valid. Some of this activity may be covered by the program evaluations. Please refer to the Technology Research section for a list of parameters that CLEAResult recommends including in the research. ○ For LEDs in the residential and commercial sector, the updates should occur annually. ○ The updates should be reviewed by a committee, which consists of technical experts from EfficiencyOne's staff, and one external member. All members on the committee should have a technical background, and specifically understand and have experience with quantifying measure energy savings, penetrations and costs. The review process for updates should occur annually, ideally in conjunction with, or adjacent to the program evaluation process, so that the two exercises can be collaborative and leverage research.
Understand Supply Chain and Service Provider Considerations	EfficiencyOne interacts with the supply chain through three different avenues: 1. Active program management which involves supply chain interaction; 2. Annual surveys through program evaluation processes; and 3. Specialized research engagements such as program design or achievable potential study	• EfficiencyOne should maintain the current manner that it uses to engage the different supply chains and service providers. It may be a consideration to develop program-specific standing advisory panels that involve the supply chain and service providers as a value add activity but it is not an essential recommendation.

General Principle	Current Activities	Recommended Activities
Understand Financial Impacts	EfficiencyOne conducts cost effectiveness testing using the TRC test. The TRC is calculated at the measure level to qualify measures, though some measures are included that do not pass the TRC test for strategic considerations. The measure level cost effectiveness screen includes total portfolio administration costs spread using a unit cost approach. The TRC is also used at the program level to screen programs for potential implementation, with the program administration costs included. Ex-post cost effectiveness is not conducted. EfficiencyOne currently tracks the programs' financial impact through individual program management operations. When incentive changes are considered, EfficiencyOne creates a financial forecast of the incentive impact on the program budget and unit costs. EfficiencyOne is implementing a new software-based data management and tracking system to track measure implementations.	• EfficiencyOne should continue understanding the macro-level budget impacts from incentive level changes • EfficiencyOne should determine the three appropriate incentive screening thresholds for each measure, either through the TRM process, or through a different process. • For the software-based data management and tracking system, based on the program delivery structure, there may be options to improve tracking frequency. It is advised that as much granularity as possible should be used for frequency. This granularity will provide insight into potential program or portfolio budget risks before they arise and allow EfficiencyOne to modify program spending accordingly. It is understood that some programs may only be able to track data monthly.

Table 15: General Portfolio Summary Table Recommendations

The priority for ensuring information is updated to account for the four principles is based on the relevance of the research at hand. For example, if EfficiencyOne has recently conducted customer research to understand motivations and barriers to participation, it may not be necessary to re-do the customer research for the specific incentive level setting exercise. It may be of more use to put research resources to another effort.

FORMAL & DOCUMENTED INCENTIVE SETTING PROCESS

It is recommended that ENS use a formal and documented incentive setting process for all incentive setting exercises. This does not necessarily mean that every step of the process needs to be fully completed, or even conducted, but there should be justification and documentation for what was included in the process. The following flow charts illustrate three potential processes to use:

1. Initial Process (applicable to all incentive setting exercises);
2. Existing Incentive Development Process (for existing incentives that are being reviewed); and
3. New Incentive Development Process (for new incentives that are being considered for implementation).

The flow charts do not explicitly list the need to document other incentives that may be available in the market for ratepayers to access. It is important to take the potential availability of these other incentives into consideration in terms of the customer research for reduced barriers, the technology research for the potential in reduced energy savings and demand reduction due to attribution issues, and for the financial impact analysis which includes both the incentive screening thresholds and the participation forecast.

INITIAL PROCESS

The initial process should be followed for the beginning of all incentive setting exercises.

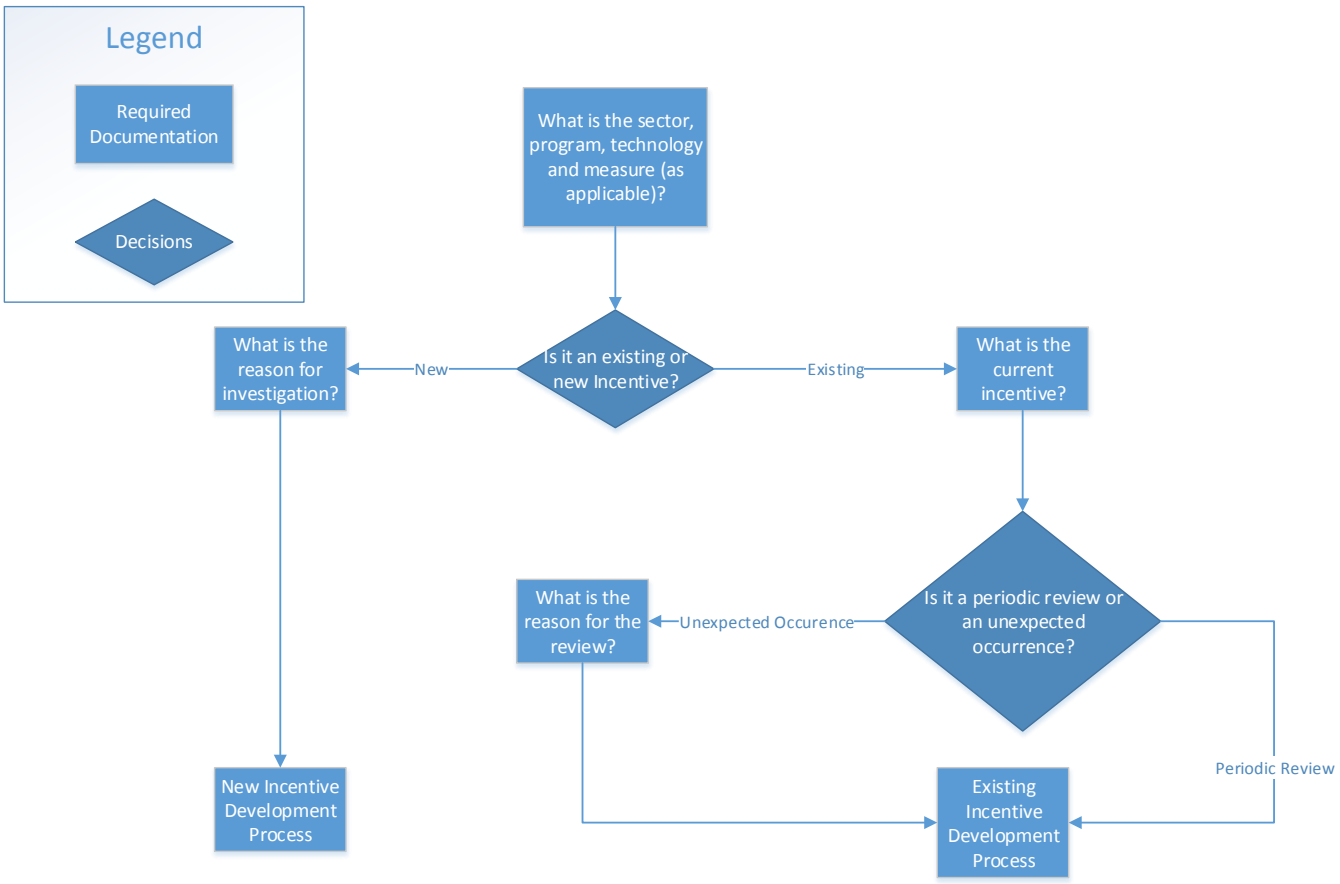


Figure 10: Initial Process for Incentive Setting

EXISTING INCENTIVE DEVELOPMENT PROCESS

The existing incentive development process should be followed for all existing incentives. While it does not necessarily need to be step-wise, all four steps should be covered in the analysis. It would be difficult to complete step (4), without completing steps (1)-(3).

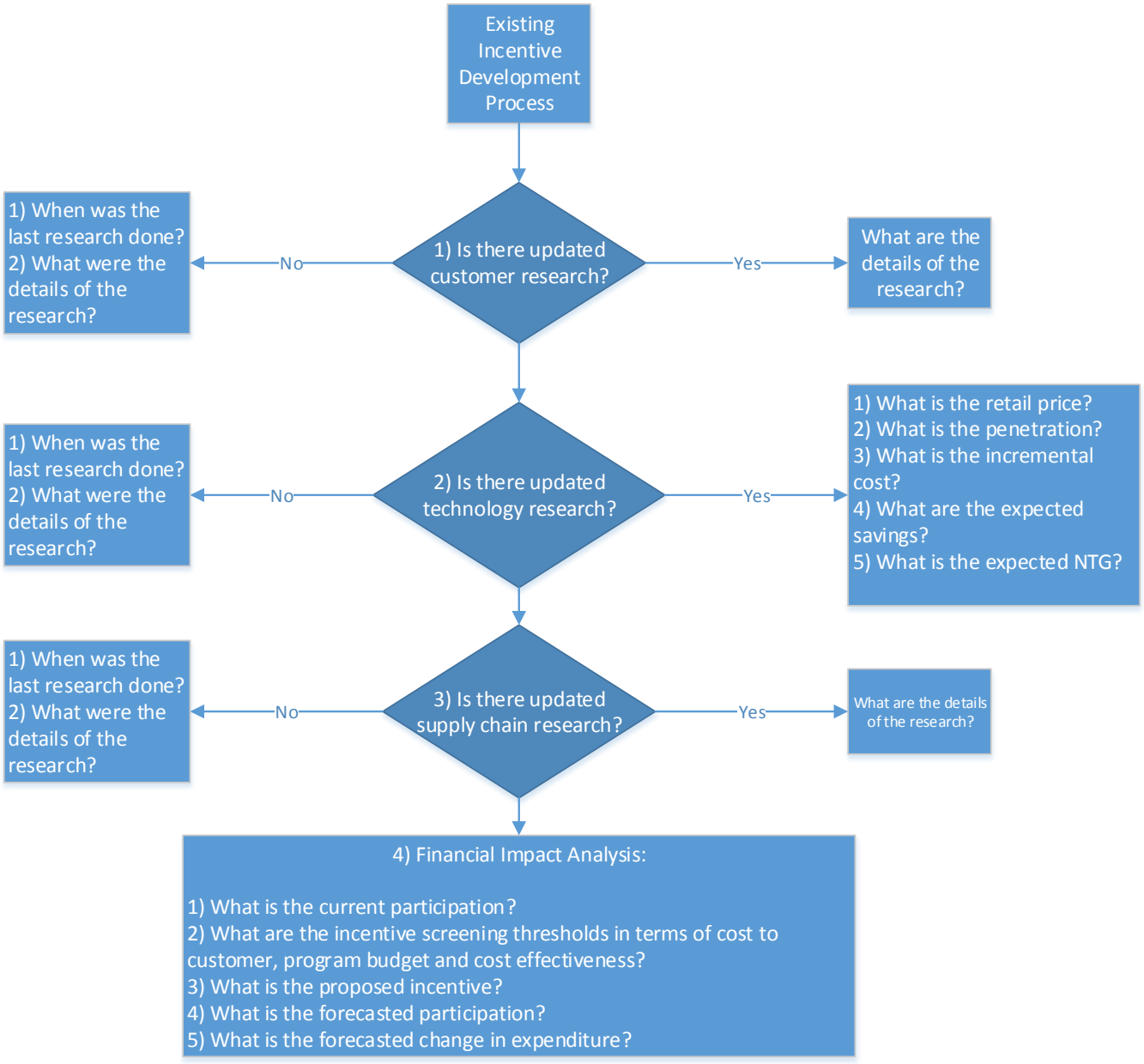


Figure 11: Existing Incentive Development Process

NEW INCENTIVE DEVELOPMENT PROCESS

The new incentive development process should be followed for all new incentives. While it does not necessarily need to be step-wise, all five steps should be covered in the analysis. It would be difficult to complete step (5), without completing steps (1)-(3).

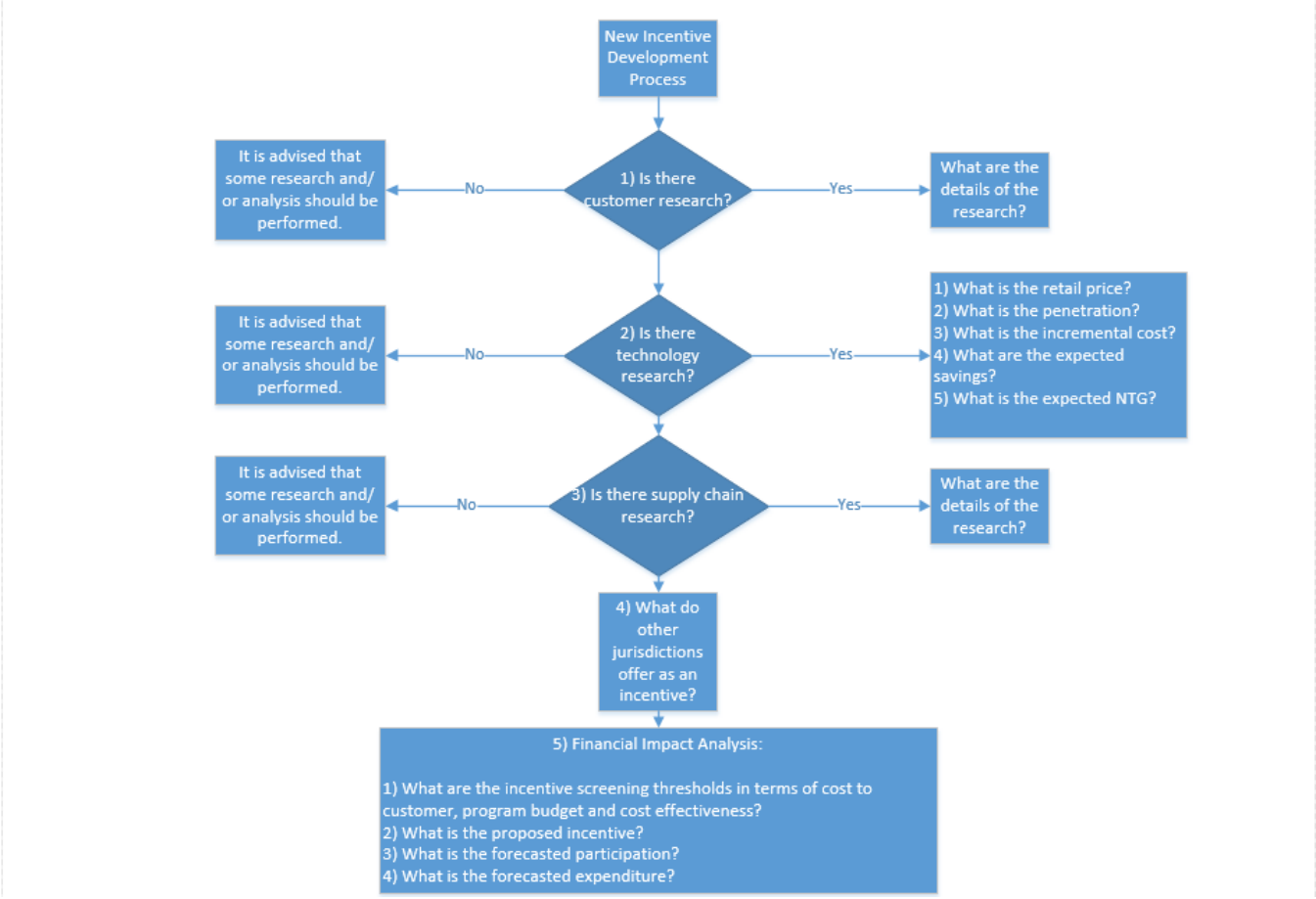
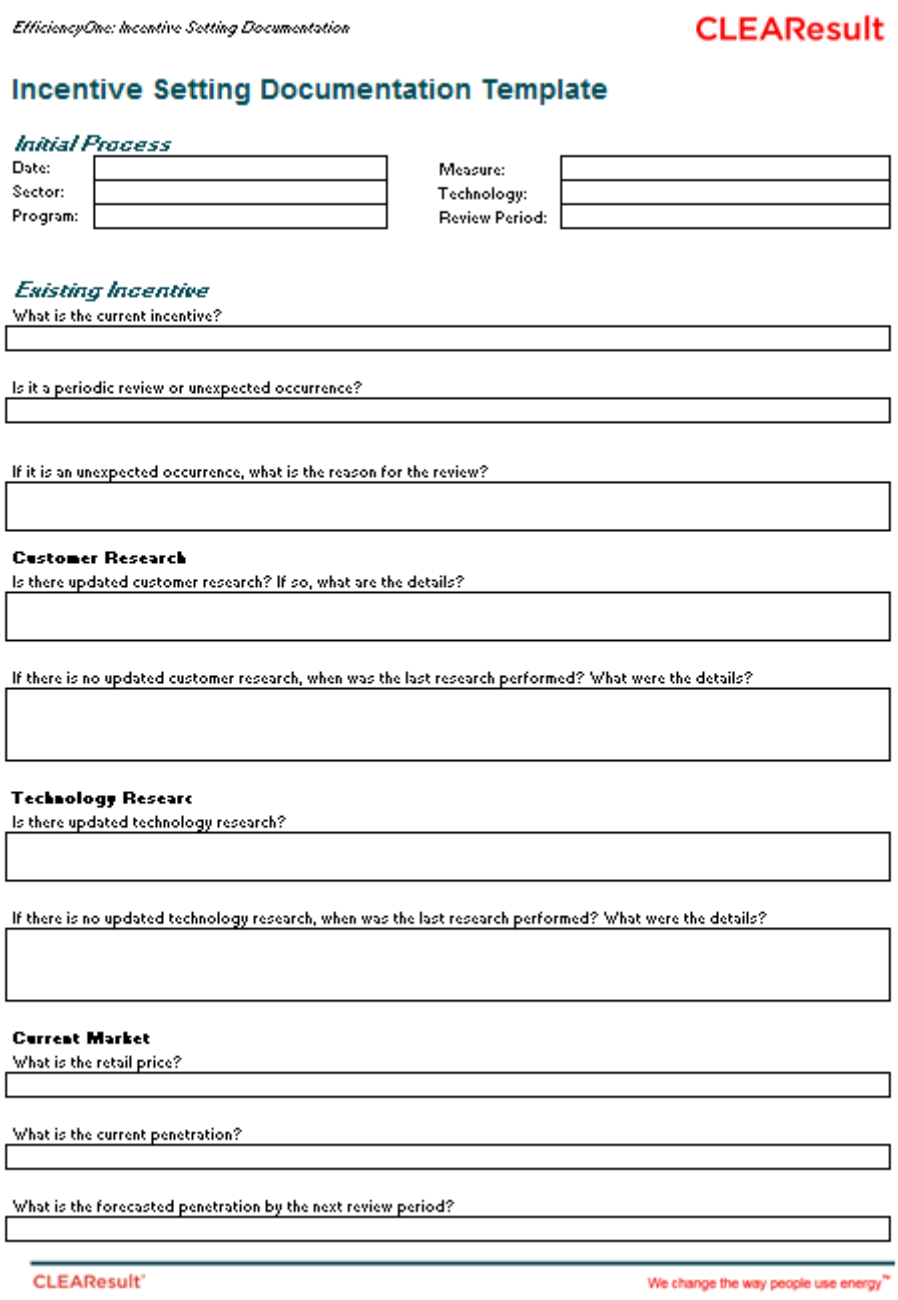


Figure 12: New Incentive Development Process

DOCUMENTATION

To complement the processes, CLEAResult is providing a template document that can be used for review and approval of any incentive setting exercise. This template document can provide a record of the considerations involved in setting the incentives, and can also serve as a platform for the review and approval process. The template document contains all of the required documentation steps in the flow charts, as indicated by the legend.

The template is provided as an attached Excel file, with a selected screenshot of the first page provided below:



EfficiencyOne: Incentive Setting Documentation

CLEAResult

Incentive Setting Documentation Template

Initial Process

Date:		Measure:	
Sector:		Technology:	
Program:		Review Period:	

Existing Incentive

What is the current incentive?

Is it a periodic review or unexpected occurrence?

If it is an unexpected occurrence, what is the reason for the review?

Customer Research

Is there updated customer research? If so, what are the details?

If there is no updated customer research, when was the last research performed? What were the details?

Technology Researc

Is there updated technology research?

If there is no updated technology research, when was the last research performed? What were the details?

Current Market

What is the retail price?

What is the current penetration?

What is the forecasted penetration by the next review period?

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INSTANT SAVINGS PROGRAM SUMMARY FOR CURRENT AND RECOMMENDED ACTIVITES

For the Instant Savings Program, CLEAResult has the following recommendations:

General Principle	Current Activities	Recommended Activities
Understand Technology Savings, Price and Market Penetration	For Instant Savings, EfficiencyOne gains an understanding of technology savings, price and penetration through the following activities: 1. Energy Efficiency Standards (Regulations); 2. Program Evaluation; 3. Industry Data; and 4. Specific Studies. In 2014, in response to upcoming codes and standards and penetration forecasts, EfficiencyOne eliminated CFLs from the program. This provides a recent example of proactivity regarding the incentive setting process. Annually, through the program evaluation process, the energy savings assumptions are reviewed, and updated as required. EfficiencyOne has active conversations with retailers (please see below) to understand market price and penetration information as well as access to other industry data for sales/shipments of certain products. Through the Achievable Potential Study conducted in 2014, EfficiencyOne has an understanding of the stock of different technologies in the residential sector, some of which are associated with the Instant Savings program.	• The current activities should be continued. • The recommendations in the General Principles section should be implemented to support this program. This covers both incentive level changes and introduction of new measures. • The energy savings assumptions validation should be expanded as required by the recommended TRM process outlined in the General Principles recommendations section. • LED-associated technology, such as dimmer switches whose savings are affected by the technology consumption, should also be updated annually for savings assumptions. *As discussed in General Principles, there should be annual reviews of the assumptions for LEDs in the residential and commercial sector. In the residential sector, the installed base of technology still seems to favour incandescent technology, but sales data shows LEDs increasing in penetration. This increased penetration is expected to happen quickly within the next five years. This anticipated transformation is the reason for the annual updates.*
Understand Customer Motivation and Barriers for Participation	For Instant Savings, EfficiencyOne gains an understanding of customer motivations and barriers through the following activities: 1. Market Research; and 2. Program Evaluation. In 2014, EfficiencyOne commissioned market research to identify the optimum rebate levels for products supported by the Instant Savings program. This research confirmed the incentive that customers would require to participate in the offer. Annually, through the program evaluation process, participant and non-participant surveys are conducted to determine free ridership and spillover savings.	• Conduct the price sensitivity research every year for the most popular program measures ≥ $400,000 in annual expenditure. • The participant and non-participant surveys should continue to be held annually, as they are required to evaluate customer motivation and barriers. • The recommended semi-annual survey for residential LED technology can be used to help understand customer motivations and barriers for this program.

General Principle	Current Activities	Recommended Activities
Understand Supply Chain and Service Provider Considerations	For Instant Savings, EfficiencyOne gains an understanding of the supply chain and service provider considerations through the following activities: 1. Ongoing Program Management; and 2. Program Evaluation. EfficiencyOne conducts annual one-on-one meetings with participating retailers and manufacturers to identify stocking plans, product pricing and joint marketing strategies for the following year. This provides insight into the technology assessment required for the TRM process. It is recommended that these annual meetings continue. Additionally, the delivery agent provides EfficiencyOne with an open channel of communication to retailers and manufacturers. Through the annual program evaluation process, there are interviews conducted with retailers and the delivery agent to understand their perspective, and suggestions for improvement.	• The current activities should be continued. EfficiencyOne, both through active program management (including with the delivery agent) and through the program evaluation process, receive insight from the supply chain. This communication is encouraged to continue, and this insight to be frequently sought out. This insight can also support the recommended market and technology research activities. • Additionally, it is recommended that EfficiencyOne try and understand if retailers or manufacturers will provide their own incentives on products during the next campaign or immediate program period. It may be difficult to gather this insight as it is understood that retailers reserve the right to make “game time” decisions regarding product sales. A complementary incentive will greatly affect uptake through increased participation, and ideally, it should be accounted for in any incentive analysis. This insight becomes even more valuable since real-time reporting of program activity is difficult to achieve for this program, which prevents instant correction.
Understand Financial Impacts	For Instant Savings, EfficiencyOne gains an understanding of financial impacts through the following activities: 1. Program Evaluation; 2. Program Planning; and 3. Financial Analysis. During the program evaluation process, the energy savings assumptions and net-to-gross ratios are reviewed, and updated as required. These inputs affect the cost effectiveness impact. During the DSM planning process, a cost effectiveness forecast is developed with all measures, programs, and the portfolio being screened for cost effectiveness using the TRC and PAC. Regulatory requirement is TRC of ≥1.0 at the program level. Since retailers require at least six months’ notice, incentive levels are not changed during campaigns. When an incentive change is proposed during the program planning process, EfficiencyOne conducts a financial forecast to track the budget impact.	• The current activities should be continued. • The recommendations in the General Principles section should be implemented to support this program. This covers both incentive level changes and introduction of new measures.

Table 16: Instant Savings Program Recommendations

Other Considerations for the Instant Savings Program

The current price floor for a participating measure is $0.99, regardless of the incentive. This floor ensures the customer pays something for the measure, and may assist with increasing the Net-to-Gross ratio. The price floor plays a similar role to incentive caps in commercial sector programs that require customers to contribute a portion of the incremental equipment or project cost. This is not possible with a point-of-purchase retailer program, since the cashier at the retailer cannot perform individual calculations on project costs or percentage contributions. However, to provide similar protection as the commercial sector programs, ENS may choose to consider different price floors for different measures in Instant Savings, based on their anticipated retail prices and the incremental equipment costs because customer contribution caps are rarely reached in the commercial sector programs, so the protection is rarely encountered.

CUSTOM PROGRAM SUMMARY FOR CURRENT AND RECOMMENDED ACTIVITIES

For the Custom Program, CLEAResult has the following recommendations:

General Principle	Current Activities	Recommended Activities
Understand Customer Motivation and Barriers for Participation	For the Custom Program, EfficiencyOne gains an understanding of customer motivations and barriers through: 1. Market Research; 2. Ongoing Program Management; 3. Program Benchmarking; and 4. Program Evaluation. <u>Market Research</u> In 2014, EfficiencyOne conducted research into the existing market barriers and consequentially the required support that businesses need to pursue energy efficiency options. This research indicated that financial support is critical for participation. For the New Construction component, customer surveys found that program implementation incentives of $1/square foot were insignificant compared to the total construction costs of $100-$200/square foot. Because of these surveys, ENS understood that financial incentives were not driving participation decisions, and that an educational incentive was more valuable in terms of energy modeling and commissioning expertise, in combination with giving customers access to financial incentives in Custom and through another program, the Business Energy Rebates. <u>Ongoing Program Management</u> Through general program management, EfficiencyOne has business development managers who are responsible for major customers. The business development managers are frequently in contact with customers. This direct customer communication and project payback documentation requirements provide key data points that EfficiencyOne uses	• Market research should continue to be conducted, especially for areas that are underperforming in terms of participation. • From the recommendations in the General Principles, the semi-annual surveys for commercial fluorescent technology, commercial LED technology, and commercial VFD technology can be used to help understand customer motivations and barriers. • ENS should continue its current program management, program benchmarking (required for new programs) and program evaluation activities to understand motivations and barriers for the large commercial and industrial sector. If possible, ENS should attempt to aggregate this research, and conduct segmentation analyses to develop a commercial sector market characterization.

	for incentive level setting and understanding customer motivation barriers. Through ongoing program management efforts, the limited uptake in the low cost financing offer indicates that direct financial support in the form of an incentive is more attractive, versus alleviating cash flow and capital purchasing concerns. For larger Custom Retrofit projects, EfficiencyOne has seen a 10 percent uptake on financing, indicating that some larger customers are sensitive to capital outlays and cash flow considerations. This level of uptake in financing has not been observed for smaller Custom projects or the residential sector. The small business sector has seen a significant uptake in financing in the past, Through the delivery of the Custom Compressed Air Optimization service, customers frequently identified that they were aware that their compressed air networks leaked, but they did not know how to assess the leaks or quantify the potential savings from optimization. EfficiencyOne introduced a new education incentive that provided technical assistance to customers to address these knowledge gaps. Customers were then offered an incentive to fix the leaks. The results from the educational incentive for leak fixing led to the deployment of low incentive costs for annual savings. <u>Program Benchmarking</u> When the Custom Retrofit program was designed in 2008, the initial incentive was designed using a $/kWh incentive rate based on a similar program by Manitoba Hydro. It was unknown what incentive level customers in Nova Scotia would respond to. Through program experience and discussions with customers, this incentive rate now sets a ceiling for individually negotiated incentives with each prospective program participant. <u>Program Evaluation</u> Through the annual program evaluation process, participant surveys are conducted to determine free ridership and spillover savings.	

Understand Technology Savings, Price and Market Penetration	For the Custom Program, EfficiencyOne gains an understanding of technology savings, price and penetration through ongoing program management. EfficiencyOne currently captures all technology savings and cost information through the feasibility study and/or project application process which are the best methods for obtaining this information, especially if it is supported by engineering calculations, technical due diligence and vendor invoices.	• Continue the current activities of collecting the energy savings and cost information through the feasibility studies and/or program application process. Due to the variability in operating hours in the commercial sector, this is important information for determining the energy savings. • The recommendations in the General Principles section should be implemented to support this program. This covers incentive level changes. • Additionally, EfficiencyOne should start tracking project type data so that it can be matched with the measure type to provide insight into general participation trends in participation, which will assist with analyzing market penetration. The semi-annual surveys for commercial fluorescent technology, commercial LED technology and commercial VFD technology can be used to complement the analysis of market penetration. • EfficiencyOne should engage the supply chain to gather insight into the types of projects they are expecting and any forecasted changes in costs or savings due to increased adoption or new efficiency options. This insight assists with market penetration analysis. The recommended supply chain engagement events in the General Principles section can be leveraged for this work. Below are two examples for large savings opportunities provided with Nova Scotia's market characteristics in mind: 1. Space cooling systems that feature direct expansion technology, either through incentives for purchasing efficient equipment or controllers, or for system maintenance. This analysis would assist with setting incentive levels for these measures. 2. Electric baseboard space heating systems especially for the installation of controls or with major renovation projects. This analysis would assist with setting incentive levels for these measures. • Finally, the incentive screening thresholds for program budget and cost effectiveness should be established on a per kWh basis for the Custom Program. It may be better to do this on a lifetime kWh basis, or account for energy savings persistence separately. Since the avoided costs are consistent amongst time periods in Nova Scotia, the incentive screening threshold (per kWh) is the same for any measure that has the same amount of energy savings persistence. These numbers should be calculated and updated every time the avoided costs are

		updated, consistent with the recommendations in the General Principles section.
Understand Supply Chain and Service Provider Considerations	For the Custom Program, EfficiencyOne gains an understanding of the supply chain and service provider considerations through: 1. Ongoing Program Management and 2. Program Evaluation. <u>Ongoing Program Management</u> Through the program management/account management process and the development of the different feasibility studies, EfficiencyOne's Business Development Managers regularly interact with the supply chain. <u>Program Evaluation</u> Through the annual program evaluation process, there are interviews conducted with select supply chain partners to understand their perspectives and suggestions for improvement.	• The current activities should be continued. • EfficiencyOne's should use its active program management and program evaluation processes to actively solicit insight from the supply chain and to support recommended market and technology research activities. • The major reason for continued engagement of the supply chain (beyond good program management) is to understand market penetration of the different technologies and to validate findings regarding customer motivations and barriers.
Understand Financial Impacts	For the Custom Program, EfficiencyOne gains an understanding of financial impacts through: 1. Individual Project Screening; 2. Ongoing Program Management; and 3. Program Evaluation. During the review of the project application, a TRC cost effectiveness analysis is conducted for each project to confirm eligibility. Due to ongoing program management (the individual negotiations of financial incentives), the budget impact is always being quantified from both a total financial impact and a unit cost perspective. During the program evaluation process, the energy savings assumptions and NTG ratios are reviewed and updated as required. These inputs affect the cost effectiveness impact.	CLEAResult recommends that: • The current activities should be continued. • The recommendations in the General Principles section should be implemented to support this program including incentive level changes. • The individual project screening for cost effectiveness should be expanded to include the PAC as well.

Other Considerations for the Custom Program

The Custom Program Retrofit incentive provides a level of flexibility that is best-in-class. Incentives are individually negotiated, based on four different parameters:

1. Capped at percentage of project costs;
2. Capped by simple payback;
3. Informed by incentive rate ($/kWh of first year savings); and
4. Capped at total dollar amount.

Through obtaining energy savings, project costs and required payback thresholds from the customer, the program has complete visibility into the potential financial implications of the incentive from the customer, the utility and society's perspective. This allows ENS to set an incentive that satisfies all three perspectives. Additionally, any costs for feasibility studies are included in the final incentive payment.

Current program data indicates that incentives are on average 20-25 percent of project costs, while they contribute to just under 60 percent of the program expenditure. Total program expenditure is averaging $0.10/kWh - $0.15/kWh, with a split between lighting and non-lighting projects that is beginning to skew towards non-lighting. The incentives typically result in a 2-3 year simple payback, though some institutions will accept a lower payback threshold.

In Nova Scotia, the avoided supply costs for energy do not differentiate the benefits derived associated with the time of the energy savings. This means there is not a cost effectiveness benefit (from energy savings) to promoting a diversity of measures in the portfolio. ENS should be encouraged to continue to promote more non-lighting measures to encourage portfolio diversity. The current incentive framework provides the flexibility to do so without changing any of the current parameters; this minimizes the impact of any such change.

Another issue to be aware of is being able to deal with participant and potential participant communication. Since the incentives are individually negotiated, there is the possibility for increased incentive costs due to information sharing and/or collusion. However, the current incentive framework caps protect against this risk. There is also the additional protection of the incentive contract containing a confidentiality clause regarding the amount of the incentive.

Finally, since the location of the energy savings are known, the consideration of local avoided costs with premium and discount zones can be applied to the Custom Program and can be used to influence the incentive negotiation. EfficiencyOne can implement these considerations once the local avoided costs are developed.

BUSINESS ENERGY REBATES CURRENT AND RECOMMENDED ACTIVITIES

For the Business Energy Rebates program, CLEAResult has the following recommendations:

General Principle	Current Activities	Recommended Activities
Understand Customer Motivation and Barriers for Participation	For the Business Energy Rebates Program, EfficiencyOne gains an understanding of customer motivations and barriers through: 1. Market Research; 2. Ongoing Program Management; 3. Program Benchmarking; and 4. Program Evaluation. <u>Market Research</u> In 2014, EfficiencyOne conducted research into the existing market barriers and, consequentially, the required support that businesses need to pursue energy efficiency options. This research indicated that financial support is critical for participation. <u>Ongoing Program Management</u> Through general program management, EfficiencyOne has a Business Development Manager that is dedicated to reaching out to participating distributors. Distributors can provide insight on the contractor and customer program experience. EfficiencyOne also has dedicated Application Coordinators for application support and approval in the program. They work with both the distributors in the midstream program and customers who access the downstream application process. Through these efforts, as well as the need for project invoices to be submitted, reference points are provided for what is acceptable in terms of an incentive, when understanding customer motivation and barriers. <u>Program Benchmarking</u> When the original program was designed, the incentives were based on a similar program that was offered for Efficiency Vermont, with adjustments made for different product pricing in the two jurisdictions. <u>Program Evaluation</u> Through the annual program evaluation process, participant surveys are conducted to determine free ridership and spillover savings. Through these surveys, their motivations and barriers are determined.	• Continue to conduct the market research, especially for areas where participation is underperforming. • From the recommendations in the General Principles, the semi-annual surveys for commercial fluorescent technology, commercial LED technology, and commercial VFD technology can be used to help to understand customer motivations and barriers. • Continue all current program management, program benchmarking (as required for new programs) and program evaluation activities to develop a clear understanding of motivations and barriers existing within the commercial and industrial sector. If possible, EfficiencyOne should aggregate this research, and conduct segmentation analyses to develop a commercial sector market characterization.

Understand Technology Savings, Price and Market Penetration	For the Business Energy Rebates program, EfficiencyOne gains an understanding of technology savings, price and penetration through: 1. Ongoing Program Management and 2. Program Evaluation. <u>Ongoing Program Management</u> EfficiencyOne currently captures technology savings and cost information through discussions with the manufacturers and distributors, as well as through the submission of project invoices, which confirm product pricing. <u>Program Evaluation</u> Through the annual program evaluation process, the energy savings assumptions are reviewed, and updated as required.	• Continue the current activities of engaging the supply chain and reviewing the project invoices to understand technology savings and pricing. • Investigate the potential to develop a method, beyond randomized audits, to document and understand the different operating hours for the program participants in the Instant Rebates stream because those hours are highly variable within the commercial sector. It is understood that a runtime analysis has been conducted recently. • Implement the recommendations in the General Principles section to support this program. Those recommendations include both incentive level changes and introduction of new measures. • EfficiencyOne should start to understand the technology penetration of the different products in the program. The semi-annual surveys for commercial fluorescent technology, commercial LED technology and commercial VFD technology can be used to complement the analysis of market penetration.
Understand Supply Chain and Service Provider Considerations	For the Business Energy Rebates program, EfficiencyOne gains an understanding of the supply chain and service provider considerations through: 1. Ongoing Program Management and 2. Program Evaluation. <u>Ongoing Program Management</u> Through the delivery of the program, EfficiencyOne interacts with the supply chain regularly through the Program Manager, Business Development Manager and Application Coordinators. <u>Program Evaluation</u> Through the annual program evaluation process, interviews are conducted with select supply chain partners to understand their perspectives and suggestions for improvement.	• EfficiencyOne should continue these current activities.
Understand Financial Impacts	For the Business Energy Rebates Program, EfficiencyOne gains an understanding of financial impacts through: 1. Ongoing Program Management and 2. Program Evaluation.	• EfficiencyOne should continue these current activities. • Implement the recommendations in the General Principles section to support this program. This covers both incentive level changes and introduction of new measures.

	Ongoing Program Management Due to ongoing program management, the costs of the products are always monitored. This monitoring allows the Program Manager to understand whether incentives are too high compared to the incremental cost, and whether the 50 percent financial cap is being reached. Program Evaluation During the program evaluation process, the energy savings assumptions and net-to-gross ratios are reviewed, and if required, they are updated. These inputs affect the cost effectiveness impact.	

Table 18: Business Energy Rebates Program Recommendations

Other Considerations for Business Energy Rebates Program

From reviewing program operations, the Business Energy Rebates program tracks retail pricing through the application process. This allows program managers to understand if incentive levels are too high compared to the retail prices, using the first type of incentive screening threshold, which is the cost to the customer. The program is forecast to have a high PAC, which assumes that the cost effectiveness threshold is not in danger of being breached due to incentives being too high. As long as there is continued active program tracking to monitor program budgets and the retail prices, the program should be effective in setting appropriate incentive levels. It is understood that similar to the retail program, customer/project information is not provided for the Instant Rebates stream. With this chosen program delivery structure, it will be difficult to include premium and discount zones to align with local avoided costs, when they are available.

HOME ENERGY ASSESSMENT CURRENT AND RECOMMENDED ACTIVITIES

For the Home Energy Assessment program, CLEAResult has the following recommendations:

General Principle	Current Activities	Recommended Activities
Understand Customer Motivation and Barriers for Participation	For the Home Energy Assessment Program, EfficiencyOne gains an understanding of customer motivations and barriers through the following activities: 1. Market Research; 2. Ongoing Program Management; 3. Program Benchmarking; and 4. Program Evaluation. <u>Market Research</u> EfficiencyOne conducted research with the participants in the Home Energy Assessment program. It was found that some customers were implementing a subset of recommended measures after receiving an audit report, although they did not complete a final audit to receive the incentives. The research found that the initial audit provided benefit to homeowners, and that it was the key to lowering unit costs for the program, through the tracking of the program-enabled/spillover savings. This was one of the factors that led to the decision to subsidize the audit incentive further. In 2014, EfficiencyOne commissioned research to identify the incentive levels and financing options required to encourage homeowners to make major efficiency upgrades (> $5,000). The research found that a 25 percent incentive would have a greater impact than interest-free financing. This is an example of a conjoint analysis, where different benefits of the program were evaluated to determine their individual contribution to value for the customer. EfficiencyOne conducted demographic research to understand the characteristics of the general population, program participants and non-participants. <u>Ongoing Program Management</u> Through general program management, EfficiencyOne frequently interacts with the service organizations and contractors to understand what customers are saying, and what are their motivations and barriers. Through these efforts as well as the need for project receipts to be submitted by participants, there can be a triangulation point for what is acceptable in terms of an incentive when understanding customer motivation and barriers. <u>Program Benchmarking</u> When the original program was designed, the incentives were based on a similar program offered by the Federal government. The rebates from the federal government were discontinued in 2012, with a corresponding reduction in participation. <u>Program Evaluation</u> Through the annual program evaluation process, participant surveys are conducted to determine free ridership and spillover savings. Through these surveys, their motivations and barriers are determined.	• It is recommended that market research continue to be conducted, especially for areas that are underperforming in terms of participation, either in terms of technology, demographic segments or geographical areas. • As per the recommendations in the General Principles, the semi-annual surveys for residential HVAC technology should be conducted to help understand customer motivations and barriers. • EfficiencyOne should continue all of the current activities with regards to ongoing program management, program benchmarking (as required for new measures) and program evaluation.

General Principle	Current Activities	Recommended Activities
Understand Technology Savings, Price and Market Penetration	For the Home Energy Assessment program, EfficiencyOne gains an understanding of technology savings, price and penetration through the following activities: 1. Ongoing Program Management and 2. Program Evaluation. <u>Ongoing Program Management</u> EfficiencyOne captures technology savings through the confirmation of the information in the final audit report. There are also frequent discussions with the service organizations that help support this analysis. <u>Program Evaluation</u> Annually, through the program evaluation process, the energy savings assumptions are reviewed, and updated as required.	• The current activities of engaging the Service Organizations and Natural Resources Canada to understand technology savings should be continued. • The recommendations in the General Principles section should be implemented to support this program. This covers both incentive level changes and introduction of new measures. • Additionally, EfficiencyOne should start to understand the technology penetration of the residential HVAC and building envelope technologies in the program. The Achievable Potential study indicates that Nova Scotia has a significant base of primary and secondary electric heating systems. As the technology mix changes due to the increased price of electricity and the decreased in costs of other options, the base case assumptions may change.
Understand Supply Chain and Service Provider Considerations	For the Home Energy Assessment program, EfficiencyOne gains an understanding of the supply chain and service provider considerations through the following activities: 1. Ongoing Program Management and 2. Program Evaluation. <u>Ongoing Program Management</u> Through the delivery of the program, EfficiencyOne interacts with the supply chain regularly through the discussions with the service organizations. <u>Program Evaluation</u> Through the annual program evaluation process, there are interviews conducted with select supply chain partners (Service Organizations) to understand their perspective, and suggestions for improvement.	• The current activities should be continued.

General Principle	Current Activities	Recommended Activities
Understand Financial Impacts	For the Home Energy Assessment program, EfficiencyOne gains an understanding of financial impacts through the following activities: 1. Program Evaluation. <u>Program Evaluation</u> During the program evaluation process, the energy savings assumptions and net-to-gross ratios are reviewed, and if required, they are updated. These inputs affect the cost effectiveness impact.	• The current activities should be continued. • The recommendations in the General Principles section should be implemented to support this program. This covers both incentive level changes and introduction of new measures.

Table 19: Home Energy Assessment Program Recommendations

Other Considerations for the Home Energy Assessment Program

The Home Energy Assessment program recently introduced an updated incentive structure, which featured an increased incentive for the initial audit, and premiums associated with bundling of incentives to encourage larger projects from participants. It will be of interest to see how these changes are received by customers, and whether there is an increase in participation and/or in savings. From the initial data that CLEAResult has received, it appears that the bundling approach is showing some promising results. The average savings realized per participating home have increased, with the unit cost for delivery decreasing. It is difficult to isolate the effects of bundling since there were changes implemented to both the audit and measure incentive amounts that were introduced at the same time.

It has been observed that bundling is an effective tactic in encouraging participation. Retailers frequently use bundling in their sales strategies to clear inventory. When applied to the energy efficiency program space, bundling may be a worthwhile tactic for programs where there is a significant resource expenditure for customer acquisition. This is because any increases in unit costs (when compared to an unbundled incentive offer) may be offset by generating the additional savings from the expenditure associated with customer acquisition. In short, if customer acquisition is a sunk cost, it may make sense to leverage as much as possible from that cost.

The provision of the personal energy planning services has helped customers understand their options and increased the savings from each project. Since delivery of the program is through the participating service organizations, and the project locations are clearly identified, there may be the opportunity to include premium and discount zones for incentives to align with local avoided costs.

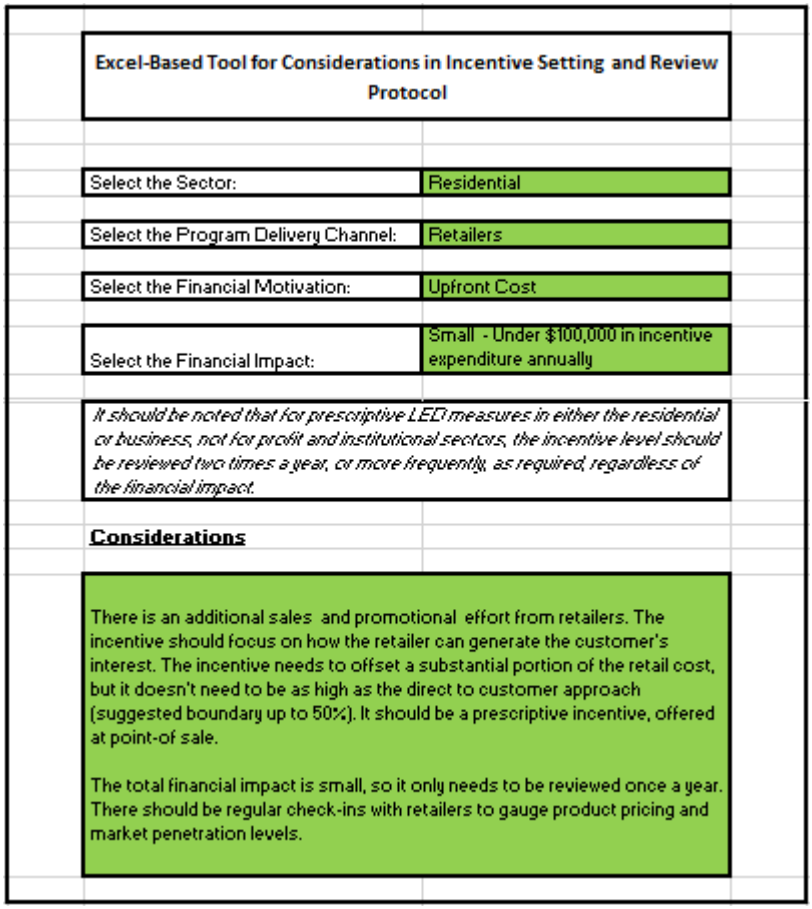
Incentive Level-Setting Excel-Based Tool for Review Protocol

To assist with determining incentive levels, CLEAResult has developed an Excel-based tool (which is provided as a separate file). The tool requires certain parameter inputs, and using those, provides a set of considerations that can be used in setting incentive levels. The considerations are not exhaustive, but they can provide a platform for the analysis. When combined with the general principles, incentive-setting process flow and the incentive documentation template, EfficiencyOne will have a set of recommendations and tools to assist with determining incentives. The tool does not provide any specific financial recommendations for incentives.

The input parameters for the tool are as follows:

- Sector
  - Residential
  - Business, Not for Profit and Institutional (Commercial) and Industrial
- Program Delivery Channel
  - Direct to Customer
  - Contractors
  - Retailers
  - Distributors
  - Other Vendors
- Financial Motivation for Participant
  - Upfront Cost
  - Payback
- Financial Impact
  - Small (under $100,000 in annual measure incentive expenditure)
  - Medium (between $100,000 - $400,000 in annual measure incentive expenditure)
  - Large (greater than $400,000 in annual measure incentive expenditure)

Once these parameters are selected, a set of considerations are provided that should be used in the incentive setting process.



Excel-Based Tool for Considerations in Incentive Setting and Review Protocol

Select the Sector:	Residential
Select the Program Delivery Channel:	Retailers
Select the Financial Motivation:	Upfront Cost
Select the Financial Impact:	Small - Under $100,000 in incentive expenditure annually

It should be noted that for prescriptive LED measures in either the residential or business, not for profit and institutional sectors, the incentive level should be reviewed two times a year, or more frequently, as required, regardless of the financial impact.

Considerations

There is an additional sales and promotional effort from retailers. The incentive should focus on how the retailer can generate the customer's interest. The incentive needs to offset a substantial portion of the retail cost, but it doesn't need to be as high as the direct to customer approach (suggested boundary up to 50%). It should be a prescriptive incentive, offered at point-of sale.

The total financial impact is small, so it only needs to be reviewed once a year. There should be regular check-ins with retailers to gauge product pricing and market penetration levels.

Figure 13: Excel-Based Tool for Review Protocol

It should be noted that for prescriptive LED measures in either the residential or business, not for profit and institutional sectors, the incentive level should be reviewed two times a year, or more frequently as required, regardless of the financial impact.

Program Financial Simulation Analysis

INSTANT SAVINGS PROGRAM FINANCIAL SIMULATION

For the Instant Savings Program, the program financial simulation analysis included the following six steps for each measure:

1. Identify the current (2015) participation and incentive level;
2. Determine the market penetration;
3. Determine an appropriate cost to customer incentive level threshold;
4. Determine an appropriate program budget incentive level threshold;
5. Determine an appropriate cost effectiveness incentive level threshold; and
6. Compare the current incentive level to the three thresholds to determine if a change was required

The following table includes the measure parameters obtained from EfficiencyOne:

Measure Parameters

Measure	Current Incentive Level ($)	2015 Participation	Incentive Expenditure*	Per Unit Net Energy Savings (kWh)**	Per Unit Net Peak Demand Savings (kW)***	Energy Savings Persistence (Years)
ENERGY STAR® LED A Lamp	$3.00	253,461	N/A	25.5	1.021	25
ENERGY STAR® LED Specialty Lamp	$5.00			25.5	1.021	25
ENERGY STAR® LED Recessed Downlight	$12.00	8,709	$104,508	51.9	0.072	16
ENERGY STAR® LED Fixture	$12.00	7,291	$87,492	151.8	0.175	13
Dimmer Switch	$4.00	6,430	$25,720	18.7	0.019	10
Indoor Motion Sensor	$5.00	439	$2,195	50.4	0.003	10
Motion Sensor with Dimmer Switch	$5.00	5	$25	59.0	0.000	10
Outdoor Motion Sensor	$5.00	569	$2,845	174.9	0.015	10
Power Bar with Timer	$5.00	71	$355	59.1	0.001	10
Smart Power Bar	$10.00	299	$2,990	59.2	0.003	10
Heavy-Duty Timer	$10.00	1,558	$15,580	134.2	0.033	10
Programmable Thermostat	$15.00	4,799	$71,985	243.1	0.185	11
Outdoor Clothesline	$5.00	1,448	$7,240	165.0	0.037	10

Table 20: Instant Savings Measure Parameters

Obtained from taking the current incentive multiplied by the 2015 participation. It does not account for any change in incentive levels in 2015.

Determined by adjusting the per unit gross energy savings for interactive effects, the NTG ratio and line losses.

*** Determined by adjusting the per unit gross demand savings for interactive effects, the NTG ratio and line losses.*

It should be noted that CLEAResult did not review the individual measure assumptions for the per unit energy and peak demand savings, and energy savings persistence.

Market Penetration

From reviewing the baseline study for the residential sector (a component of the DSM Potential Study[1]), and other data provided by EfficiencyOne, CLEAResult has developed the current estimates for market penetration of the measures. It should be noted that these are estimates only.

Measure	Estimated Market Penetration
ENERGY STAR® LED A Lamp	Low (under 30%)
ENERGY STAR® LED Specialty Lamp	Low (under 40%)
ENERGY STAR® LED Recessed Downlight	Low (under 30%)
ENERGY STAR® LED Fixture	Low (under 30%)
Dimmer Switch	Unknown
Indoor Motion Sensor	Unknown
Motion Sensor with Dimmer Switch	Unknown
Outdoor Motion Sensor	Unknown
Power Bar with Timer	Unknown
Smart Power Bar	Low (under 30%)
Heavy-Duty Timer	Unknown
Programmable Thermostat	Low (under 40%)
Outdoor Clothesline	High (over 50%)

*For the purposes of this analysis, the unknown market penetrations were assumed to be under “Low (under 40%)”. The incentive for outdoor clotheslines should be investigated, since their usage may already be standard practice in Nova Scotia.

Table 21: Market Penetration of Instant Savings Measures

[1] Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study – Navigant Consulting

Cost to Customer Incentive Level Threshold

As discussed in the Financial Impact Analysis section of the General Principles recommendations, a program that features residential customers making small purchases at retailers should use retail prices as the parameter for cost to customer. As per Table 22, CLEAResult suggests the cost to customer boundary should be 50 percent for this type of incentive.

EfficiencyOne conducted price sensitivity research in 2014. The results of that analysis were used in this exercise. It should be noted that EfficiencyOne should update these numbers internally with the information provided from ongoing program management activities, as the estimated 2016 retail prices for the measures will be more accurate.

Measure	2014 Retail Price	2014 PMI	2014 PME	Estimated 2016 Retail Price	2016 Cost to Consumer (Estimated 2016 Retail Price – Current Incentive)	Estimated 2016 PME*	Cost to Consumer Less than PME?	Current Incentive as % of Retail Price
ENERGY STAR® LED A Lamp	$15.00	$5.00	$13.50	$12.00	$9.00	$13.50	Yes	25%
ENERGY STAR® LED Specialty Lamp	$30.00	$7.00	$20.50	$25.00	$20.00	$20.50	Yes	20%
ENERGY STAR® LED Recessed Downlight	$45.00	$20.20	$44.30	$45.00	$33.00	$44.30	Yes	27%
ENERGY STAR® LED Fixture	Not Included	Not Included	Not Included	$45.00	$33.00	$44.30	Yes	27%
Dimmer Switch	$30.00	$7.00	$20.70	$25.00	$21.00	$20.70	No	16%
Indoor Motion Sensor	$24.00	$10.10	$28.80	$25.00	$20.00	$28.80	Yes	20%
Motion Sensor with Dimmer Switch	Not Included	Not Included	Not Included	$30.00	$25.00	$24.84	No	17%
Outdoor Motion Sensor	$24.00	$15.00	$35.10	$25.00	$20.00	$35.10	Yes	20%
Power Bar with Timer	Not Included	Not Included	Not Included	$20.00	$15.00	$18.00	Yes	25%
Smart Power Bar	$50.00	$15.60	$45.00	$50.00	$40.00	$45.00	Yes	20%
Heavy-Duty Timer	Not Included	Not Included	Not Included	$20.00	$10.00	$18.00	Yes	50%
Programmable Thermostat	$30.00	$11.75	$29.99	$30.00	$15.00	$29.99	Yes	50%
Outdoor Clothesline	Not Included	Not Included	Not Included	$20.00	$15.00	$20.00	Yes	25%

*The Estimated 2016 PME was based on the 2014 PME

Table 22: Cost to Customer Incentive Threshold for Instant Savings Measures

It appears that in terms of the customer cost incentive level threshold, all of the current incentives are suitable. The only two measures where the current customer cost is more than the PME are the dimmer switch and the motion sensor with dimmer switch. The PME's of both these measures are based on the analysis for the dimmer switch. It should also be noted that the difference between the customer cost and the PME for both of these measures is ≤two percent of the customer cost.

From reviewing the current incentive compared to the retail price, all of the current incentive levels fall within acceptable ranges of typical retail sales events (between 10-30 percent). The only three measures that do not are ENERGY STAR® A Lamps, Heavy-Duty Timers and Programmable Thermostats.

ENERGY STAR A Lamps have low market penetration and deliver the highest amount of savings for the Instant Savings program. It is advised that based on the cost to customer incentive level threshold, the incentive level does not change.

Programmable Thermostats have low market penetration, so the cost to customer incentive level threshold (50 percent) being reached is justified.

The market penetration of heavy duty timers is unknown. The cost to customer incentive level threshold is not breached at 50 percent, so the incentive can be justified based on this threshold.

Program Budget Incentive Level Threshold

As discussed in the Financial Impact Analysis section of the General Principles recommendations, a program that features residential customers making small purchases at retailers should use $/kWh for the program budget impact. As per 14, CLEAResult suggests the program budget boundary should be $0.50/kWh for this type of incentive. EfficiencyOne has a program budget of $0.26/kWh for this program. Based on historical expenditures, the costs for program administration have been between 20-30 percent of the total expenditure. Therefore, the incentive expenditure, on a $/kWh basis is as follows:

Parameter	Program Budget Incentive Level Threshold
Total Expenditure (Incentive + Program Administration)	$0.26/kWh
Incentive Expenditure (@ 30% Program Administration Expenditure)	$0.18/kWh
Incentive Expenditure (@ 20% Program Administration Expenditure)	$0.21/kWh

Table 23: Program Budget Incentive Level Threshold for Instant Savings Program

Each measure in the Instant Savings program has its associated program budget incentive level threshold listed below.

Measure	Current Incentive ($)	Per Unit Net Energy Savings (kWh)	Program Budget Incentive Level Threshold at 30% Program Administration Expenditure	Program Budget Incentive Level Threshold at 20% Program Administration Expenditure	Is Current Incentive Lower than Program Budget Incentive Level Threshold at 30% Program Administration Expenditure
ENERGY STAR® LED A Lamp	$3.00	25.5	$4.59	$5.35	Yes
ENERGY STAR® LED Specialty Lamp	$5.00	25.5	$4.59	$5.35	No
ENERGY STAR® LED Recessed Downlight	$12.00	51.9	$9.35	$10.91	No
ENERGY STAR® LED Fixture	$12.00	151.8	$27.33	$31.88	Yes
Dimmer Switch	$4.00	18.7	$3.37	$3.93	No
Indoor Motion Sensor	$5.00	50.4	$9.07	$10.58	Yes
Motion Sensor with Dimmer Switch	$5.00	59.0	$10.61	$12.38	Yes
Outdoor Motion Sensor	$5.00	174.9	$31.48	36.73	Yes
Power Bar with Timer	$5.00	59.1	$10.63	$12.40	Yes
Smart Power Bar	$10.00	59.2	$10.65	$12.43	Yes
Heavy-Duty Timer	$10.00	134.2	$24.16	$28.18	Yes
Programmable Thermostat	$15.00	243.1	$43.76	$51.05	Yes
Outdoor Clothesline	$5.00	165.0	$29.70	$34.65	Yes

Table 24: Program Budget Incentive Level Threshold for Instant Savings Measures

It appears that in terms of the program budget incentive level threshold, the majority of the current incentives are suitable. The only three measures that breach the program budget incentive level threshold are the ENERGY STAR specialty lamp, ENERGY STAR recessed downlight and the dimmer switch.

The current incentive for the ENERGY STAR specialty lamp is 9 percent higher than the program budget incentive level threshold (assuming a 30 percent program administration expenditure). It means a reduction of $0.41 from the current incentive of $5.00 to meet the threshold. The current incentive for the ENERGY STAR recessed downlight is 30 percent higher than the program budget incentive level threshold (assuming a 30 percent program administration expenditure). It means a reduction of $2.65 from the current incentive of $12.00 to meet the threshold.

The current incentive for dimmer switches is 20 percent higher than level threshold (assuming a 30 percent program administration expenditure). It means a reduction of $0.63 from the current incentive of $4.00 to meet the threshold.

It should be noted that EfficiencyOne has a program budget expenditure limit of $0.26/kWh. This is applied at the program level, which allows “less expensive budget impact” measures to subsidize “more expensive budget impact” measures.

Cost Effectiveness Incentive Level Threshold

EfficiencyOne has a PAC target of 1.9 for this program. For the calculation, it is assumed that program administration costs are 30 percent of total expenditure, which leaves the incentive costs at 70 percent of expenditure. Therefore the program administration expenditure is 43 percent of the incentive expenditure. This ratio can allow the PAC target to be adjusted to only include the incentive expenditure.

Alternatively, the program administration costs can be determined for each measure, and included in the cost effectiveness calculations. If this is done, the PAC threshold remains at 1.9.

To model PAC cost effectiveness for each individual measure, CLEAResult developed a simplified cost effectiveness calculator that makes several assumptions that aren't accurate in detailed cost effectiveness calculations as discussed, it is recommended that EfficiencyOne develop a cost effectiveness calculator for incentive level setting, and broader short-term program design purposes.

Measure	PAC of Current Incentive Level (including Program Administration Costs)	Is PAC of Current Incentive Greater than Cost Effectiveness Incentive Level Threshold (including Program Administration Costs)
ENERGY STAR® LED A Lamp	506.49	Yes
ENERGY STAR® LED Specialty Lamp	303.92	Yes
ENERGY STAR® LED Recessed Downlight	9.17	Yes
ENERGY STAR® LED Fixture	20.04	Yes
Dimmer Switch	5.32	Yes
Indoor Motion Sensor	4.10	Yes
Motion Sensor with Dimmer Switch	4.19	Yes
Outdoor Motion Sensor	14.84	Yes
Power Bar with Timer	4.37	Yes
Smart Power Bar	2.36	Yes
Heavy-Duty Timer	7.35	Yes
Programmable Thermostat	16.81	Yes
Outdoor Clothesline	17.57	Yes

Table 25: Cost Effectiveness Incentive Level Threshold for Instant Savings Measures

For all of the measures, the cost effectiveness incentive level threshold is not breached.

Comparison of Current Incentive to Incentive Level Thresholds

Measure	Current Incentive	Cost to Customer Threshold Exceeded?	Program Budget Threshold Exceeded?	Cost Effectiveness Threshold Exceeded?
ENERGY STAR® LED A Lamp	$3.00	No	No	No
ENERGY STAR® LED Specialty Lamp	$5.00	No	Yes	No
ENERGY STAR® LED Recessed Downlight	$12.00	No	Yes	No
ENERGY STAR® LED Fixture	$12.00	No	No	No
Dimmer Switch	$4.00	No	Yes	No
Indoor Motion Sensor	$5.00	No	No	No
Motion Sensor with Dimmer Switch	$5.00	No	No	No
Outdoor Motion Sensor	$5.00	No	No	No
Power Bar with Timer	$5.00	No	No	No
Smart Power Bar	$10.00	No	No	No
Heavy-Duty Timer	$10.00	Yes	No	No
Programmable Thermostat	$15.00	Yes	No	No
Outdoor Clothesline	$5.00	No	No	No

Table 26: Comparison of Current Incentive to Incentive Level Thresholds for Instant Savings Measures

Based on the comparison of the suggested incentive levels, it is proposed that all of the measures maintain their current incentive levels, except for programmable thermostats, heavy duty timers and outdoor clotheslines. These measures warrant further analysis.

Even though programmable thermostats have an incentive of 50 percent of their retail price, their low market penetration and high per unit energy savings make them important for future program success, especially when considering Nova Scotia's base of primary electric heating systems. Therefore, for market penetration and savings potential reasons, this incentive does not need to be updated at the moment.

For heavy-duty timers, the current incentives fall comfortably within the program budget and cost effectiveness incentive level thresholds. It is recommended that the input parameters for this analysis be confirmed, especially their market penetration. There may be an opportunity to reduce the incentive. For example, in Ontario, the incentive is only $4.00 for heavy-duty timers.

For outdoor clotheslines, while the suggested boundaries of the three incentive screening thresholds are not breached, it appears their market penetration is high, and their usage may be standard practice in Nova Scotia. Therefore, it is appropriate to consider reducing the incentive, or removing it since it may be in the early majority or late majority stage of market transformation as indicated by the Technology Adoption Curve.

CUSTOM PROGRAM FINANCIAL SIMULATION

For the Custom Program Retrofit track, the program financial simulation analysis included the following steps:

1. Identify the average project parameters for the analysis;
2. Determine an appropriate cost to customer incentive level threshold;
3. Determine an appropriate program budget incentive level threshold;
4. Determine an appropriate cost effectiveness incentive level threshold; and
5. Compare the current incentive level to the three thresholds to determine if a change was required

Identification of Parameters for Average Custom Retrofit Project

The parameters for an average Custom Retrofit project were provided by EfficiencyOne. To provide multiple options for modelling, three different measure archetypes were selected, each with varying degrees of energy savings persistence that are commonly seen in large custom projects. The energy savings persistence will only affect the cost effectiveness incentive level threshold. It should be noted that since an average measure archetype is used, CLEAResult can only comment on average project incentives, and not specific project incentives.

Measure	Average Gross Energy Savings per Project (MWh)	Average Gross Peak Demand Savings per Project (kW)	NTG	Average Net Energy Savings per Project (MWh)	Average Net Peak Demand Savings per Project (kW)	Energy Savings Persistence	Average Project Incentive ($)
Custom Project Retrofit Track	230.75	17.92	92%	212.29	16.49	10	$24,106
Custom Project Retrofit Track	230.75	17.92	92%	212.29	16.49	15	$24,106
Custom Project Retrofit Track	230.75	17.92	92%	212.29	16.49	20	$24,106

Table 27: Parameters for Average Custom Retrofit Project

Cost to Customer Incentive Level Threshold

As discussed in the Financial Impact Analysis section of the General Principles recommendations, a program that features commercial customers making either large capital equipment purchases or large project purchases should use the incremental cost or the project cost respectively, as well as simple project payback for the cost to customer. As per Tables 13 and 14, CLEAResult suggests the cost to customer boundary should be 50 percent of the project cost and no less than a one year simple project payback for this type of incentive. These are suggested boundaries for the incentive level, and the actual incentives will usually be much lower.

Measure	Project Cost ($)	Simple Project Payback	Current Cost to Customer	Cost to Customer Threshold	
Custom Project Retrofit Track	$96,424	4 years	25%	50%	2 years

Table 28: Cost to Customer Incentive Level Threshold for Average Project in Custom Retrofit

The cost to customer threshold is not breached for either the project cost or the simple payback period.

It is recommended that EfficiencyOne start determining incremental costs for each project, so that parameter can be analyzed as well.

Program Budget Incentive Level Threshold

As discussed in the Financial Impact Analysis section of the General Principles recommendations, a program that features commercial and industrial customers making either large capital equipment purchases or large project purchases should use $/kWh and total incentive for the program budget threshold. As per Table 14, CLEAResult suggests the program incentive budget boundary should be $0.25/kWh and $500,000 for this type of incentive.

For the 2016 Custom Program, EfficiencyOne has a total expenditure limit of $0.20/kWh, so these numbers will be used instead of $0.25/kWh in evaluating the appropriateness of incentives. The program budget incentive threshold is not exceeded for the average custom retrofit project.

Measure	Program Budget Incentive Threshold	Current Program Budget Incentive
Custom Project Retrofit Track	$25,475	$24,106

Table 29: Program Budget Incentive Level Threshold for Average Project in Custom Retrofit

Cost Effectiveness Incentive Level Threshold

EfficiencyOne has a PAC target of 4.9 for this program. For the calculation, it is assumed that program administration costs are 40 percent of total expenditure, which leaves the incentive costs at 60 percent of expenditure. Therefore the program administration expenditure is 67 percent of incentive expenditure.

Measure	Energy Savings Persistence	Cost Effectiveness Threshold
Custom Project Retrofit Track	10	3.14
Custom Project Retrofit Track	15	4.50
Custom Project Retrofit Track	20	5.69

Table 30: Cost Effectiveness Incentive Level Threshold for Average Project in Custom Retrofit

As can be seen from the above analysis, the PAC is greater than 4.9 for measures that have an energy savings persistence greater than 15 years. The break-even point at current incentive and program administration cost targets is an energy savings persistence between 16-17 years. When evaluating individual project incentives, EfficiencyOne should take into consideration the energy savings persistence of the project.

Comparison of Current Incentive Level to Incentive Level Thresholds

Measure	Cost to Customer Incentive Level Threshold Exceeded?	Program Budget Incentive Level Threshold Exceeded?	Cost Effectiveness Incentive Level Threshold Exceeded?
Custom Project Retrofit Track	No	No	No

Table 31: Comparison of Current Incentive Level to Incentive Level Thresholds for Average Project in Custom Retrofit

The Custom Program has appropriate incentive levels for the average project.

A key consideration for EfficiencyOne is to start tracking incremental costs so that the cost to customer can be fully understood. The incremental costs are different than the project costs, and play more of a factor in equipment replacement decisions, versus new purchase,

The program budget incentive level threshold is not exceeded.

Finally, for projects where the energy savings persistence is less than 17 years, consideration should be given to potentially decreasing the incentive. An energy savings persistence between 16-17 years is the break-even point for the target cost effectiveness threshold.

Appendix A – Jurisdictional Scans

JURISDICTIONAL SCANS - GENERAL OBSERVATIONS

Jurisdiction	Peak Load (MW) or Annual Consumption (Therms)	Population Served	Types of Electricity Generation
Nova Scotia (ENS)	2,124 MW	≈950,000	Coal, Renewables, Natural Gas
Ontario Electricity	27,005 MW	≈13.8 million	Nuclear, Natural Gas, Hydroelectric
Union Gas	N/A	N/A	-
British Columbia (BC Hydro)	11,681 MW	>4.4 million	Hydroelectric, Thermal, Diesel-Generation
California (PG&E)			
Energy Trust of Oregon - Oregon			Coal, Hydroelectric, Natural Gas, Nuclear, Wind, Solar, Wood
Energy Trust of Oregon - Washington			
New York (ConEd)	12,316 MW	>9,000,000	Nuclear, Natural Gas, Hydroelectric, Other Renewables, Coal, Petroleum-Fired
New York (NYSERDA)			
Vermont (Efficiency Vermont)	1,255 MW*	≈500,000	Nuclear, Hydroelectric
Maine (Efficiency Maine)	1,863 MW*	1.33 million	Renewable, Hydroelectric, Natural Gas, Coal, Petroleum-Fired
Massachusetts (National Grid)	13,128 MW*	≈1.1 million	Natural Gas, Nuclear

*Peak for all of state

Table 32: Jurisdiction Overview

Jurisdiction	Current Framework Period	Annual Savings Target*	Annual Budget* ($ million)	% Incentive	Unit Cost of Savings Target	Target per Retail Sales	Residential Retail Rates
Nova Scotia (ENS)	2016-2018	135.3 GWh	$34.05	≈70%	$0.25/kWh	1.3%	$0.148/kWh
Ontario Electricity	2015-2020	1,450 GWh	$366.67	N/A	$0.25/kWh	1.3%	$0.10-$0.12/kWh
Union Gas	2015-2020	211,791,091 m3 (Cumulative Cubic Meters)	$51.05	N/A	$0.24/m3		$0.1069/m3
British Columbia (BC Hydro)	2007-2020	884 GWh	N/A	N/A	N/A	N/A	$0.10-$0.12/kWh
California (PG&E)	2016+ Rolling Portfolio	593 GWh	$365.1M	81%	$0.43/kWh	1%	$0.1625/kWh
Energy Trust of Oregon - Electricity	2015-2020	55.1 aMW	$141.3M	65%	N/A	N/A	$0.1109-$0.1137/kWh

Jurisdiction	Current Framework Period	Annual Savings Target*	Annual Budget* ($ million)	% Incentive	Unit Cost of Savings Target	Target per Retail Sales	Residential Retail Rates
Energy Trust of Oregon – Gas	2015-2020	6 MMTh	$26.3M		$4.38/Therm	N/A	10.59 - 11.72 $/Mcf
New York (ConEd)	2009-2015 (EEPS) 2012-2015 (EEPS II)	163.56 GWh (EEPS) ***Average	$78.25 (EEPS) $84.23 (EEPS II) ***Average		$0.48/kWh	≈1%	$0.2885/kWh
New York (NYSERDA)						≈1%	$0.2005/kWh
Vermont	2015-2017	107.27 GWh	$43.43	55%	$0.40/kWh	2%	$0.125-$0.195/kWh
Maine (Efficiency Maine)	2014-2016	136.03 GWh (Base) 191.43 GWh (MACE Low Cost)** 191.43 GWh (MACE High Cost) 54,057.3 Dth (Base) 118,016 Dth (MACE) ***Average	$26.87 (Electric Base) $58.04 (Electric MACE Low Cost) $67.03 (Electric MACE High Cost) $0.529 (Gas Base) $1.18 (Gas MACE) ***Average		$0.20/kWh (Electric Base) $0.30/kWh (MACE Low Cost) $0.35/kWh (MACE High Cost) $9.79/Dth (Base) $10.00/Dth (MACE)		$0.1567/kWh
Massachusetts/ National Grid	2016-2018	646.33	$299.20	80%	$0.46/kWh	2.94%	$0.165-$0.185/kWh

*Annual savings targets and budgets may be presented based on calculation of averages

Table 33: **Jurisdiction Savings Targets and Budgets**

APPENDIX A-1: ONTARIO ELECTRICITY

SUMMARY

Jurisdictional Scan	
State/Province	Ontario
Utility/Agency	Independent Electricity System Operator (IESO)
Fuel	Electricity
Key Contact/Interviewee	Evelyn Lundhild
Consultant	Mayuran Srikantha

JURISDICTION OVERVIEW

Electricity Market

The following entities are the key players in the electricity system in Ontario.

- Ontario Government - Ministry of Energy
- Ontario Energy Board (OEB)
- Independent Electricity System Operator (IESO)
- 72 Local Distribution Companies (LDCs)

The Ministry of Energy sets policy for the electricity sector, and is able to provide the IESO and the OEB with direction through the use of ministerial directives. Through these directives, the IESO received guidance to develop the 2015-2020 Conservation First Framework in collaboration with the 72 LDCs.

The OEB is responsible for providing oversight and regulating the LDCs and natural gas utilities in Ontario. As such, the OEB reviews the LDCs rate applications. Conservation activity is funded separately through the IESO, and is (generally) independent of the rate setting process. Previously, from 2011-2014, participation and performance in Conservation programs were mandatory as a condition of license. This condition has been relaxed slightly since all conservation activities for LDCs are now reviewed and approved by the IESO, but there are still some conservation performance specifications in their distribution licenses.

The IESO has four major roles with regards to the electricity system in Ontario:

1. Operates the real time and day ahead markets
2. Contracts with electricity generators for long-term supply
3. Coordinates the long-term electricity system planning process
4. Provides oversight for Ontario's electricity conservation efforts

With regards to the oversight of electricity conservation efforts, the IESO is responsible for setting individual LDC savings targets and budgets, approving their conservation (CDM) plans, ensuring consistency (where possible) with regards to incentives and program delivery for customers across Ontario, managing the EM&V process, providing innovation funding for both the private sector and LDCs to leverage, and for managing the reporting and financial settlement process with LDCs.

Electric Utilities

Ontario has 72 electric utilities (LDCs). The majority of them are municipally owned, but there are a few investor-owned utilities that operate in Ontario. For conservation and efficiency program purposes, they all follow the same guidelines, regardless of ownership structure.

The LDCs range in size. The two largest LDCs are Toronto Hydro and Hydro One, both with over 500,000 customers. In comparison, Atikokan Hydro, one of the smallest LDCs, has just over 1,600 customers.

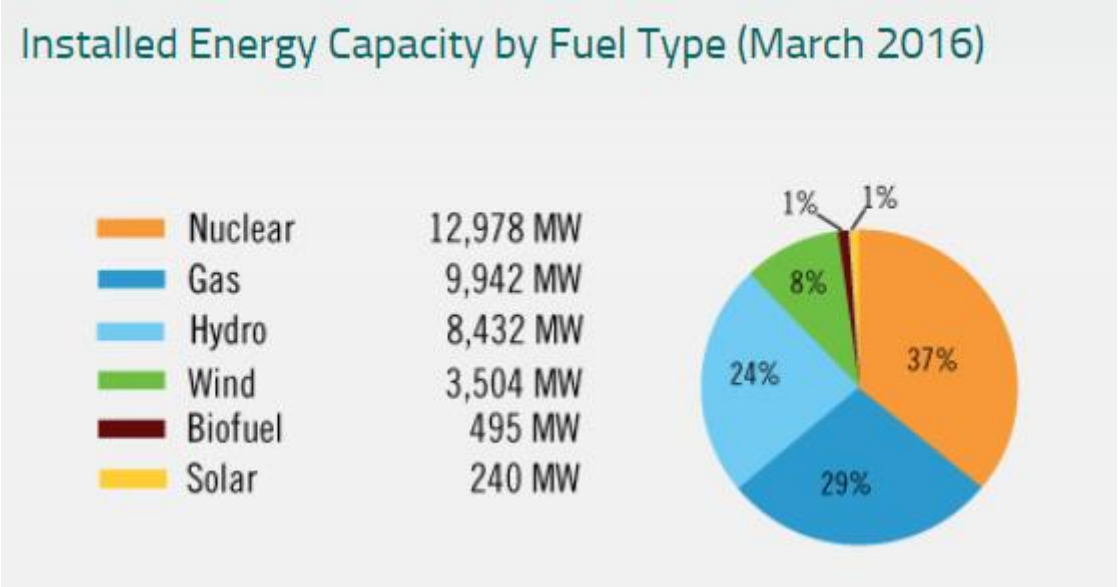
Electricity Generation

Ontario is a summer peaking province, with a peak load of 27,005 MW, which was recorded in August, 2006. Last year, the summer peak was over 22,000 MW. Some LDCs in Ontario are winter peaking.

In 2015, total electricity consumption was 114 TWh, with the sectors having the following individual consumptions:

- Residential: 45 TWh (39%)
- Commercial: 50 TWh (44%)
- Industrial: 19 TWh (17%)

Ontario's supply mix is as follows[1]:



ONTARIO ENERGY EFFICIENCY PROGRAM INCENTIVE AND COST EFFECTIVENESS POLICY

Conservation programs being delivered provincially though the IESO (formerly the OPA) started in 2006, through the delivery of third tranche programs by specific LDCs. Starting in 2007, certain programs began to be offered province-wide such as instant rebates for efficient products at participating retailers (then known as "Every Kilowatt Counts"), an appliance retirement program ("The Great Refrigerator Round up") and a business incentive program delivered through multiple partners ("ERIP", "BOMA", "MEER").

Cost Effectiveness Testing

In their conservation (CDM) plans, LDCs need to show portfolio cost effectiveness (TRC and PAC) if they are offering province-wide programs. If LDCs are offering local programs (only for their territory), those programs need to show program-level cost effectiveness. The only exception is the program to support the low-income sector which can have a TRC of 0.7. The TRC does include societal benefits, so it could be considered an SCT.

The IESO is responsible for maintaining cost effectiveness, both from a TRC and PAC perspective, for the programs province-wide and the entire portfolio.

[1] http://www.ieso.ca/Pages/Power-Data/Supply.aspx

Avoided Costs

For electricity, the major categories of benefit are:

- Avoided Capacity Costs
- Avoided Energy Costs
- Transmission and Distribution Costs
- 15% Adder for additional societal benefits
    - Environmental benefits
    - Employment benefits
    - Other societal benefits

ONTARIO (IESO) –OVERVIEW

Ontario Facts

Ontario covers a land area of 917,741 square kilometers. It has a population of just under 13.8 million people, which is almost 40 percent of Canada's entire population.

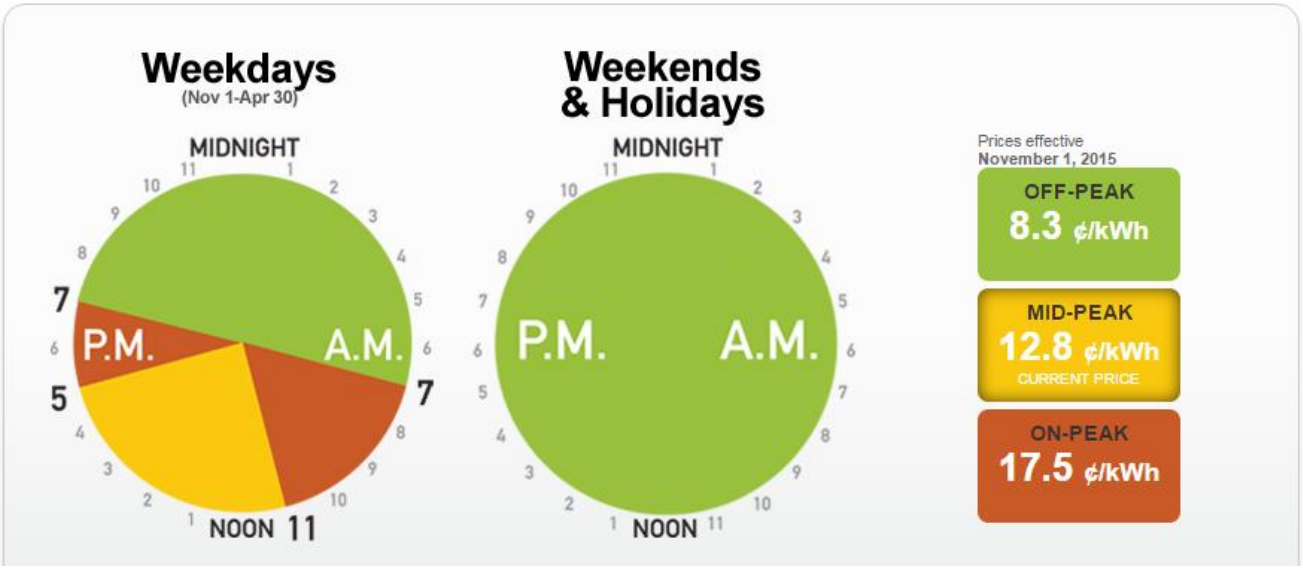
Customer Class Breakdown

In Ontario, there are 4,988,859 total electricity customers. The customers are broken down as follows:

- Residential Accounts: 4,502,650
- GS < 50 kW: 430,842
- GS >= 50 kW: 54,688
- GS > 5 MW: 117

Retail Prices of Electricity

In Ontario, the average retail price of electricity averages between $0.10-$0.13/kWh all-in for a customer's bill. Ontario is on time-of-use rates, with the following pricing structure for the winter period (November 1 – April 30)[2]:



All weekends and holidays are considered off-peak. For the winter period, the on-peak period for pricing coincides with the system peak which occurs in the early morning and evening when the space heating load is highest.

[2] http://www.ontarioenergyboard.ca/OEB/Consumers/Electricity/Electricity+Prices

In the summer period, the on-peak period for pricing occurs in the afternoon, which also coincides with the system peak, which is driven by space cooling load.

ONTARIO - ENERGY EFFICIENCY PROGRAMMING

Previous Results (Savings, Expenditure, Cost Effectiveness)

Before the current Conservation First Framework (CFF, 2015-2020), Ontario's previous cycle for efficiency programs was from 2011-2014. The following results are summarized for that period[3]:

Program	Net Savings (GWh)	Expenditure
Appliance Retirement	58	Not available
Retailer Coupons	280	Not available
Heating & Cooling Incentive	174	Not available
Home Assistance Program	55	Not available
Other Residential Programs	5	Not available
Total Residential Programs	572	Not available
Retrofit	1,527	Not available
Small Business Lighting	289	Not available
Audit	76	Not available
Process & Systems Upgrade	81	Not available
High Performance New Construction	47	Not available
Energy Managers	117	Not available
Industrial Accelerator Program	69	Not available
Other Business Programs	540	Not available
Total Business Programs	2,746	Not available

Program	TRC	PAC
Consumer	1.3	1.6
Low Income	0.6	0.6
Aboriginal	1.1	1.1
Business	1.3	2.8
Industrial	0.9	1.3
Non-LDC Demand Response	1.6	1.1
Non-LDC Industrial	0.6	0.5

[3] 2011-2014 Conservation Results: http://www.ieso.ca/Documents/2011-2014_Conservation_Results_Report.pdf

Highlights from the results include:

- Retrofit program delivered 46 percent of portfolio savings
- Over 9.9 million energy efficient products incentivized through participating retailers
- Portfolio LUEC: $37/MWh
- Portfolio TRC: 1.2
- Portfolio PAC: 2.1

FUTURE TARGETS

The Conservation First Framework covers the time period from 2015-2020. The province-wide budget for the six years is $2.2 billion, of which LDCs are provided with $1.8 billion. The IESO retains some funds for central services and coordinated program delivery.

For the 2015-2020 period, the total Ontario target is 8.7 TWh. The LDCs have a combined target of 7 TWh. On an annual basis, the total savings target for Ontario is 1.3 percent of sales.

Each LDC is required to complete a CDM plan, which must meet all required cost effectiveness requirements, as well as align with their provided budget and target. A summary table of each LDC's savings targets and budgets is provided below:

LDC Name	Target (GWh)	Budget
Algoma Power Inc.	7.5	$2,107,963
Atikokan Hydro Inc.	1.1	$311,330
Attawapiskat Power Corporation	0.5	$148,832
Bluewater Power Distribution Corporation	62.4	$15,838,687
Brant County Power Inc.	16.0	$4,109,140
Brantford Power Inc.	54.3	$14,048,458
Burlington Hydro Inc.	99.0	$25,825,521
Cambridge and North Dumfries Hydro Inc.	85.0	$21,763,931
Canadian Niagara Power Inc.	28.5	$7,355,555
Centre Wellington Hydro Ltd.	8.7	$2,252,724
Chapleau Public Utilities Corporation	1.0	$298,764
COLLUS PowerStream Corp.	16.9	$4,446,841
Cooperative Hydro Embrun Inc.	1.8	$525,743
E.L.K. Energy Inc.	16.2	$4,273,057
Enersource Hydro Mississauga Inc.	483.3	$122,499,403
Entegrus Powerlines Inc.	56.8	$14,695,867
EnWin Utilities Ltd.	151.3	$38,421,929
Erie Thames Powerlines Corporation	27.6	$7,104,954
Espanola Regional Hydro Distribution Corporation	2.4	$685,489
Essex Powerlines Corporation	31.4	$8,532,573
Festival Hydro Inc.	34.7	$8,768,149
Fort Frances Power Corporation	4.0	$1,109,758
Fort Albany Power Corporation	0.3	$98,990
Greater Sudbury Hydro Inc.	34.7	$9,672,498
Grimsby Power Incorporated	10.9	$2,894,613
Guelph Hydro Electric Systems Inc.	99.0	$24,920,625
Haldimand County Hydro Inc.	19.9	$5,410,280

Halton Hills Hydro Inc.	30.9	$8,387,497
Hearst Power Distribution Company Limited	3.2	$843,903
Horizon Utilities Corporation	330.7	$84,830,304
Hydro 2000 Inc.	1.4	$394,750
Hydro Hawkesbury Inc.	7.9	$2,139,160
Hydro One Brampton Networks Inc.	255.2	$66,798,531
Hydro One Networks Inc.	1,159.0	$321,989,874
Hydro Ottawa Limited	394.5	$105,242,155
Innisfil Hydro Distribution Systems Limited	13.0	$3,680,241
Kenora Hydro Electric Corporation Ltd.	5.3	$1,407,448
Kashechewan Power Corporation	0.5	$155,966
Kingston Hydro Corporation	34.5	$8,674,286
Kitchener-Wilmot Hydro Inc.	105.7	$27,710,719
Lakefront Utilities Inc.	12.2	$3,077,834
Lakeland Power Distribution Ltd.	11.3	$2,970,479
London Hydro Inc.	196.7	$51,192,690
Midland Power Utility Corporation	10.8	$2,739,690
Milton Hydro Distribution Inc.	45.4	$11,911,927
Newmarket-Tay Power Distribution Ltd.	36.2	$9,649,555
Niagara Peninsula Energy Inc.	74.4	$19,056,865
Niagara-on-the-Lake Hydro Inc.	11.7	$2,993,633
Norfolk Power Distribution Inc.	18.9	$5,056,939
North Bay Hydro Distribution Limited	20.3	$5,545,424
Northern Ontario Wires Inc.	4.3	$1,174,934
Oakville Hydro Electricity Distribution Inc.	92.4	$24,575,982
Orangeville Hydro Limited	14.1	$3,705,603
Orillia Power Distribution Corporation	16.6	$4,318,856
Oshawa PUC Networks Inc.	73.0	$19,963,922
Ottawa River Power Corporation	8.7	$2,282,373
Parry Sound Power Corporation	4.5	$1,171,912
Peterborough Distribution Incorporated	37.9	$9,781,455
PowerStream Inc.	535.4	$140,696,240
PUC Distribution Inc.	26.4	$7,440,107
Renfrew Hydro Inc.	4.2	$1,070,574
Rideau St. Lawrence Distribution Inc.	5.0	$1,306,239
Sioux Lookout Hydro Inc.	3.7	$1,016,095
St. Thomas Energy Inc.	17.5	$4,643,532
Thunder Bay Hydro Electricity Distribution Inc.	48.4	$12,927,445
Tillsonburg Hydro Inc.	11.3	$2,881,461
Toronto Hydro-Electric System Limited	1,576.1	$400,296,506
Veridian Connections Inc.	153.0	$40,482,340
Wasaga Distribution Inc.	6.3	$1,814,647
Waterloo North Hydro Inc.	82.4	$21,192,868
Welland Hydro-Electric System Corp.	25.5	$6,584,437
Wellington North Power Inc.	5.9	$1,493,412

West Coast Huron Energy Inc.	8.1	$2,012,404
Westario Power Inc.	23.0	$6,101,269
Whitby Hydro Electric Corporation	58.4	$15,860,460
Woodstock Hydro Services Inc.	23.0	$5,898,316
Ontario LDCs	7,000.0	1,835,264,930.7

INCENTIVE LEVEL SETTING METHODOLOGY

While Ontario does not have a documented incentive level setting methodology, a formal process has been established for all potential program changes and new program proposals. This process covers incentive level changes. All proposed changes and new programs must follow a business case development, review and approval process. Individual LDCs, groups of LDCs, or the official LDC-IESO working groups that oversee program design and delivery can all decide to explore a potential incentive change. The change must get general buy-in from the LDC community and approval from the IESO to proceed to business case development. During the business case development process for an incentive level change, the following considerations have to be addressed:

- Technology Costs
- Technology Savings
- Current and Future Technology Penetration
- Market Structure and Delivery Strategy
- Market Research for Customer and Supply Chain Insight
- Historical Participation and Program Evaluation Insight
- Financial Impact
- Cost Effectiveness Impact
- Program Operations Impact including changes to processes, documents and implementation considerations

The business case, once developed, is reviewed by the relevant LDC-IESO working groups, as well as internal IESO management. The ultimate approval and authorization to proceed is provided by the IESO.

The IESO and the LDCs conduct several activities that support the incentive level setting process:

- Standing market research surveys with residential customers and businesses
- Specific market research projects that assist with incentive level development
- Ongoing channel engagement with key supply chain actors
- Rigorous annual program evaluations that cover both impact and process evaluations
- Ongoing technology and measure research to update the Measures & Assumptions (M&A) list
- Best-practice research from other jurisdictions

The insight, analysis and recommendations from these activities are all inputs into the incentive setting process.

Often, incentive levels are reviewed during the program evaluation or program design process. Program evaluation occurs annually, while program design addresses a gap in the market place or in response to an issue. Ontario does not currently prescribe a frequency for incentive level review for the different programs, but certain programs and delivery strategies have natural review cycles. For example, the retailer program incentive levels are reviewed each year and before each campaign. A key market structure insight to consider is that retailers need six to eight months advance notice for incentive level changes, so analysis and recommendations have to be conducted with this structural issue in mind.

Recently, the Retrofit program approved new incentive levels for the prescriptive lighting track. This process involved reviewing historical participation information; calibrating what the incentive level change would mean for those historical

participants; and analyzing what future impacts would be on uptake, the budget and cost effectiveness based on current and future participation trends.

ONTARIO CORE PROGRAM OFFERINGS (RESIDENTIAL AND BUSINESS)

Currently, the conservation programs in Ontario cover the residential, low income, small business, commercial and industrial, and large industrial sectors. The programs cover financial incentives for energy efficient technologies, energy efficiency and energy management coaching and assistance, assessments and direct install of products for the low income and small business sectors, and various capability building and training initiatives for the supply chain. Ontario has featured rigorous evaluation of the conservation program portfolio for the past five years, and due to program maturity, energy efficiency baselines are moving up. For example, standard efficiency T8s, the foundation of several utility programs are now the baseline for efficiency. Recently, Ontario just released a pay-for-performance framework for LDC funding of Conservation Program delivery, the first of its kind in North America.

Program Name	Program Area	Program Measures	Links
Retailer (Coupons, Instant Rebates)	Residential	This program features prescriptive incentives for qualifying measures, purchased from participating retailers. The incentives are provided at point of purchase. Qualifying measures include LEDs, controls, power strips, pipe wrap etc. The incentives are based on up-front cost to the customer, with program cost effectiveness setting a secondary ceiling. Prior to 2010, incentives were limited to a maximum of 30 percent of the retail price.	https://saveonenergy.ca/Consumer/Programs/Instant-Rebates.aspx
Appliance Retirement	Residential	This program features free pick up and environmentally friendly decommissioning of appliance. Additional incentives were not provided since the program, pilot and barriers analysis determined that biggest barrier to appliance retirement was lack of convenience. The program ended in 2015 due to successful removal of the majority of old, pre-1994 inefficient units. Qualifying equipment included full sized fridges and freezers, with customers given the option of providing window air conditioners and dehumidifiers as secondary equipment.	
Heating & Cooling Incentive	Residential	This program features mail-in or online submission of rebates through participating HVAC contractors for qualifying high efficiency furnaces ($250) and central air conditioners ($250 or $400). The incentives were set based on analyzing the up-front cost difference to the consumer between a standard unit and an efficient unit. Program cost effectiveness set a secondary ceiling, with the program equipment mix (75 percent furnace/25 percent air conditioner) allowing the less cost effective air conditioners to be provided with a higher incentive.	https://saveonenergy.ca/Consumer/Programs/HVAC-Rebates.aspx

Residential New Construction	Business	This program features both a prescriptive and performance track for incentives. Prescriptive incentives are available for installation of energy efficiency lighting and HVAC equipment. The performance track provides $500 or $1,000 per home for obtaining the appropriate Energuide rating. Incentives were set based on attracting builder to consider program for additional electricity efficiency measures.	
Retrofit Prescriptive	Business	This program features prescriptive incentives for qualifying equipment. Incentive applications are submitted online or through a paper-based approach, and are paid after equipment installation and review of the application. Incentives were set based on upfront cost. The incentives were capped at 50 percent of the total costs. Secondary ceilings for triangulating incentive levels were based on amount of savings delivered and cost effectiveness.	https://saveonenergy.ca/Business/Program-Overviews/Retrofit-for-Commercial/Available-Incentives/Prescriptive.aspx
Retrofit Custom	Business	This program was designed to be for larger projects in the commercial and industrial sector, and to capture any projects that might not fall into the Retrofit prescriptive track. Incentives were set based on kW or kWh savings realized, with lighting savings receiving a lower incentive rate than non-lighting savings to encourage greater penetration of the latter category. The incentives were capped at 50 percent of the total cost. With the recent update, the $/kW incentive rate has been removed. An M&V Plan is required for incentive approval. The incentive rates guarantee measure cost effectiveness for almost all technologies and applications from a program administrator perspective.	https://saveonenergy.ca/Business/Program-Overviews/Retrofit-for-Commercial/Available-Incentives/Custom.aspx
Small Business Lighting	Business	This program is targeted to pursuing lighting efficiency for small business customers (under 100 kW) through a direct install approach. Recently, the incentives for the program were updated to include cost sharing for certain measures that were more expensive on a savings delivered basis. Incentives are based on the lower of the price of the equipment supply and installation, or a prescribed incentive rate per kWh savings. The customer is required to contribute the remaining amount if the incentive rate is the limiting factor. The incentive rate helps guarantee measure cost effectiveness from a program administrator perspective. The program still features a free lighting assessment audit for the customer.	https://saveonenergy.ca/Business/Program-Overviews/Small-Business-Lighting-and-AC.aspx

Energy Managers		This program provides funding for hiring an Energy Manager for larger commercial or industrial customers. The incentive funding is provided through either a guaranteed salary option or a pay for performance option based on realized savings through the year. The pay for performance stream sets funding at $40/MWh. Energy Managers are provided annual savings targets which help with program cost effectiveness.	https://saveonenergy.ca/Business/Program-Overviews/Energy-Managers.aspx
Process & Systems Upgrade (including Industrial Accelerator Program (IAP) portion)		This program is targeted towards large customers, including transmission-connected customers. The incentive funding is provided based on the lower of three options: a prescribed incentive rate for savings, a 40 percent project cost cap or the incentive required to drop the project to a one year payback. In practice, usually one of the first two options is encountered.	https://saveonenergy.ca/Business/Program-Overviews/Process-and-System-Upgrades.aspx http://www.ieso.ca/Pages/Participate/Industrial-Accelerator-Program/Process-and-Systems.aspx

APPENDIX A-2: ONTARIO GAS (UNION GAS)

The incentive setting methodology and cost effectiveness section was based on secondary research and interview with Union Gas. All other sections are based solely on secondary research performed by CLEAResult.

GEOGRAPHIC DEFINITIONS

Union Gas Limited (Union Gas) and Enbridge Gas Distribution Inc. (Enbridge) are the two primary natural gas utilities in Ontario. Together, they serve close to 3.5 million natural gas customers throughout Ontario.

LOAD AND CONSUMPTION INFORMATION

- Total Number of Customers in Ontario (2014): 3,489,238
- Union Gas: 1,400,536
  - Residential: 1,300,000
  - Commercial and Industrial: 116,000
  - Large Volume: 1,000
- Union Gas Sales in 2014 (General Service, in 10^3 m^3)
  - M1 Rate*: 3,328,692
  - M2 Rate*: 1,284,428
  - 01 Rate*: 1,053,067
  - 10 Rate*: 379,430

*M1 and 01 rates are residential, M2 and 10 rates are commercial. M1 and 01 are for customers who consume less than 50,000 m3 per year. M2 and 10 are for medium - large commercial and small industrial customers who consume greater than 50,000 m4 per year. Most residential customers fit in M1 and 01 but there are some commercial customers in M1 and 01.

Cost Rates

Figure 14: Union Gas' Rates [1]

Area	Residential Rate (cents/m3)	C&I Rate (cents/m3)
Eastern ON	10.8100	10.8100
Fort Francis	10.5266	10.5266
Northern ON	10.7178	10.7178
Northwestern ON	10.6017	10.6017
Southern ON	10.8007	10.8007

[1] Union Gas, "Current natural gas rates," https://www.uniongas.com/residential/rates/current-rates (2016)

Figure 15: Historical Canadian Natural Gas Demand by Sector [2]

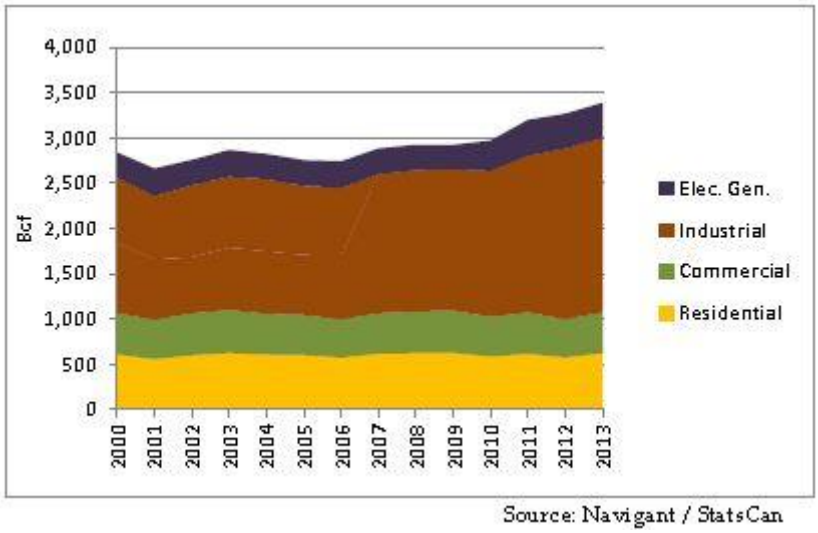
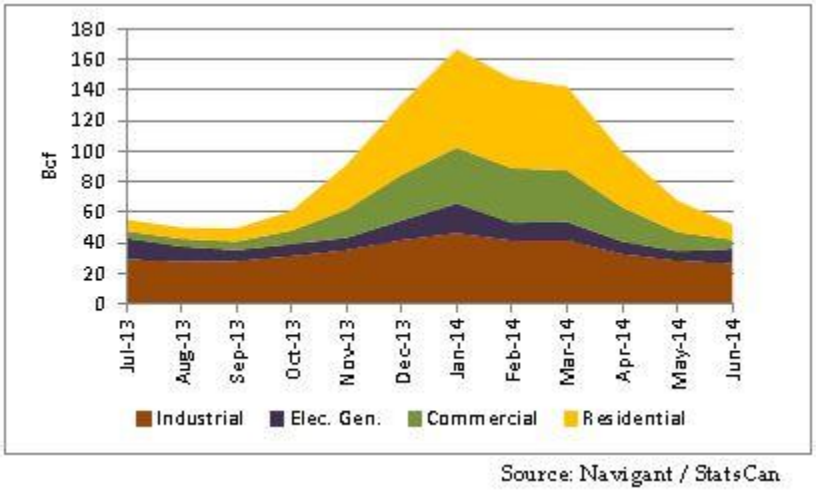


Figure 16: Ontario Monthly Natural Gas Demand by Sector [2]



MARKET STRUCTURE OVERVIEW

DSM is a core part of the conservation first policy in Ontario as per the 2013 Long-Term Energy Plan. In 2014, the Minister of Energy issued a directive to the Ontario Energy Board (OEB) for the development of a new framework for natural gas DSM. The OEB regulates Ontario's natural gas sector and has responsibilities revolving around rates for the transmission and distribution of natural gas.

A part of this directive, the DSM Framework is to enable the achievement of all cost-effective DSM and align closely with electricity Conservation and Demand Management (CDM) efforts as applicable. OEB, along with stakeholders and comments from the public, were to develop this framework with a final version completed in December 2014.

The result is a DSM framework designed to reduce natural gas consumption in Ontario and contains all gas utilities' DSM activities. This includes guiding principles for gas utilities in their design of individual programs, development of DSM strategies

[2] Navigant Consulting Inc., "2014 Natural Gas Market Review Final Report," http://www.ontarioenergyboard.ca/oeb/_Documents/EB-2014-0289/2014_Natural_Gas_Market_Review_Final_Report.pdf (2014)

and for assessing the appropriateness DSM plans for 2015-2020. The framework can also be used in gas utilities' proposal reviews/approvals for their DSM plans by the OEB. Guiding principles include:

1. Invest in DSM where the cost is equal to or lower than capital investments and/or the purchase of natural gas
2. Achieve all cost-effective DSM that result in a reasonable rate impact
3. Where appropriate, coordinate and integrate DSM and electricity CDM efforts to achieve efficiencies
4. Gas utilities will be able to recover costs and lost revenues from DSM programs
5. Design programs so that they achieve high customer participation levels
6. Minimize lost opportunities when implementing energy efficient upgrades
7. Ensure low-income programs are accessible across the province
8. Programs should be designed to pursue long-term energy savings
9. Shareholder incentives will be commensurate with performance and efficient use of funds
10. Ensure DSM is considered in gas utility infrastructure planning at the regional and local levels

For each program developed based on the guiding principles, Union Gas and Enbridge submits participant proposed annual budgets, eligibility criteria, target metrics and shareholder incentives for the OEB's approval. There is a mid-term review in 2018 that intends to establish more specific direction and to assess performance on annual metrics, budget levels, impact on customer rates and shareholder incentives. The utilities will be required to file all completed studies and reports at the mid-term review. These include:

- Infrastructure Resource Planning study
- Natural Gas Conservation Potential study
- Report on free rider reduction efforts and results across all programs
- On-bill presentment status report
- Joint studies and initiatives with electric utilities

The gas utilities are also the administrator of their own programs. Gas utilities are required to provide annual reports to the OEB. The OEB will be leading program evaluation starting in 2016, by hiring the Evaluation Contractor (EC) and chairing the Evaluation Advisory Committee (EAC). The utilities are a member of the EAC.

PORTFOLIO MATURITY AND HISTORICAL PERFORMANCE

DSM of natural gas has been practiced in Ontario for 21 years. The previous DSM Guidelines (EB-2008-0346) were in place from June 2011 regarding development of new multi-year DSM plans for the gas utilities 2012-2014. Prior, the gas utilities were guided by the Decision in the Generic DSM Proceeding in 2006 (EB-2006-0021) from the OEB. The principles and priorities were for gas utilities to follow from 2007-2009.

Figure 17: Total Savings and Costs of Gas Utilities [3]

Year	Annual Savings (m^3)	Costs ($)
2012	137,438,488	31,322,216
2013	179,966,564	32,838,926
2014		30,091,000(Budget)

[3] Ontario Energy Board, Multiple documents from: "Natural Gas Demand Side Management," http://www.ontarioenergyboard.ca/oeb/_Documents/EB-2014-0289/2014_Natural_Gas_Market_Review_Final_Report.pdf (2016)

Figure 18: TRC Ratio in 2012-2013 by Programs [3]

Program Category	TRC Ratio (2012)	TRC Ratio (2013)
Union Gas	3.91	3.83
Residential	5.07	4.4
Commercial/Industrial	3.07	2.01
Low-Income	1.32	0.77
Large Volume	6.33	8.74
Optimum Home	N/A	N/A

CURRENT CYCLE

The gas utilities have developed and submitted their annual DSM program budgets for all proposed programs for OEB approval 2015-2020. The budgets are comprehensive including financial, marketing and communications, administration and staffing requirements and program evaluation. The OEB has approved annual DSM budgets for the 2015-2020 with modifications:

Figure 19: Gas Program Budgets [4]

Approved Annual DSM Budgets

Utility	2014 (Actuals)	2015	2016	2017	2018	2019	2020	2015-2020 Total
Enbridge	$ 32,511,266	$ 37,722,230	$ 56,361,117	$ 62,933,844	$ 67,554,087	$ 66,421,773	$ 67,757,376	$ 358,750,427
Union	$ 33,713,172	$ 33,988,000	$ 56,821,373	$ 58,570,073	$ 63,272,305	$ 63,268,773	$ 64,349,541	$ 340,270,066
Total	$ 66,224,438	$ 71,710,230	$ 113,182,490	$ 121,503,917	$ 130,826,393	$ 129,690,546	$ 132,106,917	$ 699,020,493

Notes:
2014 budgets are actuals while 2015-2020 are approved.
Excludes the maximum annual shareholder incentive of $10.45 million / utility / year.

Figure 20: Gas Program Budgets Incentive/Admin Split [4]

Union Overhead Budgets	2016	2017	2018	2019	2020
Proposed Program Overhead Costs	$10,023,000	$8,342,000	$8,505,000	$8,524,000	$8,542,000
Approved Program Overhead Costs	***$8,747,373***	***$9,696,073***	***$9,868,305***	***$9,901,773***	***$9,919,541***
Proposed Portfolio Overhead Costs	$11,735,000	$6,142,000	$5,642,000	$5,642,000	$5,642,000
Approved Portfolio Overhead Costs	***$11,235,000***	***$5,642,000***	***$5,642,000***	***$5,642,000***	***$5,642,000***
Total Proposed Overhead Costs	$21,758,000	$14,484,000	$14,147,000	$14,166,000	$14,184,000
Total Approved Overhead Costs	***$19,982,373***	***$15,338,073***	***$15,510,305***	***$15,543,773***	***$15,561,541***

Reference: Proposed overhead costs - Union Application, Exhibit A, Tab 3, Schedule 4, Page 6.

The gas utilities have also developed targets for each proposed program 2015-2020. The gas utilities incorporated multiple performance metrics via a weighted scorecard approach that weighs lifetime natural gas savings more highly. It is recognized that the industry and market is to look more broadly at conservation and with other key priorities outside of just savings. The result is the scorecard as seen below.

[4] Ontario Energy Board, "Decision and Order EB-2015-0029/EB-2015-0049," http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/513656/view/Decision_and_Order_Enbridge_Union%20_DSM_20160120.PDF (2016)

Figure 21: Union Gas Scorecard [4]

Union	Resource Acquisition	Low-Income	Large Volume	Market Transformation	Performance-based
Cumulative natural gas savings metric weight	75%	100%	100%	0%	0%
Other metric weight	25%	0%	0%	100%	100%

Union Gas proposed other metrics targeting:

- Participants in the Home Reno Rebate program
- Homes built in the Optimum Home new construction program
- Participants in the RunSmart and Strategic Energy Management programs

Figure 22: Union Gas Targets & Performance Metrics [4]

Resource Acquisition Scorecard

Metric	Units	Weight	2016 Target
Metrics and Targets			
Cumulative Savings	CCM (millions)	75%	1,110
Home Reno Rebate Participants	Homes	25%	3,000

Low Income Scorecard

Metric	Units	Weight	2016 Target
Metrics and Targets			
Single Family Cumulative Savings	CCM (millions)	60%	34
Social & Assisted Multi-Family Cumulative Savings	CCM (millions)	35%	15
Market Rate Multi-Family Cumulative Savings	CCM (millions)	5%	2

Market Transformation Scorecard

Metric	Units	Weight	2016 Target
Metrics and Targets			
Homes built >20% above code	Homes	100%	2015 Actual +20%

Performance Based Scorecard

Metric	Units	Weighting 2016	2017	2018	2019	2020	2016 Target	2017-2018 Targets
Metrics and Targets								
RunSmart Participants	Participants	50%	20%	10%	10%	10%	25	125% of Prior Year Actual
SEM Participants	Participants	50%	20%	10%			3	2+ Prior Year Actual
RunSmart Savings (%)	m3		60%	40%	40%	40%		10% Aggregate Participant Savings
SEM Savings (%)	m3			40%	50%	50%		2018: 5%; 2019-2020: 102% of Prior Year Actual

Figure 23: Union Gas Targets and Budgets [4]

Resource Acquisition - Residential	2016 OEB Approved Budget	2016 OEB Approved CCM Targets	2016 OEB Approved Participant Targets	2017 OEB Approved Budget	2018 OEB Approved Budget	2019 OEB Approved Budget	2020 OEB Approved Budget	Total OEB Approved Budget (2016-2020)
Home Reno Rebate	$ 7,233,000	85,745,550	3,300	$ 9,880,000	$ 12,226,000	$ 12,226,000	$ 12,226,000	$ 53,791,000
Energy Savings Kits (ESK) - *Rejected*	$ -	-		$ -	$ -	$ -	$ -	$ -
Behavioural - *Rejected*	$ -	-		$ -	$ -	$ -	$ -	$ -
Residential Resource Acquisition Program Budget	$ 7,233,000			$ 9,880,000	$ 12,226,000	$ 12,226,000	$ 12,226,000	$ 53,791,000
Residential Overhead (Evaluation & Administration) - Revised	*$ 1,378,657*			*$ 1,488,828*	*$ 1,681,697*	*$ 1,681,697*	*$ 1,681,697*	*$ 7,912,576*
Development and Start-up - Revised	$ -			$ -	$ -	$ -	$ -	$ -
Evaluation	*$ 559,000*			*$ 709,000*	*$ 859,000*	*$ 859,000*	*$ 859,000*	*$ 3,845,000*
Administrative costs - Revised	*$ 819,657*			*$ 779,828*	*$ 822,697*	*$ 822,697*	*$ 822,697*	*$ 4,067,576*
Residential Program Total including Overhead	$ 8,611,657	85,745,550		$ 11,368,828	$ 13,907,697	$ 13,907,697	$ 13,907,697	$ 61,703,576
Resource Acquisition - Commercial & Industrial								
Commercial & Industrial Prescriptive	$ 6,755,000	302,055,812		$ 6,763,000	$ 7,486,000	$ 7,149,000	$ 7,149,000	$ 35,302,000
Commercial & Industrial Direct Install - *Revised*	$ 500,000	6,699,181		$ 2,500,000	$ 2,500,000	$ 2,500,000	$ 2,500,000	$ 10,500,000
Commercial & Industrial Custom (Studies & Metering)	$ 7,808,000	819,603,817		$ 7,808,000	$ 7,808,000	$ 7,808,000	$ 7,808,000	$ 39,040,000
Commercial & Industrial Resource Acquisition Program Budget	$ 15,063,000			$ 17,071,000	$ 17,794,000	$ 17,457,000	$ 17,457,000	$ 84,842,000
Commercial & Industrial Overhead - Revised	*$ 4,253,176*			*$ 4,964,334*	*$ 4,931,584*	*$ 4,946,286*	*$ 4,946,286*	*$ 24,041,667*
Evaluation	*$ 180,000*			*$ 180,000*	*$ 180,000*	*$ 180,000*	*$ 180,000*	*$ 945,000*
Administrative costs - Revised	*$ 4,064,176*			*$ 4,775,334*	*$ 4,742,584*	*$ 4,757,286*	*$ 4,757,286*	*$ 23,096,667*
Commercial & Industrial Program Total including Overhead	$ 19,316,176	1,128,358,810		$ 22,035,334	$ 22,725,584	$ 22,403,286	$ 22,403,286	$ 108,883,667
Resource Acquisition Total	**$ 27,927,833**	**1,214,104,360**		**$ 33,404,162**	**$ 36,633,281**	**$ 36,310,983**	**$ 36,310,983**	**$ 170,587,243**
Performance-Based								
RunSmart	$ 297,000	(% savings; no 2016 target)	28	$ 592,000	$ 837,000	$ 582,000	$ 802,000	$ 3,110,000
Strategic Energy Management (SEM)	(budget Included above)	(% savings; no 2016 target)	3	***	***	***	***	***
Performance-Based Program Budget	$ 297,000			$ 592,000	$ 837,000	$ 582,000	$ 802,000	$ 3,110,000
Performance-Based Overhead	*$ 251,000*			*$ 251,000*	*$ 251,000*	*$ 251,000*	*$ 251,000*	*$ 1,255,000*
Evaluation	*$ 35,000*			*$ 35,000*	*$ 35,000*	*$ 35,000*	*$ 35,000*	*$ 175,000*
Administrative costs	*$ 216,000*			*$ 216,000*	*$ 216,000*	*$ 216,000*	*$ 216,000*	*$ 1,080,000*
Performance-Based Total	**$ 548,000**			**$ 843,000**	**$ 1,088,000**	**$ 833,000**	**$ 1,053,000**	**$ 4,365,000**
Low Income								
Home Weatherization - *Revised*	$ 6,335,000	36,049,492		$ 6,136,000	$ 7,495,000	$ 8,063,000	$ 8,374,000	$ 36,403,000
Aboriginal	$ 8,000	N/A		$ 419,000	$ 511,000	$ 456,000	$ 448,000	$ 1,842,000
Furnace End-of-Life	$ 761,000	1,736,856		$ 784,000	$ 924,000	$ 919,000	$ 917,000	$ 4,305,000
Multi-Family	$ 2,651,000	18,855,839		$ 3,359,000	$ 2,984,000	$ 3,031,000	$ 3,573,000	$ 15,598,000
Low Income Program Budget	$ 9,755,000			$ 10,698,000	$ 11,914,000	$ 12,469,000	$ 13,312,000	$ 58,148,000
Low Income Overhead - Revised	*$ 1,652,470*			*$ 1,644,841*	*$ 1,656,954*	*$ 1,675,720*	*$ 1,693,488*	*$ 8,323,473*
Evaluation	*$ 220,128*			*$ 213,015*	*$ 225,948*	*$ 244,982*	*$ 263,008*	*$ 1,167,082*
Administrative costs	*$ 1,432,342*			*$ 1,431,826*	*$ 1,431,006*	*$ 1,430,737*	*$ 1,430,480*	*$ 7,156,391*
Low Income Total	**$ 11,407,470**	**56,642,187**		**$ 12,342,841**	**$ 13,570,954**	**$ 14,144,720**	**$ 15,005,488**	**$ 66,471,473**
Large Volume								
Large Volume - *Revised*	$ 3,150,000	Section 5.29		$ 3,150,000	$ 3,150,000	$ 3,150,000	$ 3,150,000	$ 15,750,000
Large Volume Overhead - Revised	*$ 850,000*			*$ 850,000*	*$ 850,000*	*$ 850,000*	*$ 850,000*	*$ 4,250,000*
Evaluation - Revised	*$ 63,000*			*$ 63,000*	*$ 63,000*	*$ 63,000*	*$ 63,000*	*$ 315,000*
Administrative costs - Revised	*$ 787,000*			*$ 787,000*	*$ 787,000*	*$ 787,000*	*$ 787,000*	*$ 3,935,000*
Large Volume Total	**$ 4,000,000**	**Section 5.29**		**$ 4,000,000**	**$ 4,000,000**	**$ 4,000,000**	**$ 4,000,000**	**$ 20,000,000**
Market Transformation								
			2015 Actuals +					
Optimum Home - *Revised*	$ 841,000		20%	$ 841,000	$ 841,000	$ 841,000	$ 841,000	$ 4,205,000
Commercial Savings By Design - New	$ 500,000		8	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 4,500,000
Program Budget	$ 1,341,000			$ 1,841,000	$ 1,841,000	$ 1,841,000	$ 1,841,000	$ 8,705,000
Market Transformation Overhead - Revised	*$ 362,070*			*$ 497,070*	*$ 497,070*	*$ 497,070*	*$ 497,070*	*$ 2,350,350*
Evaluation - Revised	*$ 26,820*			*$ 36,820*	*$ 36,820*	*$ 36,820*	*$ 36,820*	*$ 174,100*
Administrative costs - Revised	*$ 335,250*			*$ 460,250*	*$ 460,250*	*$ 460,250*	*$ 460,250*	*$ 2,176,250*
Total MT budget	**$ 1,703,070**			**$ 2,338,070**	**$ 2,338,070**	**$ 2,338,070**	**$ 2,338,070**	**$ 11,055,350**
Total Program Budget without Overheads	$ 36,839,000			$ 43,232,000	$ 47,762,000	$ 47,725,000	$ 48,788,000	$ 224,346,000
Total Program Overhead	*$ 8,747,373*			*$ 9,696,073*	*$ 9,868,305*	*$ 9,901,773*	*$ 9,919,541*	*$ 48,133,066*
Total Program Budget with Program-level Overhead	$ 45,586,373			$ 52,928,073	$ 57,630,305	$ 57,626,773	$ 58,707,541	$ 272,479,066
Portfolio-level Overhead - Revised	*$ 11,235,000*			*$ 5,642,000*	*$ 5,642,000*	*$ 5,642,000*	*$ 5,642,000*	*$ 33,803,000*
Research	*$ 1,500,000*			*$ 1,000,000*	*$ 1,000,000*	*$ 1,000,000*	*$ 1,000,000*	
Evaluation	*$ 1,300,000*			*$ 1,300,000*	*$ 1,300,000*	*$ 1,300,000*	*$ 1,300,000*	
Administration	*$ 2,035,000*			*$ 2,842,000*	*$ 2,842,000*	*$ 2,842,000*	*$ 2,842,000*	
Pilots - Revised with Direct Install Pilot Removed	*$ 500,000*			*$ 500,000*	*$ 500,000*	*$ 500,000*	*$ 500,000*	*$ 2,500,000*
DSM Tracking and Reporting System Upgrades	*$ 5,000,000*			*$ - *	*$ - *	*$ - *	*$ - *	*$ - *
Total DSM Budget Pre-Inflation	$ 56,821,373			$ 58,570,073	$ 63,272,305	$ 63,268,773	$ 64,349,541	$ 306,282,066
Cumulative Inflation @ 1.68% - Rejected	$ -			$ -	$ -	$ -	$ -	$ -
GRAND TOTAL	$ 56,821,373	1,270,746,547		$ 58,570,073	$ 63,272,305	$ 63,268,773	$ 64,349,541	$ 306,282,066

COST EFFECTIVENESS TESTING

Technical Reference Manual

The EC reviews and proposes updates to the OEB with regards to data within the TRM. This occurs yearly. This review and update includes input assumptions to reflect the findings of the annual DSM evaluation and audit. Additional research may be required to include new technologies to the TRM and improve existing assumptions.

Cost Effectiveness Requirements

The gas utilities' overall DSM goals are to achieve all the cost-effective DSM available in its market. The OEB determined that cost effectiveness should be based on the Total Resource Cost-plus (TRC-plus) test when screening prospective programs.

Low-income programs are screened with the same TRC-plus test as Resource Acquisition programs but have a lower requirement of a minimum of 0.7 while Resource Acquisition programs are to have TRC-plus ratio of at least 1.0.

Market transformation programs and pilots are not held to the same requirement as their goals are to change behaviours throughout the marketplace. These programs are not required to have a cost effectiveness test.

Avoided Supply Cost (Benefits)

Given the differences between Union Gas' and Enbridge's geography, system and customers and such, it is expected the avoided supply cost will be different between the two gas utilities.

Under the TRC-plus test, benefits include:

- Avoided natural gas costs
- Avoided transmission and distribution costs (such as pipelines and storage facilities)
- A 15 percent non-energy benefit adder accounting for other benefits not related to the reduction in natural gas such as environmental, economic and social benefits

Costs

Under the TRC-plus test include:

- Costs incurred by program participants (incremental costs)
- Costs of running the energy efficiency programs (delivery and administration costs)

INCENTIVE RATE SETTING

Union Gas is responsible for setting incentive levels for their programs. Periodic reviews of the appropriateness of incentive levels is conducted and adjustments to financial incentives are made. Below is an overview of the process employed by Union Gas when examining an incentive level for a new measure or proposing a significant change to an existing measure.

1. **Market Research**
   The process starts by performing both primary and secondary market research in order to determine the measure performance metrics and costs. The objective is to determine awareness, barriers and purchase decisions. Market penetration and age of technology is considered as well (e.g. new technology versus widespread solutions).
2. **Technical Reference Manuals**
   The Technical Evaluation Committee approve/deny measures for TRMs which are used for savings and assumptions and enables Union Gas to include solutions in programs. Measures with large savings potential can warrant higher incentive levels.
3. **Benchmarking**
   Union Gas also reviews other jurisdictions and evaluates their measures and incentives relative to what is offered in other territories. The goal is to be relatively similar to other territories in their incentives. Other factors such as incremental costs are investigated.
4. **Incremental Cost Design**
   Based on the market research and technology, Union will attempt to incentivize a portion of the incremental cost determined to motivate customers to implement. Typically, this has fallen between 25-35 percent of incremental costs. Incremental costs for measures with base cases, are calculated by the difference between the measure cost and standard measure cost. For measures without base cases, the incremental cost is taken as the full measure cost.
5. **Incentive Rate Finalized**
   Once the incremental measure cost is finalized, Union Gas will set a standard incentive using the above considerations.

The above process is used for prescriptive measures. For custom measures, a similar process as steps 1-5 is followed but other considers may be evaluated such as customer rate class.

EXISTING MAIN PROGRAMS – UNION GAS [4]

Program Area	Program Name	Description	Incentives	Links
Resource Acquisition	Home Reno Rebate	Program provides an audit of customer homes to identify areas of improvement and also rebates or incentives to perform the recommended improvements.	- Incentives for the audit - Basement Insulation: $450 - $1,000 for insulating 100 percent of the basement (Incentive amount depends on spec) - Exterior Wall Insulation: $1,000 - $1,500 - Attic Insulation: $250 - $500 - Air Sealing: $100 - $150 - Furnace/Boiler: $500 - Water Heater: $200 - Window: $40 per window	https://www.uniongas.com/residential/save-money-energy/rebates-promotions/home-reno
	C&I Prescriptive	Program provides customers rebates for a list of recommended efficient technologies and equipment.	- Check link for list of measures and incentives	https://www.uniongas.com/business/save-money-and-energy/space-heating-programs https://www.uniongas.com/business/save-money-and-energy/water-heating-programs https://www.uniongas.com/business/save-money-and-energy/cooking-programs
	C&I Custom	This program is similar to the above but provides incentives based on overall	- Contract customers: $0.10 up to $100,000	https://www.uniongas.com/busi

		natural gas savings realized by the customer's specific needs.	- General service customers: $0.20 up to $40,000 (Total not to exceed 50 percent of project cost)	ness/save-money-and-energy/engineering-projects
Low-Income	Home Weatherization	Program provides low-income qualified residential customers with a home energy assessment and weatherization at no cost. Customers are also eligible to receive energy efficient showerheads, faucet aerators and a programmable thermostat.	The following at no cost: - Home Energy Assessment - Insulation - Water Saving Products - ProgrammableThermostat	https://www.unionogas.com/residential/save-money-energy/rebates-promotions/weatherization/offer
	Aboriginal	This program combines customers with free natural gas energy efficiency measures installed by Union Gas representatives and carbon monoxide detector at no cost. Also, financial incentive to upgrade existing furnaces.	- No cost for measures and installation - Financial incentives for upgrading furnaces	
	Furnace End-of-Life	Program provides social and assisted housing providers and private market customer financial incentives to upgrade to a 95 percent or higher efficiency rating.	- Financial incentives for upgrading furnaces	
	Multi-family	Program targets customers living in social-housing buildings/privately-owned buildings with a high proportion of low-income residents with measures, audits and education.	- Financial incentives to use towards boilers, ventilation systems, custom measures and window upgrades. Tenants are eligible to receive energy efficient showerheads, faucet aerators, and educational information related to energy conservation	
Performance Based	RunSmart	Program provides smaller commercial and industrial customers with a free on-site building assessment, a report on their energy use and recommendations on how to improve their energy efficiency through operational changes.	- Education, Healthcare, Office, Multi-Unit Residential and Entertainment Commercial Customers has financial rate of: $0.10/m3 to a maximum of $20,000	https://www.unionogas.com/business/save-money-and-energy/engineering-projects

Large Volume	Large Volume	This program provides large volume customers with technical support and customer training along with financial incentives for energy saving projects.	- Check link for details	https://www.uniongas.com/business/save-money-and-energy/engineering-projects
Strategic Energy Management		The Strategic Energy Management is a long-term and deep savings initiative for large customers. The customer's energy will be tracked and measured against their baseline performance for continuous improvements.	Incentives are structured to support initial start-up costs as well as provide incentives for measured energy efficiency improvements over the 5-year participation.	http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/472262/view/

APPENDIX A-3: BRITISH COLUMBIA (BC HYDRO)

GEOGRAPHIC DEFINITIONS

BC Hydro is in British Columbia, Canada. They generate and deliver electricity to 95 percent of the population of the province serving over four million people.

LOAD AND CONSUMPTION INFORMATION

- Peak Demand (2017 Forecast): 11,681 MW
- Consumption (2017 Forecast): 63,238 GWh
  - Residential: 19,761 GWh (31%)
  - Commercial: 17,815 GWh (28%)
  - Industrial: 19,016 GWh (30%)

- Annual Savings Target: 884GWh

Figure 24: Customer Count and Loads[1]

Customers	Count	Electricity Sold 2014 (Gigawatt-Hours)
Residential	1,709,071	17,965
Light Industrial and Commercial	201,812	18,501
Large Industrial	177	13,994
Other	3,489	2,558
Trade	239	50,082
Total	**1,914,788**	**103,100**

In BC Hydro, approximately 90 percent of their customer accounts are residential accounts. The remainder is either commercial or industrial and each represents about one third of the total electricity supplied.[2]

RATE INFORMATION[3]

- Residential Customers: $0.0829/kWh (First 1,350kWh), $0.1243/kWh thereafter
- Small Business: $0.1116/kWh
- Medium Business: $0.1030/kWh (First 14,800kWh), $0.0719/kWh thereafter up to individual baseline
- Large Business: $0.1114/kWh (First 14,800kWh), $0.0536/kWh thereafter up to individual baseline

GENERATING CAPACITY (2015)

- Hydroelectric: 11,440 MW (91%)
- Thermal: 1,069 MW (8.5%)
- Diesel Generation: 59 MW (0.5%)

[1] BC Hydro, "BC Hydro Annual Report 2014," https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/accountability-reports/financial-reports/annual-reports/bc-hydro-annual-report-2014.pdf (2014)

[2] BC Hydro, "BC Hydro Service Plan 2013/14-2015/16," https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/service-plans/bc-hydro-service-plan.pdf

[3] BC Hydro, "General Service Business Rates," https://www.bchydro.com/accounts-billing/rates-energy-use/electricity-rates/business-rates.html (2016)

MARKET STRUCTURE OVERVIEW

BC Hydro is a provincial Crown corporation. Their mandate is to generate, distribute, purchase and sell electricity. The sole shareholder of BC Hydro is the Province of British Columbia. BC Hydro reports to the Ministry of Energy and Mines (Ministry) with the British Columbia Utilities Commission (BCUC) has their regulator. BCUC's primary responsibility is regulation of natural gas and electricity utilities in the province. They are an independent regulatory agency operating under and administering the Utilities Commission Act.

The Integrated Resource Plan is long-term strategic plan for BC Hydro to address growth in electricity demand over 20 years. The 2007 BC Energy Plan contains policies BC Hydro is to follow. BC Hydro and other utilities that fall within this plan are to pursue and invest in all cost-effective demand side management (DSM). They are encouraged to develop a diversified program portfolio for the benefit of all ratepayers. DSM programs are funded by ratepayers.

The Clean Energy Act also contributes to the 2007 BC Energy Plan providing further guidance to meeting objectives. It sets targets for increased investments in clean and renewable energy, electricity self-sufficiency as well as reduced greenhouse gas emissions. It also directs BC Hydro to have 66 percent of future incremental energy demand be met through conservation by 2020.

The Ministry monitors utilities' progress on DSM and energy efficiency assessing barriers to the cost-effective program implementation. They may also propose regulatory directions to BCUC as required. The Ministry is also involved with assessing if appropriate incentives are available for utilities to identify and pursue cost-effective programs.

PORTFOLIO MATURITY AND HISTORICAL PERFORMANCE

Figure 25: Electricity Savings from Energy Efficiency Programs F2003 - F2007[4]

	Cumulative Electricity Savings (GWh/year)		
F2003	353	358	1%
F2004	610	739	21%
F2005	890	1,147	29%
F2006	1,177	1,391	18%
F2007	1,743	1,879	8%

CURRENT CYCLE

There is a forecast of 10,610 GWh of savings per year and 1,756 MW of savings in 2020. The year 2020 is also the milestone year for the 2007 Energy Plan's conservation target. This is based on the Conservation Potential Review (CPR) conducted in 2006 and 2007. The CPR actually determined a range of 6,200 to 10,800 GWh per year of achievable electricity savings by 2021 impacted by market, government policy and DSM measures. [4]

[4] BC Hydro, "2008 Long-Term Acquisition Plan Appendix K," http://www.bcuc.com/Documents/Proceedings/2008/BCH_LTAP_B-1-1_APPENDICES/Appendix%20K.pdf

Figure 26: Planned Energy Savings in F2020 (GWh/yr)[4]

	Codes and Standards	Rate Structures	Programs	Total
Residential	2,760	980	1,070	4,810
Commercial	500	390	1,480	2,370
Industrial	110	730	2,590	3,430
Total	3,370	2,090	5,150	10,610

Figure 27: Planned Capacity Savings in F2020 (MW)[4]

	Codes and Standards	Rate Structures	Programs	Total
Residential	584	217	202	1,003
Commercial	65	63	194	322
Industrial	14	95	321	430
Total	**662**	**375**	**719**	**1,756**

Below is the cumulative rate of annual electricity savings resulting from DSM activities. This includes programs, codes and standards and rate structures.

Figure 28: Cumulative GWh/Year following the 2008 BC Energy Plan[4]

GWH/YEAR	F2008	F2009	F2010	F2011	F2012
Target	295	761	1,700	2,300	3,500
Actual	326	983	1,778	2,348	

BC Hydro has developed annual cumulative targets using the Conservation Potential Review and research related to other DSM tools.[2]

The LTAP 2008 also includes support initiatives in the DSM Plan[4]:

- Codes and standards support
- Public awareness and education
- Community engagement
- Technology innovation
- Indirect and portfolio enabling activities
- Information technology
- Rate structures

INCENTIVE LEVEL-SETTING METHODOLOGY

The following is a rough sketch of what we have seen in other territories.

BC Hydro is responsible for setting incentive levels for their programs and introducing new measures and programs. This is performed through business cases for programs and typically occurs every two to three years. Below is an overview of the process employed by BC Hydro when examining an incentive level for a new measure or proposing a significant change to an existing measure.

6. **Benchmarking**
   BC Hydro reviews other jurisdictions and evaluates their measures and incentives relative to what is offered in other territories. Other factors such as incremental costs are investigated. Benchmarking is usually performed by directly contacting the utility of programs.
7. **Market Research**
   Market research depends on the sector/incentive. It can either be achieved by broad primary research or by one-on-one consultations for larger customers. The objective is to determine awareness, barriers and purchase decisions.
8. **Technical Reference Manuals**
   The engineering team, M&V team, program managers, evaluation group and other in-house BC Hydro resources approve/deny measures for TRMs which are used for savings and assumptions. They enable BC Hydro to include solutions in programs. All proposed incentives go through a governance process for technical and business review.
9. **Incremental Cost Design**
   Based on the market research and technology, BC Hydro will attempt to incentivize a portion of the incremental cost determined to motivate customers to implement. Typically, 50-75 percent of incremental costs have been incented. For "Replace on Burnout" measures, the incremental cost is calculated as the difference between the measure cost and that of the standard measures. For Retrofit/Direct Install measures, the incremental cost is taken as the full measure cost including the price of labour. For larger end uses, it is specific to the project, taking into account technology life left – for instance, a very old pump could be repaired almost indefinitely. An old compressor unit will likely be tossed out.
10. **Incentive Rate Finalized**
    Once the incremental measure cost is finalized, BC Hydro will set a standard incentive using the above considerations. Other considerations include:
    - Interaction with conservation rates
    - Interaction with codes and standards
    - Estimated free-ridership and spillover – for instance, no free ridership might mean that the incentive is too low

COST EFFECTIVENESS REQUIREMENTS

Total Resource Cost (TRC) is used by BC Hydro and the BCUC at the program level to evaluate performance. Programs must have a TRC of 1.0 or greater. There is an expectation of low-income programs. Internally, other cost effectiveness tests are used including utility cost and ratepayer impact measure.

Calculating Cost effectiveness

Cost effectiveness analysis is performed by looking at the stream of benefits and costs resulting from the DSM investment. Four metrics are calculated for each test:

1. Benefit-cost ratio = PV (benefits) / PV (costs)
2. Net present value (NPV) = PV (benefits) - PV (costs)
3. Gross Levelized cost ($/kWh) = PV (costs) / PV (energy savings)
4. Net Levelized cost ($/kWh)1 = PV (costs – all benefits except for electric energy benefits) / PV (energy savings)

TRC Test

Benefits	Costs
• Avoided electric energy costs • Avoided electric capacity costs • Avoided non-electric fuel costs • Customer non-energy impacts[2]	• Utility program costs • Allocated overhead costs • Customer costs • Partner organization program costs

Utility Test

Benefits	Costs
• Avoided electric energy costs • Avoided electric capacity costs	• Utility program costs • Utility incentive costs • Allocated overhead costs

Non-Participant Test (RIM)

Benefits	Costs
• Avoided electric energy costs • Avoided electric capacity costs	• Utility program costs • Utility incentive costs • Allocated overhead costs • Lost revenues

Participant Test

Benefits	Costs
• Electricity bill savings • Non-electricity bill savings • Utility and partner incentive costs • Customer non-energy impacts	• Customer costs

BC HYDRO PROGRAMS

Program Type	Programs	Details
Residential	Behaviour Program[5]	This program intends to inform and educate residential customers about their electricity consumption and motivate customers to reduce that consumption through behavioural changes in their homes. Customers engage in a one-year challenge in reducing electricity consumption by 10 percent, and receive $50 if successful in addition to the bill savings.
	Lighting Program	This program motivates residential customers to make energy efficient choices in their homes and seasonal lighting to transform the market to include more energy efficient lighting products.
	Renovation Rebate Program[5]	Primarily focused on lowering space heating load, this program is targeted towards electrically heated homes and townhouses with forced-air furnaces. It is followed by a home energy assessment. Based on the recommendations on the assessment, customers choose to complete one or more retrofits to improve energy efficiency in their homes. On average, each participant receives about $1,250 in incentives.
	New Home Program	This program intends to create demand and build homes that are more energy efficient than minimum requirements of the B.C. Building Code. Individual measures vary between sites, but will be measured using the EGNH rating system. On a scale of 0-100, homes that achieve greater than 77 may be branded as Power Smart Silver, rating of 80 or more will be branded as Power Smart Gold. Incentives vary depending on the level of achievement, and incentives are also provided for ENERGY STAR appliance and lighting packages.
	Low Income Program[6]	The Low Income Program provides some low-cost energy savings measures that can easily be installed by a homeowner or tenant. The energy saving package includes CFL lamps, faucet aerators, low-flow showerheads, pipe wrap, caulking, draft proofing materials, outlet gaskets, window film, and a number of additional measures as well as energy saving tips. Further offerings are available and delivered through ECAP. They provide qualified low-income residential account holders with a home energy evaluation, the installation of additional energy saving products such as energy-efficient refrigerators and personalized energy efficiency advice. All services and equipment are provided free of charge.
	Appliances and Electronics (Seasonal)	This program motives customers to purchase ENERGY STAR compliant appliances and electronics. This program will focus on the largest energy consuming and most common appliances and electronics that have an ENERGY STAR label.
Commercial	BC Hydro Leaders in Energy Management	This program provides a range of technologies, but focuses on indoor and outdoor lighting, information technology infrastructure (e.g., data servers), heating, ventilation and air conditioning equipment, refrigeration and building operations. There are a number of tools and resources through the program to support this initiative including: • Business Management: Access tools to help you get started by identifying energy efficiency opportunities in your organization • Asset Management: Apply for funding to support energy efficiency implementation projects • Change Management: Obtain education and training to gain energy efficiency expertise and for participant's employees engaged in the process • Peer and Public Recognition: Celebrate designation and achievements

[5] BC Hydro, "Demand Side Management Milestone Evaluation Summary Report F2013," https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/revenue-requirements/directive-66-f2013-demand-side-management-milestone-evaluation-summary-report.pdf (February 2014)

[6] BC Hydro, "F2012 Demand Side Management Milestone Evaluation Summary Report," https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/revenue-requirements/directive-66-f2012-demand-side-management-milestone-evaluation-summary-report.pdf (December 2012)

	High Performance Building	The objective of this program is to acquire energy savings by reducing the energy intensity of new commercial buildings through more efficient design and construction relative to standard practices, and to transform the new commercial building industry to a higher level of energy efficiency. • Whole Building Design: Offers co-funding of energy studies to quantify potential energy savings from integrated design and energy saving measures for the building envelope, lighting and HVAC systems • Energy Efficient Lighting Design: Provides funding for the creation of an energy efficient lighting design and a daylighting study and an incentive for the implementation of approved designs
	Energy Management Assessment (Commercial) Program	This program helps participants to take the first step towards improving energy management practices. It involves: • A diagnostic workshop with senior management • Responding to a series of questions regarding energy management which produces a detailed report that highlights areas of opportunities within your organization • Working together with BC Hydro to provide you with resources to implement recommendations and develop action plans • Conducting a benchmark analysis which ranks your organization against other within your industry • An annual review to track progress
Industrial	Energy Studies & Audits	Energy assessments are given to determine how to use energy and trim costs. Eligibility is based on energy consumption and system size. The types of studies available are: • Customer Site Investigation • Plant-wide Audit • End Use Assessment • Energy Efficiency Feasibility Study
	Project Incentives	• Self-Serve Incentive Program: Industrial customers and facilities that use 500 megawatt-hours or more electricity per year o Eligible technologies are: Compressed Air Systems between 40 and 200 horsepower; and/or Industrial Lighting • Distribution: Customers that use more than one gigawatt-hour of electricity per year that will save at least 50 megawatt-hours per year o Funding covers all aspects of your project including: design, equipment, installation, disposal and tax • Transmission: Customers that use more than one gigawatt-hour of electricity per year that will save at least 300 megawatt-hours per year o Funding covers all aspects of your project including: design, equipment, installation, disposal and tax • New Plant Design: Customers in early stage of planning a new facility or expanding an existing facility, an expectation to increase the power load by five percent or more, and an electricity savings potential of more than 300 megawatt-hours per year
	Strategic Energy Management	• Industrial Energy Manager: Customers with more than 10 gigawatt-hours of electricity consumption per year, must hire an energy manager as a full-time employee o 100 percent funding of: energy management consulting services, required training for a new energy manager, on-site Energy Management Assessment • Energy Management Assessment: Must participate in the Strategic Energy Management Program o A free three-hour on-site facilitated session provided • Employee Energy Awareness o Variety of free materials given to remind, educate, and to introduce new operational procedures o BC Hydro also provides funding to help energy managers deliver on Workplace Conservation Awareness

Others	Sustainable Communities Program	• Community Energy & Emissions Plan (CEEP): Intended for improved energy management and it can be used to foster green economic development in the community • Community Energy Manager (CEM): Funding for a dedicated staff resource within local government to drive sustainable policies and projects that reduce electricity consumption and greenhouse gas emissions within the community • Local Area Plan (LAP): To integrate energy planning and conservation measures into land use planning for a specific area. Funding provided for energy experts to participate on the multidisciplinary planning team and to provide data compilation, analysis and recommendation • Project Implementation (Pilot): Funding to drive energy conservation plans, policies and projects into action
	Business Energy Advisors	A Business Energy Advisor will meet with participants to tour their business and identify energy saving opportunities for both electricity and natural gas. Advisors will also introduce applicable incentives for upgrading to energy efficient technologies to better understand consumption as well as simple energy saving behaviours a business can do.

APPENDIX A-4: CALIFORNIA (PG&E)

BACKGROUND

Efficiency Nova Scotia has contracted CLEAResult to conduct energy conservation and energy efficiency program incentive research. The project covers the following areas:

- Identification of best practices for incentive rate setting from other jurisdictions
- Application to Nova Scotia's market

The goal of the project is to generate a guideline for program incentive setting, which features best practices and considerations. Ultimately, this will be used by Efficiency Nova Scotia to help optimize their energy conservation and efficiency program design and delivery to meet their conservation and environmental protection goals.

To assist with the first part of the project, CLEAResult has identified jurisdictions that are considered best in class for their conservation efforts and program offers. We aim to understand how these jurisdictions set their incentives for their programs. In order to do this, we would require a one-time 30-minute to 1-hour telephone interview with key contact(s) in those jurisdictions.

Regarding publication, the jurisdictional scan will be included in the submission to Efficiency Nova Scotia. It will contain all of the details captured in the interview guide. The key contact(s) will be able to review the final jurisdictional scan document before submission. The final project documents will be included in Efficiency Nova Scotia's submission to the Utility and Review Board (UARB), Nova Scotia's regulatory body, and will be publically available.

OVERVIEW

Jurisdictional Scan	
State/Province	California
Utility/Agency	Pacific Gas & Electric
Fuel	Electricity
Key Contact/Interviewee	Carolyn Weiner Manager, EE Core Products carolyn.weiner@pge.com office: 415-973-2391 cell: 415-852-8663
Consultant	Jonathan Houle

STATE OVERVIEW OF ELECTRICITY MARKET

As the largest U.S. state by population[1], and second largest in terms of energy consumption[2] California has a rich history of providing utility and government sponsored energy efficiency programs to its residential and industrial customer base. Regarding energy efficiency programs, the following are the key stakeholders in utility or agency sponsored energy efficiency and demand management program regulation and delivery:

- California Public Utilities Commission
- Load Serving Entities, specifically the Investor Owned and Publically Owned Utilities
- California Energy Commission
- California ISO

[1] Enchantedlearning.com, http://www.enchantedlearning.com/usa/states/population.shtml

[2] U.S Energy Information Association – Detailed State Data, https://www.eia.gov/electricity/data/state/

Load Serving Entities

California is served by approximately 81 load serving entities (LSEs)[3]. These are broken down as:

- Investor-Owned Utilities - 6
- Electricity Service Providers - 22
- Publicly Owned Utilities - 46
- Rural Electricity Cooperatives - 4
- Community Choice Aggregators - 3

The five largest utilities based on and total electricity consumption (in 2014) were:

1. Southern California Edison Company (SCE)
2. Pacific Gas and Electric Company (PG&E)
3. Los Angeles Department of Water and Power (LADWP)
4. San Diego Gas & Electric (SDG&E)
5. Sacramento Municipal Utility District (SMUD)

Electricity Generation

Figure 1 below highlights the various forms of generation (both in-state and out of state) used to meet California's electricity needs in 2014[4]. Figure 2 highlights the historical trend of installed in-state capacity from 2001 to 2014.[5]

2014 Total System Power in Gigawatt Hours

Fuel Type	California In-State Generation (GWh)	Percent of California In-State Generation	Northwest Imports (GWh)	Southwest Imports (GWh)	California Power Mix (GWh)	Percent California Power Mix
Coal	1,011	0.5%	-	17,877	18,888	6.4%
Large Hydro	14,052	7.1%	160	2,138	16,350	5.5%
Natural Gas	121,934	61.3%	1	10,151	132,087	44.5%
Nuclear	17,027	8.6%	-	8,193	25,220	8.5%
Oil	46	0.0%	-	-	46	0.0%
Other	16	0.0%	-	-	16	0.0%
Renewables	44,887	22.5%	11,423	3,493	59,803	20.1%
Biomass	6,721	3.4%	762	24	7,507	2.5%
Geothermal	12,186	6.1%	150	694	13,030	4.4%
Small Hydro	2,426	1.2%	361	-	2,787	0.9%
Solar	10,557	5.3%	-	2,009	12,566	4.2%
Wind	12,997	6.5%	10,151	766	23,913	8.1%
Unspecified Sources of Power	N/A	N/A	25,676	18,757	44,433	15.0%
Total	198,973	100.0%	37,261	60,609	296,843	100.0%

Figure 29: California Total System Power 2014

[3] http://energyalmanac.ca.gov/electricity/overview.html

[4] http://energyalmanac.ca.gov/electricity/total_system_power.html

[5] http://energyalmanac.ca.gov/electricity/electric_generation_capacity.html

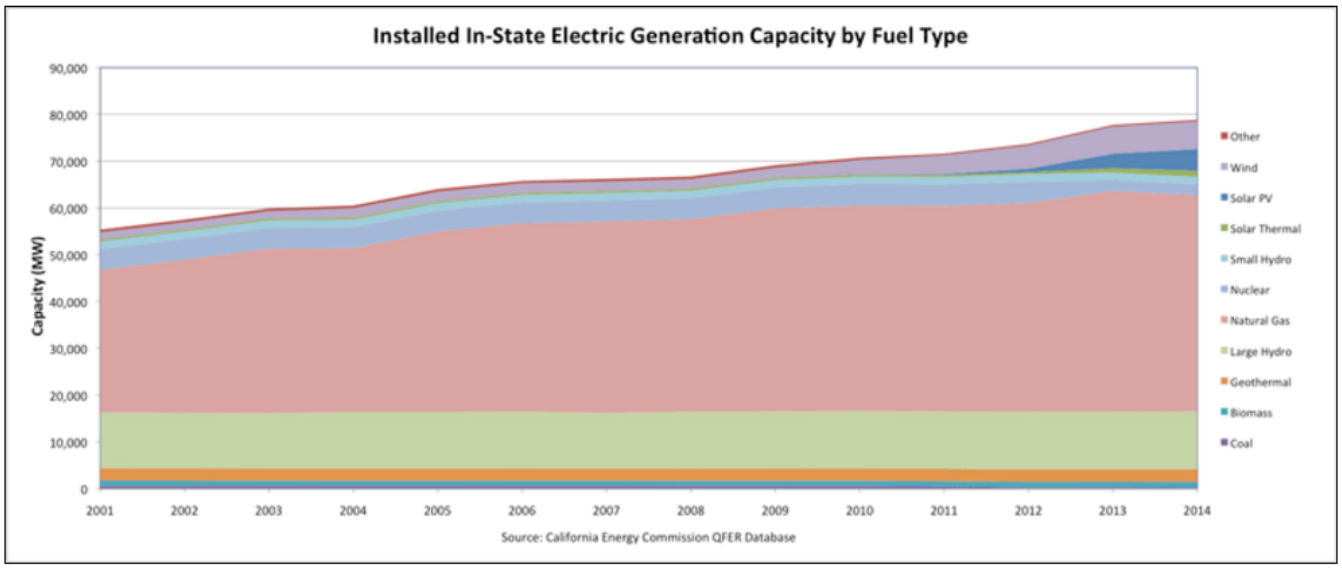


Figure 30: California Total Installed In-State Capacity by Fuel Type

Average Retail Prices[6]

Sector	Retail Rate (cents/kWh)
Residential	16.25
Commercial	15.62
Industrial	12.34

Table 34: Average Retail Rates California - 2014

CALIFORNIA ENERGY EFFICIENCY PROGRAM INCENTIVE & COST EFFECTIVENESS POLICY

California has long been recognized as one of the leading jurisdiction in North America regarding the regulatory standards and policies established to guide the design and delivery of energy efficiency programming. Recently, in order to set annual target and budgets for Program Administrators (PAs), the CPUC moved forward in a proposed decision[7] to create a "Rolling Target" system where long-term targets would be set and updated on an annual basis to include the next year in the long-term forecast. This new rule would require IOUs to submit annual budget to the Commission for approval along with a "business plan" every five years.

While PAs do not have set budget over the term of the forecast, D.14-10-046 has committed to funding roughly $1B in ratepayer funds towards energy efficiency and conservation programs on a go-forward basis.

[6] Energy Information Association, http://www.eia.gov/electricity/state/california/index.cfm
[7] Rulemaking 13-11-005, California Public Utilities Commission, Filed August 18, 2015 http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M154/K225/154225993.PDF

Cost Effectiveness Testing

As detailed in D.14-10-046[8], the CPUC has interpreted its mandate to deliver cost-effective energy efficiency and conservation programs as meaning that all energy efficiency portfolios of delivery agents should be cost effective. Within the utility and agency sponsored energy efficiency and conservation community, California's Standard Practice Manual is seen as a benchmark regarding the integration of energy efficiency as a resource and how to use cost effectiveness testing to weigh the contribution of those resources. Programs are evaluated based on Total Resource Cost (TRC) test and the Program Administration Cost (PAC) test.

The Energy Efficiency Policy Manual requires that the energy efficiency portfolio as a whole has higher benefits than costs for both the TRC and PAC tests. The Standard Practice Manual defines the TRC test as the measurement of the net benefits and costs that accrue to society, which is defined as a program administrator (usually a utility) and all of its customers. It compares the benefits, which are the avoided cost of generating electricity and supplying natural gas, with the total costs, which include program administration and customer costs. The TRC does not include the costs of incentives. On the other hand, the PAC test does not include the costs incurred by participating customers but does include incentives paid to participating customers. The PAC test measures the benefits and costs that accrue to the program administrator, which is usually, but not always, the utility.

California uses its DEER database to perform measure level cost effectiveness testing. Additionally, Energy and Environment Economics (E3) has made a portfolio cost effectiveness testing model.

Avoided Costs

Within California, the avoided costs of electricity are generated by E3 for a 20-year period based on the following components: generation energy, generation capacity, ancillary services, transmission and distribution capacity, environment (i.e., avoided greenhouse gases), and the avoided renewable portfolio standard. The avoided cost model is periodically updated to improve the accuracy of how benefits of demand-side resources are calculated. Natural gas avoided costs include: commodity costs, losses, transmission and distribution, and emissions.[9]" The most recent update was completed in 2011.

Please see Table 1 below which details what factors are taken into account when examining each avoided cost component in California:

Component	Basis of Annual Forecast	Basis of Hourly Shape
Generation Energy	Forward market prices and the $/kWh fixed and variable operating costs of a CCGT	**Historical hourly day-ahead market price shapes from MRTU OASIS**
Generation Capacity	Residual capacity value a new simple-cycle combustion turbine	**Top 250 CAISO hourly system loads**
Ancillary Services	Percentage of Generation Energy value	**Directly linked with energy shape**
T&D Capacity	Marginal transmission and distribution costs from utility ratemaking filings	**Hourly temperature data**
Environment	Synapse Mid-Level carbon forecast developed for use in electricity sector IRPs	**Directly linked with energy shape with bounds on the maximum and minimum hourly value**
Avoided RPS	Cost of a marginal renewable resource less the energy market and capacity value associated with that resource	**Flat across all hours**

Table 35: California Avoided Cost Components

[8] Decision 14-10-046, California Public Utilities Commission, Filed November 14, 2013 http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M129/K228/129228024.pdf

[9] Energy and Environmental Economics (E3), Energy Efficiency Avoided Cost 2011 Update, December 2011, https://ethree.com/public_projects/cpuc4.php

PACIFIC GAS & ELECTRIC (PG&E) – UTILITY OVERVIEW

Utility Facts[10]

- Service area stretches from Eureka in the north to Bakersfield in the south, and from the Pacific Ocean in the west to the Sierra Nevada in the east
- 141,215 circuit miles of electric distribution lines and 18,616 circuit miles of interconnected transmission lines
- 42,141 miles of natural gas distribution pipelines and 6,438 miles of transportation pipelines
- 5.3 million electric customer accounts
- 4.4 million natural gas customer accounts

Fourth Quarter and full year, 2015 vs. 2014

	Three Months Ended December 31,		Twelve Months Ended December 31,	
	2015	2014	2015	2014
Sales from Energy Deliveries (in millions kWh)	21,015	20,944	85,860	86,303
Total Electric Customers at December 31			5,311,178	5,276,025
Total Gas Sales (in Bcf)	226	214	854	870
Total Gas Customers at December 31			4,415,332	4,394,283
Sources of Electric Energy (in millions kWh)				
Total Utility Generation	6,790	7,444	30,372	28,794
Total Purchased Power	12,713	11,496	48,175	52,008
Total Electric Energy Delivered (1)	21,015	20,944	85,860	86,303

Figure 31: PG&E 2015 Annual Report - 2014 vs. 2015 Utility Fact[11]

Customer Class Breakdown

The chart below highlights PG&E's consumption by customer class as identified by California's Energy Consumption Data Management System[12]. The total annual energy consumption in 2014 was 86TWh.

[10] PG&E Company Profile, https://www.pge.com/en/about/company/profile/index.page

[11] http://www.pgecorp.com/news/pdf/2015Q4EarningsSlides.pdf

[12] http://www.ecdms.energy.ca.gov/elecbyutil.aspx

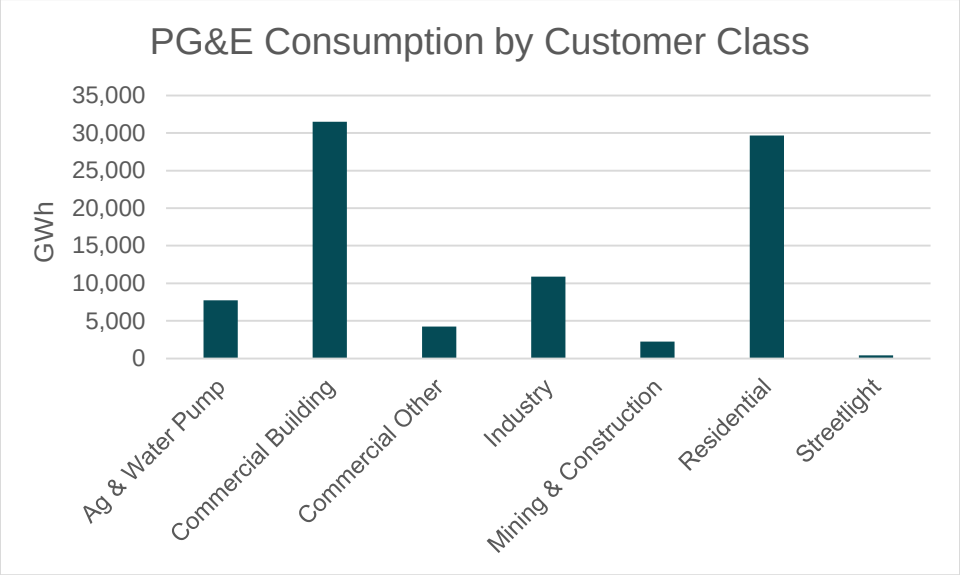


Figure 32: PG&E Consumption by Customer Class

PG&E - ENERGY EFFICIENCY PROGRAMMING

PG&E has been delivering energy efficiency programs to its customers since 1976 having kept more than 168 million metric of CO_2 out of the atmosphere based on cumulative lifecycle gross energy savings. [13]

Savings

PG&E's programs have proven very successful at reducing energy consumption and incentivizing energy efficient behaviours and investment decisions. In the 2013-2015 period, PG&E managed to achieve between 110-143 percent of annual gross energy savings goals and 130-164 percent of annual demand goals delivered through PG&E Programs (excludes Codes & Standards savings).[14]

[13] http://www.pge.com/en/about/environment/pge/energyefficiency/index.page
[14] http://eestats.cpuc.ca.gov/Views/Documents.aspx

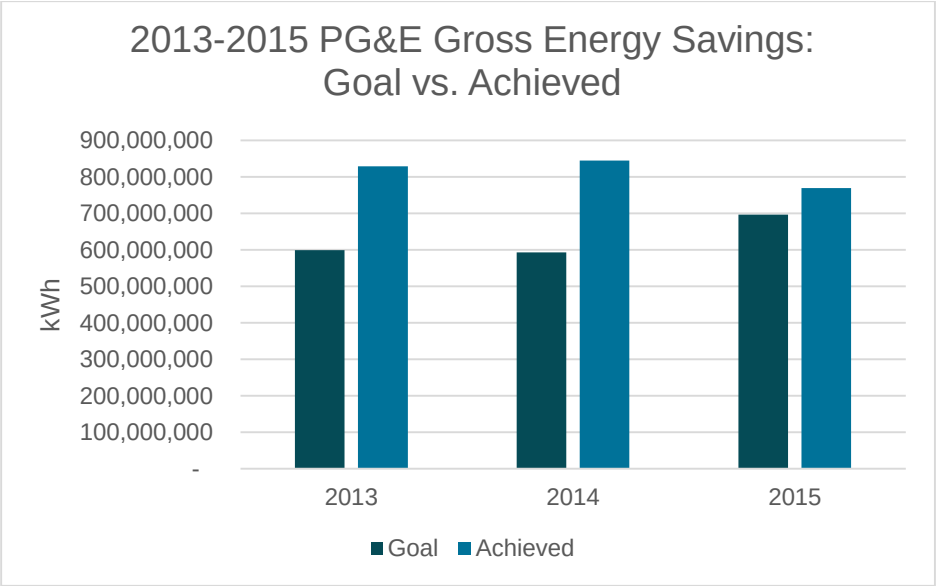


Table 36: PG&E 2013-2015 Gross Energy Savings

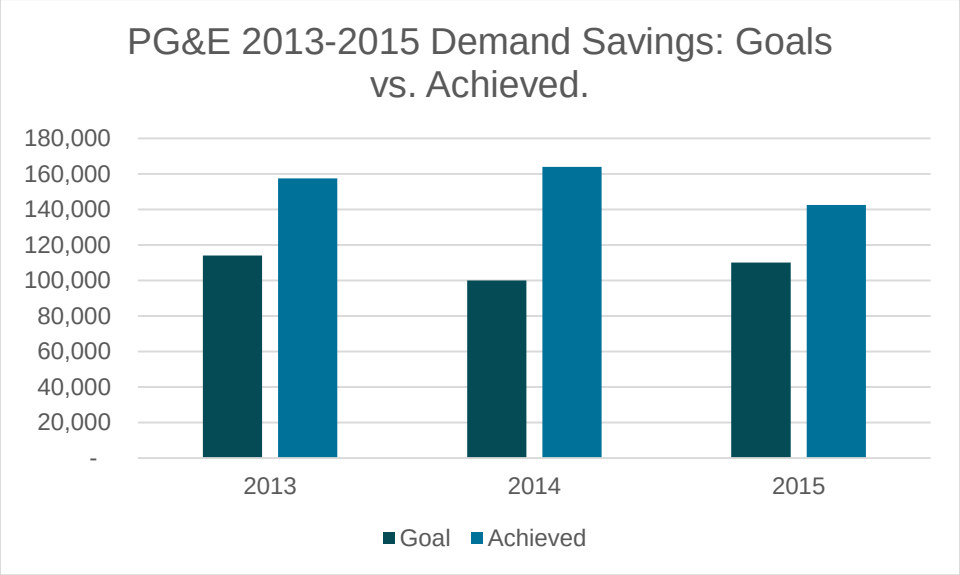


Table 37: PG&E 2013-2015 Demand Savings

Budget & Spending

PG&Es total budget spending on energy efficiency programming (including Codes & Standards funding and On-Bill Financing) achieved through actual expenditures of $1.53B vs. a budget of $1.68B. This is to be commended given PG&E's ability to exceed its targets. The budget specific to energy efficiency programming is as follows:

2013-2015 Total Portfolio $/kWh*			
	2013	**2014**	**2015**
Gross Savings (kWh)	828,999,924	845,181,086	769,529,791
Spending	$ 317,221,372	$ 365,056,021	$ 385,199,846
$/kWh	$ 0.38	$ 0.43	$ 0.50
*Excludes C&S,EM&V and On-Bill Financing expenses reported			
**Budgeted, not actuals			

PG&E 2013-2015 Incentive-to-Administrative Spending Ratios			
	2013	**2014**	**2015**
Incentive	261,270,952	296,147,345	N/A
Administration	$ 55,950,420	$ 68,908,676	N/A
Incentive: Administration Spending Ratio	82:18	81:19	N/A

Cost Effectiveness

All California PAs must deliver energy efficiency portfolios which have a TRC and PAC greater than 1. Below is PG&E's historical cost effectiveness for its 2013 and 2014 program portfolio.

PG&E 2013-2015 Incentive-to-Administrative Spending Ratios			
	2013	**2014**	**2015**
TRC	1.33	1.38	N/A
PAC	2.36	2.18	N/A

FUTURE TARGETS

Below are individual IOU gross annual targets filled to the CPUC in R-13-11-005:

Table 1. Annual GWh

	PG&E			SCE			SDG&E		
Year	IOU Programs	Net C&S[17]	Total	IOU Programs	Net C&S	Total	IOU Programs	Net C&S	Total
2016	625	611	1,236	674	631	1,304	183	143	327
2017	637	506	1,144	694	522	1,216	186	119	305
2018	507	408	916	528	421	949	141	96	237
2019	511	401	912	542	414	955	144	94	238
2020	519	381	900	553	393	946	147	89	236
2021	524	326	850	542	337	879	147	76	223
2022	541	295	836	559	304	863	151	69	220
2023	558	254	812	573	262	835	154	59	214
2024	581	240	821	593	247	840	158	56	214

Figure 33: California IOU Annual GWh Energy Efficiency Targets 2016-2024

Table 2. Annual MW

	PG&E			SCE			SDG&E		
Year	IOU Programs	Net C&S	Total	IOU Programs	Net C&S	Total	IOU Programs	Net C&S	Total
2016	85	141	226	122	145	267	25	33	58
2017	87	105	193	123	108	231	26	25	51
2018	69	103	172	99	106	206	20	24	44
2019	70	103	173	103	107	210	20	24	44
2020	71	101	173	107	104	211	21	24	45
2021	74	94	169	103	97	201	21	22	43
2022	80	90	170	109	92	201	22	21	43
2023	86	84	171	113	87	200	23	20	43
2024	92	82	173	119	84	203	25	19	44

Figure 34: California IOU Annual MW Energy Efficiency Targets 2016-2024

INCENTIVE LEVEL SETTING METHODOLOGY

PG&E's Energy Efficiency Products organization was formed approximately six years ago in part to standardize and streamline the measures developed and marketed through PG&E's breadth of energy efficiency programs. One of the organization's responsibilities is to provide PG&E the resources to actively study market and technology trends (both

technologically and economically) while optimizing PG&E's portfolio of incentivized products based on the technological and market maturity of a measure.

It is important to highlight the regulatory approach for communicating incentive levels to California's Public Utility Commission. The PA's Program Implementation Plans provide incentive levels for each measure offered in that respective program; when a change is made to an incentive level, the PA is required to report that change when it changes more than 50 percent of the reported amount. Historically, the Public Utility Commission may focus on the portfolio cost effectiveness including the total incentive spend for programs as well as other major cost elements like administration, marketing, and other non-incentive implementation costs.

To ensure measure design is properly vetted, PG&E's Products organization has instituted a structured process in which new energy efficiency solutions and services are researched and evaluated for their appropriateness for inclusion in the energy efficiency program portfolio and appropriate incentive levels are defined. This "gated" process ensures that all new and existing technologies are properly vetted by engineering and program staff and are approved on their technical merits (i.e., energy savings potential) by the Commission. Outside of regulatory proceedings this process, named SPARC (Smart Products and Rewards Customers), has been presented to the Commission and is attached in Exhibit A.

Below is an overview of the process employed by PG&E when examining an incentive rate for a new product or proposing a significant change to an existing incentive rate (change in incentive greater than 50 percent). Please note that PG&E uses a streamlined version of the E3 Cost Effectiveness model at each stage in order to calculate preliminary measure level incentives and cost effectiveness to ensure that the incentives will be properly set to achieve the appropriate market transformation goals while maintaining portfolio level cost effectiveness. It is important to note that for PG&E, there is no requirement for individual measures to have a TRC or PAC greater than 1 which allows PG&E to invest in high potential measures and technologies.

11. **Market Research**
    PG&E staff will begin the incentive setting process by performing both primary and secondary market research in order to determine the measure performance metrics and costs. This will include holding interviews with the appropriate manufacturers and distributors to obtain information on their price buildups while also obtaining a sample set of sufficient size to determine the above metrics. These results of manufacturer and distributor interviews are kept confidential in order to protect any competitive information or market intelligence which may have the potential to harm a certain manufacturer or distributor.
12. **Work Paper**
    Once measure level data is acquired from the market, the Products organization will engage its engineering staff to produce a Work Paper. The Work Papers, similar to TRMs found in other jurisdictions, are documents which detail how measure savings are to be calculated including the appropriate EM&V protocols as well as the measure costs. Once completed, the Work Papers are approved by the Commission and the measure is now available to be offered with a PAs program portfolio. It is important to note that the Work Papers do not include any incentive rates as this is determined by the PA and reviewed with the CPUC through Program Implementation Plans.
    The next step in the incentive design is to determine the proposed measure's incremental cost. Generally, PG&E will attempt to incentivize 75-100 percent of the incremental cost of new measure and adjust accordingly as the technology and market penetration matures. For "Replace on Burnout" measures the incremental cost is calculated as the difference between the measure cost and that of the standard measures contained in the building code. For Retrofit/Direct Install measures, the incremental cost is taken as the full measure cost including the price of labor.
13. **Incentive Rate Finalized**
    Once the incremental measure cost is finalized, the Products team will set a standard incentive using the above considerations. Currently, PG&E is attempting to standardize this process in order to cascade the incentive rate not only into PG&E's utility administered programs but as well as third-party programs (3P) administered by outside implementers. The 3Ps have the option to provide "kickers" (increased incentive rates) in order to drive additional market participation in their programs.

For programs where the incentives are not fixed but are based on a $/kWh or $/kW, a similar gated process as the above is employed but is somewhat modified using the following considerations:

- Historical Project Costs: In order to determine the broad project costs, a sample set of historical projects is reviewed.

- Payback Period: PG&E attempts to set the $/kWh or $/kW incentives based on bringing average project payback per category (i.e., lighting vs. non-lighting) to approximately under five years. A product is usually not incentivized should it have a payback greater than 10 years without incentives.
- Targeted vs. Non-Targeted Incentives: The targeted incentives are put in place to try and encourage program participants to implement “deeper” measures/retrofits.
- Cost Effectiveness: Cost effectiveness is only tested at the program level and not the measure level.
- Incentive Update Frequency: The $/kW and $/kWh incentives are not updated as frequently as the fixed incentives within PG&E’s portfolio. The last update was performed approximately three years ago.

APPENDIX A-5: OREGON & WASHINGTON (ENERGY TRUST OF OREGON)

BACKGROUND

Efficiency Nova Scotia has contracted CLEAResult to conduct energy conservation and energy efficiency program incentive research. The project covers the following areas:

- Identification of best practices for incentive rate setting from other jurisdictions
- Application to Nova Scotia's market

The goal of the project is to generate a guideline for program incentive setting, which features best practices and considerations. Ultimately, this will be used by Efficiency Nova Scotia to help optimize their energy conservation and efficiency program design and delivery to meet their conservation and environmental protection goals.

To assist with the first part of the project, CLEAResult has identified jurisdictions that are considered best in class for their conservation efforts and program offers. We aim to understand how these jurisdictions set their incentives for their programs. In order to do this, we would require a one-time 30-minute to 1-hour telephone interview with key contact(s) in those jurisdictions.

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OVERVIEW

Jurisdictional Scan	
State/Province	Oregon, Washington
Utility/Agency	Energy Trust of Oregon
Fuel	Electricity, Natural Gas
Key Contact/Interviewee	Marshall Johnson Residential Sector Manager Marshall.johnson@energytrust.org Office: 503-445-2949
Consultant	Jonathan Houle

OVERVIEW OF ENERGY TRUST OF OREGON UTILITIES & ENERGY MARKETS

The Energy Trust of Oregon serves four utilities which cover two states:

- Portland General Electric (PGE), Oregon – Electricity
- Pacific Power, Oregon – Electricity
- NW Natural, Oregon & Washington – Gas
- Cascade Natural Gas, Oregon– Gas

The Energy Trust is regulated by the Oregon Public Utilities Commission and the Washington Utilities and Transportation Commission. Please note that Cascade Natural Gas and NW Natural also operate their own energy efficiency programs in markets outside of Oregon.

Utility	Description

Cascade Natural Gas[1]	• 272,000 customers in 96 communities
	  ○ 68 in Washington
	  ○ 28 in Oregon
	  ○ 60,000-70,000 of those customers are served by the Energy Trust
	• 32,000 square miles

NW Natural[2]	• Over 700,000 customers[3]
	  ○ 14,000 miles of distribution and transmission pipeline
	  ○ ~647,000 residential, ~67,000 commercial, ~1,000 industrial
	• 90% Oregon & 10% Washington
	  ○ In total 100 cities in 18 counties with a population of 3.5 million

Portland General Electric[4]	• Total Population Served: 1,800,000
	• Number of retail customers:
	  ○ Residential: 735,502
	  ○ Commercial: 105,231
	  ○ Industrial: 260
	• Cities Served: 52
	• Total GWh delivered: 19,266GWh

Pacific Power (PacifiCorp)	• Customers Total: 1,783,000
	  ○ Residential: 1,551,000
	  ○ Commercial: 196,000
	  ○ Industrial and irrigation: 36,000
	• Customers by state
	  ○ Oregon: 562,050
	  ○ Washington: 128,140
	  ○ California: 44,732
	  ○ Utah: 835,232
	  ○ Wyoming: 138,868
	  ○ Idaho: 73,871

Please note that not all customers highlighted above are served by the Energy Trust of Oregon as the utilities operate outside of the Energy Trust's service area. In total, the Energy Trust serves approximately 1.5 million customers.

[1] http://www.cngc.com/utility-navigation/about-us

[2] http://www.snl.com/Cache/1001201668.PDF?Y=&O=PDF&D=&fid=1001201668&T=&iid=4057132

[3] http://www.snl.com/Cache/33120620.pdf?IID=4057132&FID=33120620&O=3&OSID=9

[4] https://www.portlandgeneral.com/our-company/pge-at-a-glance/quick-facts

STATE ELECTRICITY GENERATION MIX

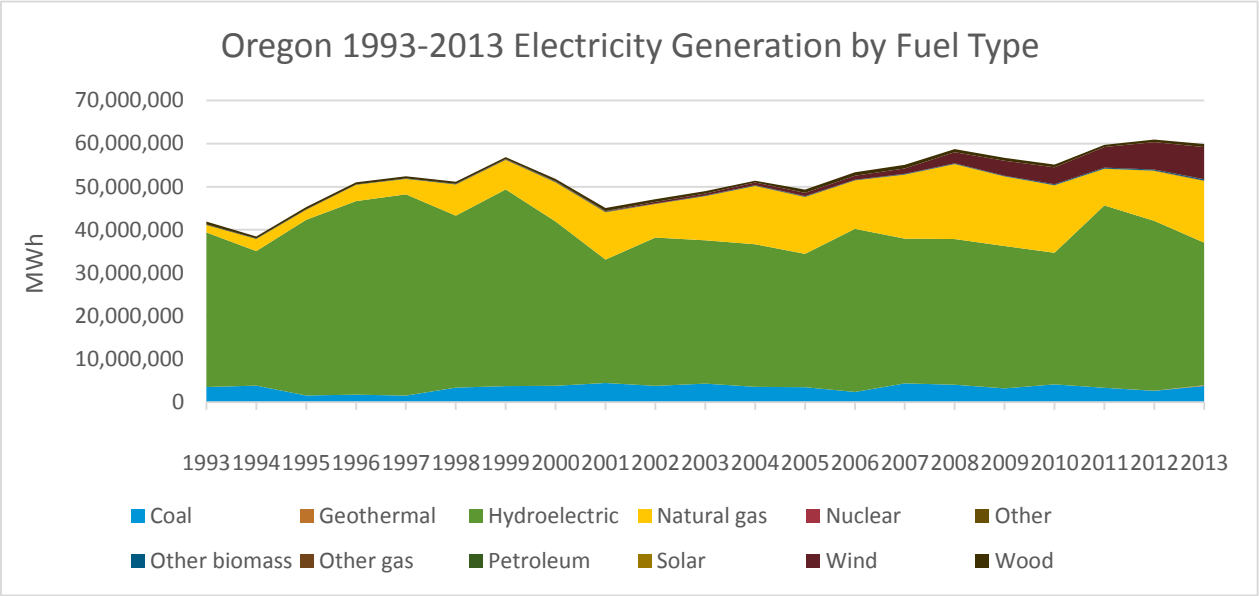


Figure 35: Oregon 1993-2013 Electricity Generation by Fuel Type[5]

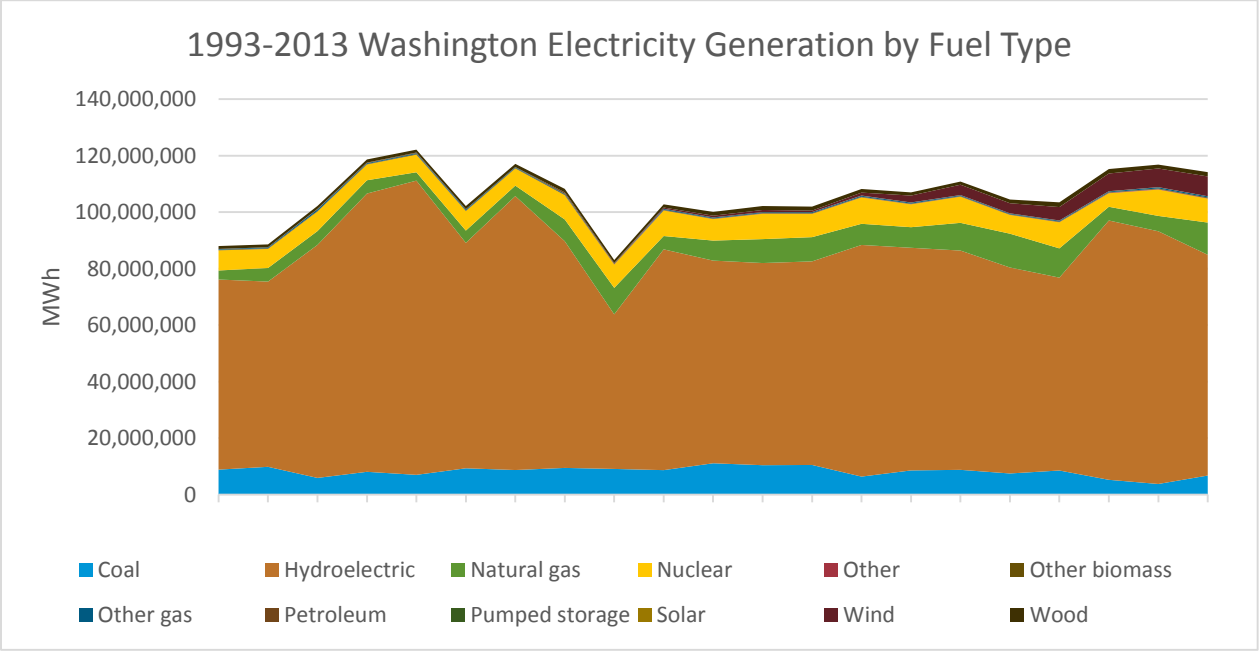


Figure 36: Washington 1993-2013 Electricity Generation by Fuel Type[6]

[5] http://www.eia.gov/electricity/state/oregon/index.cfm
[6] http://www.eia.gov/electricity/state/washington/index.cfm

RETAIL ENERGY RATES

Below are the 2014 electricity rates for Portland General Electric and Pacific Power and the 2014 retail natural gas rates for Oregon and Washington sourced from the U.S. Energy Information Association. These rates are inclusive of transmission and distribution and are in U.S. dollars.

2014 Retail Electricity Rates[7] (cents/kWh)	Portland General Electric	Pacific Power
Residential	11.37	11.09
Commercial	9.14	9.08
Industrial	6.46	7.37

2014 Retail Electricity Rates[8] ($/Mcf)	Oregon	Washington
Residential	11.72	10.59
Commercial	9.44	9.03
Industrial	5.79	8.55

ENERGY TRUST OF OREGON STRUCTURE AND FUNDING[9]

History

In 1999, Oregon lawmakers and citizens envisioned a future with Oregon homes and businesses powered by clean, affordable energy. They established stable, consistent funding to help Oregonians invest in energy efficiency and renewable resources. A new non-profit organization—Energy Trust of Oregon—was created to lead the way.

Energy Trust began operation in March 2002, charged by the Oregon Public Utilities Commission with investing in cost-effective energy efficiency, helping to pay the above-market costs of renewable energy resources, delivering services with low administrative and program support costs and maintaining high levels of customer satisfaction.

Customers of four utilities in two states now fund and directly benefit from Energy Trust programs.

Energy Trust of Oregon Funding

Through state legislation, tariffs and other requirements, Energy Trust is funded by customers of Portland General Electric, Pacific Power, NW Natural and Cascade Natural Gas. Customers of all four utilities pay a dedicated percentage of their utility bills to support a variety of energy-efficiency and renewable energy services and programs.

As a result of a 1999 energy restructuring law, Oregon's two largest electric investor-owned utilities (PGE and Pacific Power) are required to collect a three percent “public purpose charge” from their customers. The funds support:

1. Energy conservation in K-12 schools delivered through school districts
2. Low-income housing energy assistance delivered through Oregon Housing and Community Services
3. Energy efficiency and renewable energy programs for residential and business customers delivered through Energy Trust, an independent, third party approved by the OPUC in 2001

In addition to its work under the 1999 energy restructuring law, Energy Trust administers gas conservation programs for Oregon residential and business customers of NW Natural (as of 2003) and Cascade Natural Gas (as of 2006). In 2009,

[7] http://www.eia.gov/electricity/data.cfm#sales

[8] http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_SOR_a.htm

[9] https://energytrust.org/about/who-we-are/

through an agreement with NW Natural and the Washington Utilities and Transportation Commission, Energy Trust began serving NW Natural's customers in Washington.

The last piece of Energy Trust funding is separate legislation passed in 2007 that allows PGE and Pacific Power to work with Energy Trust on capturing more low-cost electric efficiency for their customers—avoiding the need to purchase more expensive electricity.

The pace at which Energy Trust energy-efficiency programs delivered savings changed significantly after 2008. In 2013, Energy Trust programs saved twice as much electric energy (58 average megawatts) as they did in 2009 (27 aMW). This doubling in annual savings was made possible by the passage of SB 838, which allowed the electric utilities to supplement funding for electric efficiency beyond the three percent charge established in Energy Trust's enabling legislation, to acquire all cost-effective energy efficiency identified in their long-term planning processes.

Natural gas savings also increased from 2.7 million annual therms in 2009 to 5.3 MMTh in 2013 as Energy Trust programs matured and expanded to address the needs of more customers and closely align with utility long-term planning. Also in 2009 Energy Trust and NW Natural entered into agreements to provide program offerings for a portion of NW Natural industrial demand-side management customers and for NW Natural customers in southwest Washington.

With the passage of SB 838 and the expanded gas efficiency agreements, Energy Trust's goals were set to acquire cost-effective energy efficiency as determined within utility long-term planning. Prior to that, goals were limited by funding and not by opportunity. Achieving this higher level of performance required a focused effort to diversify and refine Energy Trust programs, generate faster feedback from participants on program effectiveness, process more incentives and serve more customers with strategies tailored to meet their needs. It also required a larger annual budget and expenditures, bringing Energy Trust's expenditures for energy efficiency to $117 million in 2013, as compared to $63 million in 2008.[10]

Northwest Power Plan[11]

The Northwest Power & Conservation Council represents the regional power planning efforts of Idaho, Washington, Oregon and Montana. The Northwest Power Act requires that the Council produce a 20-year Power Plan each 5 years. The most recent Plan was released in February 2016. Within the Plan, it identifies energy efficiency as the resource with the least cost, while also avoiding risks of volatile fuel prices, financial risks associated with large-scale resources and also mitigating the risk of carbon reduction policies. Energy efficiency was also identified as contributing significantly to the region's future capacity needs.

Accordingly, the Council has stated that the development of all cost-effective energy efficiency should remain the priority in the region to meet electricity resource needs. The Council has balanced the cost of procuring energy efficiency resources to ratepayers against the cost of future capacity and generation requirements.

ENERGY EFFICIENCY BUDGETS AND TARGETS[12]

Below are the annual budgets and targets presented by the Energy Trust in its Annual Budget and Action Plans referred to below.

	2013	2014	2015	2016
Electricity Efficiency	$125,804,504	$130,262,893	$130,359,188	$141,288,266
Gas Efficiency	$28,471,175	$28,946,948	$23,316,785	$26,347,507
Total	$154,275,679	$159,209,841	$153,675,973	$167,635,773

[10] http://assets.energytrust.org/api/assets/plans/2015-2019_Strategic_Plan0.pdf
[11] https://www.nwcouncil.org/media/7149935/7thplanfinal_chap03_resstrategy.pdf
[12] https://energytrust.org/About/policy-and-reports/Plans.aspx

	2013	2014	2015	2016
Electricity Savings (aMW)	50.3	57.7	53.1	55.1
Natural Gas Savings (MM Therms)	6.0	6.1	5.8	6.0

INCENTIVE-TO-ADMINISTRATION EXPENSE RATIOS

Below are the incentive-to-administration expense ratios by year obtained from the annual approved budgets for the Energy Trust's Annual Budget and Action Plans. The expenses listed are related to energy efficiency. Please note that "administration" in this context refers to both Energy Trust's costs of managing its budget and programs, third party delivery agent costs, marketing, IT and evaluation costs. The incentives include only costs related to providing product incentives or direct services to program participants. (i.e., audits).

	2013	2014	2015	2016
Incentive Costs	$85,792,815	$87,475,385	$81,650,474	$90,618,627
Administration	$68,482,871	$71,734,454	$72,025,504	$77,017,143
Incentive-to-Administration Ratio	56:44	55:45	53:47	65:35

2015-2019 STRATEGIC PLAN[13]

Goal: Acquire all achievable, cost-effective energy efficiency for utility customers

Five-year energy-efficiency goals:

- Between 2015 and 2019, save 240 average megawatts (aMW) of electricity
- Between 2015 and 2019, save 24 million annual therms (MMTh) of natural gas

[13] http://assets.energytrust.org/api/assets/plans/2015-2019_Strategic_Plan0.pdf

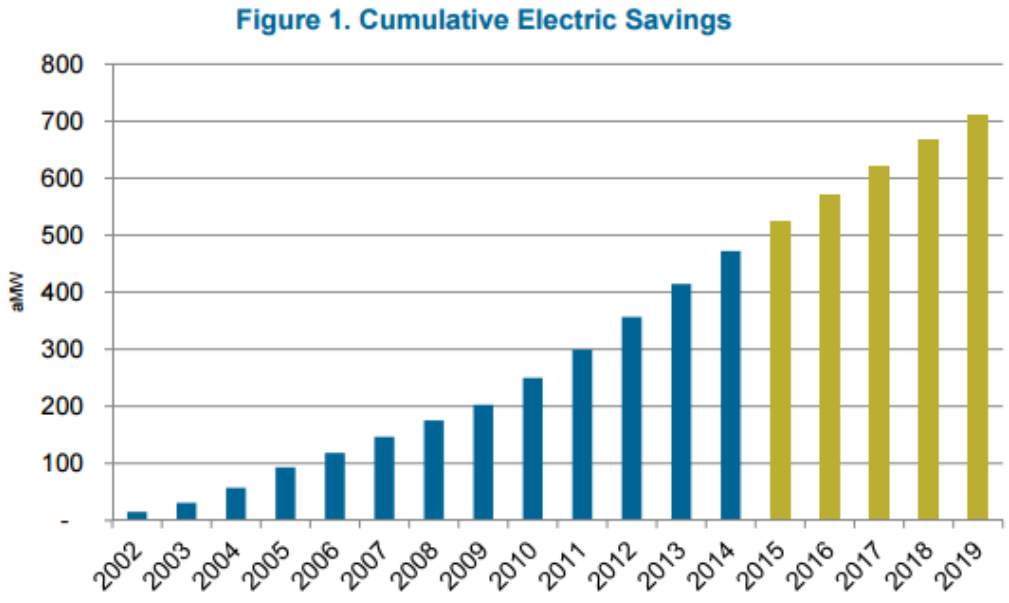


Figure 37: Energy Trust 2015-2019 Cumulative Electric Savings Target

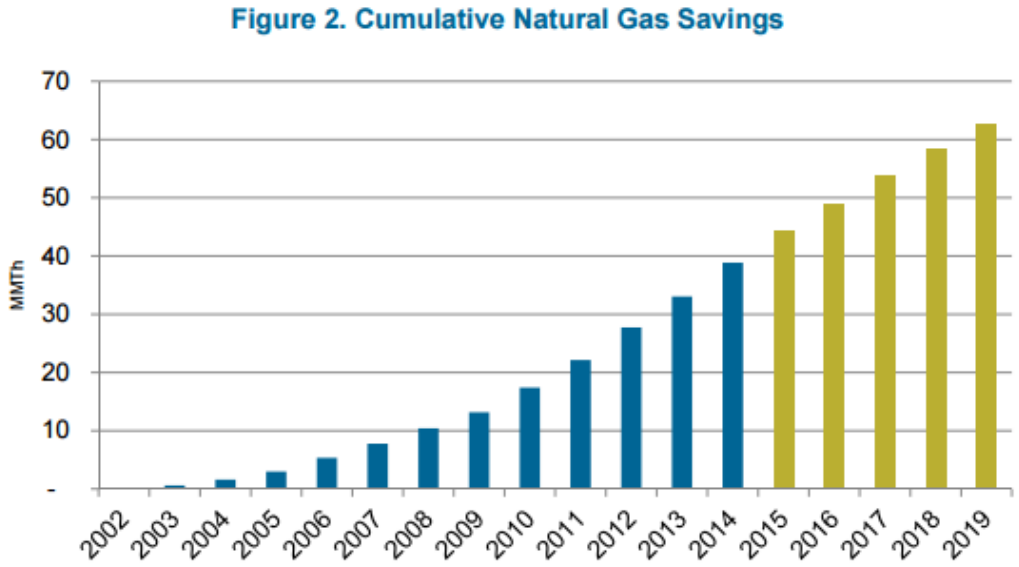


Figure 38: Energy Trust 2015-2019 Cumulative Natural Gas Savings Target

COST EFFECTIVENESS TESTING & AVOIDED COSTS[14]

Cost Effectiveness - Electricity

When evaluating cost effectiveness, the OPUC defined in Docket UM-551 that the following cost effectiveness tests are to be used:

- Utility System Test
- Societal Cost Test (similar to TRC)

Programs and measures that pass both tests (i.e., benefit cost ratio 1.0 or greater), or are likely to over time, are eligible for Energy Trust Investment. Cost effectiveness is used to qualify measures for introduction within the Energy Trust's program portfolio while portfolio level cost effectiveness testing is reported *ex post* to report on portfolio performance.

Costs

The OPUC has defined that the following elements be considered when determining the costs from the societal perspective[15] (i.e., Total Resource Cost):

1. Total cost of efficiency measures and actions[16], including costs to the Energy Trust and participants
2. Energy Trust administrative costs
3. Energy Trust program management costs

The utility system test includes only the Energy Trust incentives and items 2 and 3 above (i.e., all Energy Trust efficiency costs, not those paid by consumers). Costs excluded are the value of Oregon and/or Federal tax credits will be deducted from the cost of measures because similar tax credits are not included in avoided costs used by the Energy Trust. Program administration or management costs of local program that are paid by federal or state agencies will not be included as they are often associated with non-energy consideration such as equity, employment, etc. and are not included in the benefit cost tests under PUC guidance.

Benefits (Avoided Costs)

In the societal test, the Energy Trust will include the following benefits:

1. The value of the electrical and/or gas energy saved based on the avoided cost forecasts of the utilities whose customers are served by the Energy Trust, as reviewed and approved by the PUC.[17] Periodically, the Energy Trust will work with the utilities and PUC to develop an average, or merged cost forecast. This will be done separately for the electric utilities and gas utilities, so that the Energy Trust program decisions are based on a single set of price forecasts for each fuel. The Energy Trust may include factors such as hedge value, if not considered in the utility forecasts, based on agreement with the utilities and PUC.
2. Non-energy benefits will be quantified by a reasonable and practical method. Unless and until the OPUC develops an alternative approach, the Energy Trust may use proxies for these benefits where research shows that the benefits are large, they cannot quantified and they clearly influence consumer decisions.
3. For electricity, both line losses and avoided transmission and distribution construction.
4. Natural gas capacity benefits from reduced transmission and delivery losses will be included where significant and quantifiable.
5. In addition, the Energy Trust will apply in its analysis the 10 percent credit for energy efficiency as required under the Northwest Power Act and OPUC Docket UM-551. This credit recognizes the benefits of conservation in addressing risk and uncertainty.

Avoided costs based on integrated resource planning will be provided to the Energy Trust by utilities. The utility system test will include items 1, 3, 4 and 5 above.

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[14] https://energytrust.org/library/policies/4.06.000.pdf

[15] In Washington, the primary cost/benefit criterion is the societal test, applied to entire programs. In addition to this guidance, the Energy Trust will continue to apply the test to specific measures to assure consistency of program across states and optimal ratepayer value.

[16] For equipment or structures that would be purchased regardless of efficiency actions, this is the incremental cost of upgrading the efficiency of the purchase beyond common practice.

[17] This includes the value of avoided peak energy use.

Currently, utility avoided costs include the forecast value of reduced carbon dioxide emissions. OPUC guidance provides that other environmental pollutant costs may be considered only when specified by the PUC.

Exceptions to Cost Effectiveness for Measure inclusion into programs[18]

For measures which do not pass both the utility and societal (total resource cost) tests, the OPUC does allow measures to be included in programs assuming the measure meets the following conditions as defined in Docket UM-551:

1. The measure produces significant non-quantifiable non-energy benefits. In this case, the incentive payment should be set at no greater than the cost effective limit (defined as the present value of avoided cost plus 10 percent) less the perceived value of bill savings (e.g., two years of bill savings)
2. Inclusion of the measure will increase market acceptance and is expected to lead to reduced cost of the measure
3. The measure is included for consistency with other DSM programs in the region
4. Inclusion of the measure helps to increase participation in a cost-effective program
5. The package of measures is included in a pilot or research project intended to be offered to a limited number of customers
6. The measure is required by law or is consistent with Commission policy and/or direction

Portfolio vs. Measure Level Cost Effectiveness

As mentioned above, cost effectiveness is calculated at both the measure and program levels. It is important to note that there are fundamental differences in what costs are included when testing cost effectiveness at each levels. When performing measure level testing, administration and delivery costs are excluded from the calculation. The reasoning behind this approach is that the costs are, to a large extent, tied to the programs and not dependent on which measures are included. Therefore, the measure level testing only includes the measure's incremental or full costs depending on whether it is a retrofit or replace on burnout or new construction measure.

To counterbalance the measure level testing, the Energy Trust also performs program level testing which includes administration and delivery costs in order to ensure that the total benefits of the savings obtained are greater than the total costs of the programs. Programs are required to achieve a benefit-cost ratio greater than 1 for both UCT and TRC tests.

Historical Cost Effectiveness Results

Below are the cost effectiveness results which were calculated for each program as part of the Energy Trust's 2014 Annual Report.[19]

Program	Utility Cost Test Benefit Cost Ratio	Societal (Total Resource Cost) Test Benefit Cost Ratio
New Homes and Products	2.0	1.7
Existing Homes	2.0	2.5
Existing Building (including Multifamily)	2.5	1.7
New Buildings	3.0	1.9
Production Efficiency	3.5	2.0

[18] http://edocs.puc.state.or.us/efdocs/HAA/um1696haa94619.pdf
[19] http://assets.energytrust.org/api/assets/reports/2014_ETO_Annual_Report.pdf

COST EFFECTIVENESS – NATURAL GAS

The current market condition for natural gas prices (i.e., low price environment) has caused the Energy Trust and PUCs to re-examine gas measures over the last few years. The Energy Trust has been able to call upon Order 94-950 and the exemption conditions listed. In this case, condition 6, whereby a measure is consistent with Commission policy or direction was referenced. The Energy Trust was given relief with measure level cost effectiveness and currently applies the following guidelines:

- Total gas energy efficiency portfolio must have a TRC equal or greater than 1.0
- Measures with a TRC of 0.5-0.9 may receive specific exceptions from the OPUC if Energy Trust requests
- A measure with a TRC less than 0.5 should be removed from the portfolio unless for substantiated reasons

The reasoning behind this approach is that it allows the Energy Trust to maintain its program delivery infrastructure as well as market momentum for the programs until such time that gas prices increase and the portfolio can be grown. By performing cost effectiveness tests at the portfolio level, it allows the Energy Trust to examine the effect of measure with lower cost effectiveness and thus manage program delivery and promotion efforts accordingly.

MEASURE DEVELOPMENT & INCENTIVE SETTING PROCESS

The Energy Trust has created a standardized, four step process (see Appendix A for flow chart) by which to introduce new measures to their product portfolio and set their maximum eligible incentives. The Energy Trust and its program delivery agents can then determine the measure incentives up to the maximum eligible level while balancing the remainder of their delivery and administration expenses required to meet their goals.

Idea Generation & Vetting	Preliminary Measure Development	Detailed Measure Development	Measure Approval
• Identify new measure from multiple souces • Determine if measure addresses the appropriate considerations** • Determine if measure is to be pursued/updated or "parked" for the future	• Collection and analysis of preliminary measure information • Internal Program Lead creates plan to develop measure • Identify if any other program may use measure and identify potential cross-program issues • Preliminary program criteria check and engineering check • If measure is identified as a good fit for current program, it is promoted to the detailed development stage	• Identify technical guidelines and data, identify any data gaps and create research plan for gaps • Stakeholder outreach • Facilitation of cross-program coordination • Cost Effectiveness testing • Draft Measure Approval Document (MAD)** • If measure has sufficient available and reliable data, strong stakeholder interest, cost effective and proper timing and fit it is promoted to approval level • Measures with insufficient data can be piloted	• Finalize MAD • Manager of Planning Engineering published MAD

Considerations for vetting ideas, measures and measure updates

Below are the considerations taken by the Energy Trust and its program delivery agents when introducing a new measure into its program portfolio or updating a measure's metrics:

- Savings potential
- Budget impact
- Fit into long-term strategy
- Stakeholder interest
- Risk Analysis with regards to pursuing or not pursuing measure
- Market availability and maturity
- Market acceptance
- Market timing
- Energy Trust previous experience with the measure

Measure Assumptions Document (MAD)

What is a MAD: It is the decision of record determining measure cost effectiveness and authorizing use of a measure. The measure is clearly defined along with the conditions under which it is approved. The MAD provides documentation of all final assumptions used to characterize a measure and determine its cost effectiveness. Variables that are considered key to the savings calculations and cost effectiveness of the measure are highlighted. Any needs for follow up research are listed. While the majority of analysis originates with Energy Trust delivery contractors, all MADs are approved by Energy Trust engineering staff.

A MAD will contain the following sections:

- Valid date: Publication and expiry date
- Scope: Identifying the measure as new, replacement or retrofit
- Program: List of approved programs for which the measure can be used
- Market segment: List of the building types for which the measure can be used (if applicable)
- Description of Measure: Description of the technology and how it saves energy
- Revision History: Describes why changes are being made to the measure (if needed)
- Additional Details
- Cost Effectiveness: The measure's cost effectiveness results along with any exceptions that may have been granted if needed
- Incentive: Lists the maximum measure incentive in the same structure in which it will be incentivized (i.e., $/lamp, $/hp)
- Requirements: Defines the requirements for the measure/project to qualify for incentive (e.g., measure specifications, participation limits and data collection requirements)
- Baseline Conditions
- Savings: Describe what the measure savings are and how they are to be calculated along with the assumptions
- Measure Costs: Includes how to account for the costs (i.e., full vs. incremental) along with sources
- Technological Characteristics: Measure life, load profiles, non-energy benefits, etc.

Incentive Setting Considerations

When setting a measure incentive the following components are some of the key considerations taken by the Energy Trust and their program delivery agents:

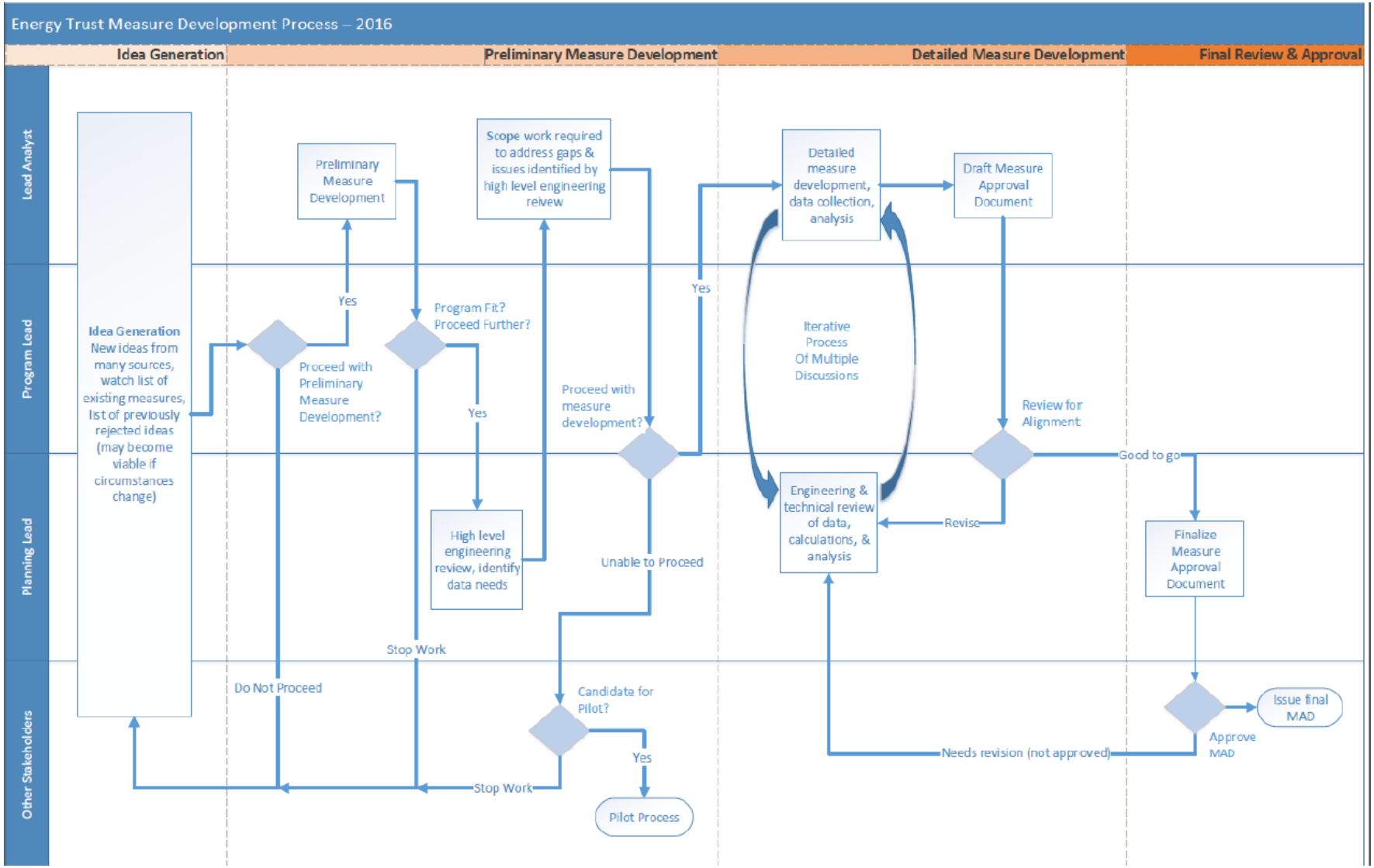
- Relationship of incentive to measure incremental cost
  - The baseline setting process is a key part of properly determining measure incremental costs
- Determination of the incentive's impact on market uptake and barriers
  - The Energy Trust is also mindful of how an incentive will drive participation of distributors with regards to stocking levels
- Total portfolio cost effectiveness and budget
  - The state of the market above will impact the required go-to-market strategy and hence the balance between incentives and program delivery

Overall, it was commented that the process of setting incentives is “more of an art than a science” and determining the ideal incentive for a measure or program is a very difficult if not nearly impossible task. Hence, having a process to update the incentives on a regular basis can be important to adjust incentives as the market evolves and transforms.

It was noted that the Energy Trust has an internal guideline whereby a portfolio’s maximum LUEC must be approximately 3-3.5 cents/kWh for electricity programs and approximately 50 cents/therm for natural gas programs. It is important to note that this is a guideline, the total savings goals are still determined annually by the Commissions. In Oregon, the Commission sets annual performance measure for each utility under the Energy Trust and in 2016, they are 3.4 cents/kWh and 3.5 cents/kWh for PGE and PacifiCorp respectively and 37 cents/therm and 47 cents/therm respectively for Northwest Natural and Cascade.[20] Within the performance measures, the Energy Trust is also evaluated for achieving 85 percent of its 2016 savings goal for each utility and 115 percent of its LUEC target. Lastly, the Energy Trust is also held to a financial performance standard whereby it should target that eight percent of its budget is used to administer the activities of the Energy Trust with the remainder being spent on participant incentives and program delivery agents.

[20] https://energytrust.org/library/forms/2016_OPUC_Performance_Measures.pdf

APPENDIX A: MEASURE DEVELOPMENT PROCESS



APPENDIX A-6: NEW YORK (CONSOLIDATED EDISON)

GEOGRAPHIC DEFINITIONS

Consolidated Edison of New York (Con Ed) is one of the seven large utilities in the state of New York. Con Ed provides service to the downstate markets of New York City and Westchester County.

LOAD AND CONSUMPTION INFORMATION

Peak Demand

- Electricity: 12,316 MW (2015)
- Gas: 1,068 MDt (2016)

Electric Retail Price per kWh in 2014 for Con Ed (In Cents)

- Residential: 28.85
- Commercial: 22.16
- Industrial: 20.18
- Transportation: 17.44

Retail Price per Thousand Cubic Feet in 2015 for New York State (In Dollars)

- Residential: 11.20
- Commercial: 6.89
- Industrial: 8.13 (2014 Price)

State Net Generation (GWh): 11,794

- Nuclear: 4,044 (34%)
- Natural Gas: 3,978 (34%)
- Hydroelectric: 2,270 (19%)
- Coal: 606 (5%)
- Wind: 422 (4%)
- Wood: 32 (0%)
- Petroleum: 254 (2%)
- Other Biomass: 133 (1%)
- Solar: 3 (0%)
- Other: 74 (0%)

NY Electric Utility Net Generation (GWh): 2,639

- Hydroelectric: 1,802 (68%)
- Natural Gas: 746 (28%)
- Petroleum: 112 (4%)
- Coal: 2 (0%)

Figure 39: Electricity Use and Number of Customers[1]

ELECTRIC - (millions of kilowatt-hours)

YEAR	RESIDENTIAL	COMMERCIAL & INDUSTRIAL (C&I)	RAILROADS & RAILWAYS	PUBLIC AUTHORITIES	TOTAL SALES AND DELIVERIES TO FULL-SERVICE CUSTOMERS *	DELIVERY SERVICE FOR ENERGY CHOICE	DELIVERY SERVICE TO NYPA AND OTHERS	SERVICE FOR MUNICIPAL AGENCIES	TOTAL SALES AND DELIVERIES IN FRANCHISE AREA	OFF-SYSTEM AND ESCO SALES
2014	**9,868**	**9,834**	**2**	**53**	**19,757**	**26,221**	**9,951**	**374**	**56,303**	**490**
2013	10,273	9,776	2	67	20,118	26,574	9,846	380	56,918	605
2012	10,718	9,848	2	53	20,621	25,990	10,268	322	57,201	982
2011	11,404	11,148	4	66	22,622	24,234	10,408	562	57,826	691
2010	11,518	12,559	5	60	24,142	23,098	10,834	619	58,693	471
2009	10,952	12,457	6	67	23,482	21,859	10,651	675	56,667	798

ELECTRIC DATA - (average number of customers)

YEAR	RESIDENTIAL	C&I	OTHER	TOTAL	RETAIL CHOICE (Included in Total)
2014	**2,868,468**	**493,466**	**6,148**	**3,368,082**	**896,565**
2013	2,859,556	488,715	6,344	3,354,615	896,266
2012	2,849,583	489,646	6,366	3,345,595	829,260
2011	2,832,772	490,176	6,358	3,329,306	690,163
2010	2,807,492	494,199	6,375	3,308,066	627,642
2009	2,780,685	492,451	4,718	3,277,854	615,197

Figure 40: Gas Use and Number of Customers[1]

GAS - (thousands of dekatherms)

YEAR	RESIDENTIAL	GENERAL	FIRM TRANSPORTATION	TOTAL FIRM SALES AND TRANSPORTATION	INTERRUPTIBLE SALES	DELIVERY SERVICE FOR NYPA AND OTHERS	OFF-SYSTEM SALES	TRANSPORTATION OF CUSTOMER-OWNED GAS	TOTAL SALES AND TRANSPORTATION
2014	**46,661**	**28,969**	**68,731**	**144,361**	**10,498**	**152,560**	**15**	**163,073**	**307,434**
2013	38,872	28,135	61,139	128,146	10,900	136,061	4,638	151,599	279,745
2012	33,457	24,138	52,860	110,455	5,961	156,193	730	162,884	273,339
2011	38,160	26,536	54,291	118,987	10,035	132,056	97	142,188	261,175
2010	37,963	25,629	51,859	115,451	8,521	124,556	7	133,084	248,535
2009	39,749	28,245	48,671	116,665	8,225	124,218	2	132,445	249,110

GAS DATA - (average number of customers)

YEAR	RESIDENTIAL	C&I	OTHER	TOTAL	RETAIL CHOICE (Included in Total)
2014	**942,977**	**122,052**	**4,051**	**1,069,080**	**226,035**
2013	943,925	120,023	4,022	1,067,970	227,599
2012	943,864	119,738	4,000	1,067,602	216,493
2011	942,103	118,824	3,976	1,064,903	182,319
2010	939,220	118,840	3,959	1,062,019	166,702
2009	936,527	117,773	3,955	1,058,255	151,212

MARKET STRUCTURE OVERVIEW

The electric and natural gas Energy Efficiency Portfolio Standard (EEPS) was established in 2008 by the New York State Public Service Commission (the Commission). This initiative is part of the broader State policies for clean energy industry and economy development. Through the EEPS, New York State Energy Research and Development Authority (NYSERDA), as well as the major investor-owned utilities in New York, must provide incentives to homeowners and businesses for energy efficiency improvements. The overall goal is to reduce New Yorkers' electricity usage by 15 percent from the forecasted 2015 level with comparable results in natural gas conservation. This initiative is funded through the ratepayers through the System Benefits Charge (SBC)[2]. The Commission administers this initiative and funds may only be used for programs upon their approval. Utilities are required to report to the Commission annually on programs, budgets and expenditures.

The Evaluation Advisory Group (EAG) exists to advise the Commission and the Department of Public Service (DPS) on statewide evaluation and reporting. The DPS acts as an oversight agency for EEPS program evaluations. The Commission intends for the EAG to act as an advisor to DPS.

NYSERDA's energy efficiency role is the designated administrator of a set of programs separate from the utilities. However, there is some collaborative programs as well. They are funded by the PSC and act like more of a centralized service.

The EEPS was replaced by the Clean Energy Fund (CEF) in February of 2016[3].

[1] Consolidated Edison Inc., "6-Year Financials and Operating Statistics," http://www.google.ca/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0ahUKEwi83d-_0aLMAhVIMz4KHeg8A34QFggbMAA&url=http%3A%2F%2Fphx.corporate-ir.net%2FExternal.File%3Fitem%3DUGFyZW50SUQ9NjA0MjI5fENoaWxkSUQ9MzE1MTkwfFR5cGU9MQ%3D%3D%26t%3D1&usg=AFQjCNFFMp7_hHqqe3xg5LvjnlxhewoUaA&sig2=x7NSjBgK2fQcE3Ov1iJvFw&bvm=bv.119745492,d.cWw

[2] State of New York Public Services Commission, "Order Establishing Energy Efficiency Portfolio Standard and Approving Programs," http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7bD9F7E0DF-A518-4199-84CC-C2E03950A28D%7d (June 2008)

[3] State of New York Public Service Commission, "Order Extending Clean Energy Programs," http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b0A5494A4-2CD1-4CFE-8BEE-B3E943C04F01%7d (December 2015)

KEY PLAYERS

Electric Utilities[4]:

- Bath Electric, Gas & Water Systems
- Central Hudson Gas & Electric Corp.
- Consolidated Edison Company of New York, Inc.
- Fishers Island Electric Corporation
- City of Jamestown
- Board of Public Utilities
- Town of Massena Electric Department
- New York State Electric & Gas Corp.
- National Grid
- Orange & Rockland Utilities, Inc.
- Pennsylvania Electric Company
- Penn Yan Municipal Utilities Board
- Village of Penn Yan
- City of Plattsburgh
- Plattsburgh Municipal Lighting Department
- Rochester Gas & Electric Corp.
- City of Salamanca Board of Public Utilities
- Village of Akron
- Village of Andover
- Village of Angelica
- Village of Arcade
- Village of Bergen
- Village of Boonville - Municipal Commission of Boonville
- Village of Brocton
- Village of Castile
- Village of Churchville
- Village of Endicott
- Village of Fairport
- Village of Frankfort
- Frankfort Power & Light
- Inc. Village of Freeport
- Freeport Electric
- Village of Green Island
- Village of Greene
- Village of Groton
- Village of Hamilton
- Village of Holley
- Village of Ilion
- Ilion Board of Light Commissioners
- Village of Little Valley
- Municipal Electric Department
- Village of Mohawk
- Mohawk Municipal Commission
- Inc. Village of Philadelphia
- Village of Richmondville
- Village of Rockville Centre

[4] State of New York Public Service Commission, "Electric Utilities Listing," http://www3.dps.ny.gov/W/PSCWeb.nsf/All/03627EFC626529EE85257687006F39CD?OpenDocument

- Village of Rouses Point
- Village of Sherburne
- Village of Silver Spring
- Village of Skaneateles
- Skaneateles Electric Light Department
- Village of Spencerport
- Village of Springville Electric Systems
- Village of Theresa
- Village of Wellsville
- Village of Westfield

Natural Gas Utilities regulated by NYSPSC[5]:

- Bath Electric, Gas & Water System
- Central Hudson Gas & Electric Corporation
- Chautauqua Utilities, Inc.
- Consolidated Edison Company of N Y, Inc.
- Corning Natural Gas Corporation
- Empire State Pipeline
- Filmore Gas Company, Inc.
- Keyspan Energy Delivery (New York)
- Keyspan Energy Delivery (Long Island)
- National Fuel Gas Distribution Corporation
- N.E.A. Cross of New York, Inc.
- New York State Electric & Gas Corporation
- Niagara Mohawk Power Corporation
- Orange and Rockland Utilities, Inc.
- Reserve Gas Company, Inc.
- Rochester Gas & Electric Corporation
- St. Lawrence Gas Company, Inc.
- Valley Energy, Inc.
- Woodhull Municipal Gas Company

The New York Independent System Operator:

The New York Independent System Operator (NYISO) operates the wholesale markets to manage the flow of electricity across the state.

PORTFOLIO MATURITY AND HISTORICAL PERFORMANCE[6]

In the 1980s to 1990s, New York State electric utilities operated large scale energy efficiency programs. The annual spending on these programs was $286 million at its peak in 1992. Total utility spending during 1990-1996 was over $1.2 billion. This resulted in 5,744 GWh of energy savings. The SBC was then established in 1996 with the NYSERDA as the administrator, and utility energy efficiency programs were scaled back. Efforts of New York Power Authority (NYPA), Long Island Power Authority (LIPA) and the Division of Housing and Community Renewal (DHCR) were also present in the market during this period.

[5] State of New York Public Service Commission, "Natural Gas Utilities regulated by NYSPSC," http://www3.dps.ny.gov/W/PSCWeb.nsf/All/AF91A30E4F00289785257687006F3A53?OpenDocument
[6] State of New York Public Service Commission, "Staff Preliminary Proposal for Energy Efficiency Program Design and Delivery," http://www.dps.ny.gov/07M0548/07M0548_EPS_StaffTeamPrelimProposal_FINAL.pdf (August 2007)

Figure 41: NYSERDA Efficiency Programs: Energy Savings and Program Costs: 1998-2009[7]

Year	Cumulative Annual Reductions		Cumulative Annual Peak Non-Curtailable Electric Demand Reductions	Cumulative Peak Curtailable Demand Reductions	Annual Spending
	Electric (GWh)	Other (MMBtu)	(MW)	(MW)	($ Millions)
System Benefits Charge					
1998-2001	399	1,470,403	106	Not available	$ 27.4*
2002	690	3,000,000	218	434	$ 113.7
2003	1,000	2,800,000	270	610	$ 129.3
2004	1,400	2,600,000	325	535	$ 135.5
2005	1,950	4,000,000	445	595	$ 137.5
2006	2,350	4,049,000	495	618	$ 146.1
2007	3,060	4,660,000	650	550	$ 154.0
2008	3,220	5,400,000	700	575	$ 163.8
2009**	3,454	5,250,000	755	590	$ 147.0
Con Edison Gas Funded					
2005	-	-	-	-	$ 0.4
2006	-	-	-	-	$ 1.4
2007	-	134,689	-	-	$ 2.5
2008	-	232,135	-	-	$ 7.3
2009	-	277,740	-	-	$ 10.2
National Fuel Gas Funded					
2008	-	24,778	-	-	$ 1.7
2009	-	59,133	-	-	$ 6.1
National Grid Funded					
2008	-	1,811	-	-	$ 0.18
2009	-	28,229	-	-	$ 2.7
System-Wide Program					
2006	10	-	3	9	$ 3.6
2007	38	-	13	31	$ 17.1
2008	82	-	24	61	$ 5.7
2009 **	83	-	24	67	$ 2.0
Total	3,537	5,615,102	779	657	$ 1,223.18

The figure above summarizes NYSERDA administered programs from 1998- 2008. It also includes three energy efficiency programs that NYSERDA administers on behalf of three utilities: Consolidated Edison, National Fuel Gas, and National Grid.

CURRENT CYCLE

The State of New York's target for electricity use reduction is 15 percent for the 2008-2015 period with similar targets for gas. This target is part of the EEPS divided in two phases. Phase 1 is from 2009-2011 and Phase 2 is from 2012-20152.

[7] "Energy Efficiency Assessment, New York State Energy Plan," http://www.google.ca/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0ahUKEwjE7ZPB9aLMAhUCOj4KHQziBIcQFggiMAA&url=http%3A%2F%2Fenergyplan.ny.gov%2F-%2Fmedia%2Fnysenergyplan%2Ffinal%2FEnergy_Efficiency.pdf&usg=AFQjCNHew5BlRXlfZTubclHm31tEfsN36g&sig2=NHDE3his-pjfp6vRdysS8w (August 2007)

Figure 42: Overall Targets 2007 - 2015[8]

	Energy Efficiency Savings (GWh)								
	2007	2008	2009	2010	2011	2012	2013	2014	2015
Statewide Goals [1]									
New York State 15 x 15 Goals	564	1,471	3,991	7,263	10,631	14,082	17,608	21,222	24,927
NYSERDA SBC III Cumulative State Goals	401	739	1,076	1,413	1,751	2,188	2,626	3,063	3,500
Jurisdictional Gap for the State (EEPS Goals)			833	2,820	4,557	5,563	5,898	6,390	7,687
Con Edison Territory Goals									
NYS PSC Approved EEPS Goals for Con Edison Territory [2]			505	909	1,313	1,717	2,121	2,525	2,828
NYSERDA SBC III Goals for CE Territory [3]	148	273	398	523	648	810	972	1,133	1,295
Total	**148**	**273**	**903**	**1,432**	**1,961**	**2,527**	**3,093**	**3,658**	**4,123**
Energy Efficiency Potential Studies									
Con Edison Energy Efficiency Study 2010 [4]									
Maximum Achievable Potential (MAP)				1,801	3,324	4,784	5,995	6,570	7,061
Realistic Achievable Potential (RAP) (mid)				435	948	1,628	2,355	2,923	3,511
Optimal Energy Efficiency Study 2008 [5]									
MAP			674	1,815	3,400	4,853	6,424	8,081	9,824

Figure 43: Electric Program Budgets[9]

Program Names	C&I Custom Efficiency	C&I Equipment Rebate	Small Business Direct Install	Residential Direct Install	Appliance Bounty	Residential Room Air Conditioning	Residential HVAC	Residential Electric	Multi-family Energy Efficiency
2009	N/A	$54,185,252	$76,702,689	N/A	N/A	N/A	$10,544,823	N/A	$16,589,934
2010	$10,660,000			$3,832,285	$5,659,857	$2,593,500			
2011									
2012	$29,365,716	$144,919,976	$111,567,548	$4,519,285	$5,564,562	$2,739,807	$5,907,497		$29,493,216
2013								$17,741,736	
2014				Discontinued	Three programs combined into Residential Electric Program.				
2015									

Figure 44: Gas Program Budgets[9]

Figure 45: Electric Savings Result[9]

[8] Global Energy Partners, LLC, "Energy Efficiency Potential Study for Consolidated Edison Company of New York, Inc. Volume 1: Executive Summary," http://www.coned.com/documents/Volume_1_Executive_Summary.pdf (June 2010)
[9] State of New York Public Service Commission, "Energy Efficiency Portfolio Standard," http://documents.dps.ny.gov/public/EEPS/EEPSSearch.aspx?SearchType=PRG&PA=2&ProgramType=Gas&ProgramStatus=Open,Closed&SectorSubsector=2:3,1~3:2,1~1:2,1

Program Names (Savings in MWh)	Accumulated Savings to Year	C&I Custom Efficiency	C&I Equipment Rebate	Small Business Direct Install	Residential Direct Install	Appliance Bounty	Residential Room Air Conditioning	Residential HVAC	Residential Electric	Multi-family Energy Efficiency
2009	765	N/A			N/A	N/A	N/A			
2010	62,398	$7,006,015		$2,671,200	2,633 (18%)	$13,469,308	3,213 (40%)	$5,595,624	N/A	N/A
2011	227,910					17,402 (53%)		6,444 (87%)		$3,046,588
2012	405,083									
2013	565,842	111,506 (167%)	186,784 (57%)	480,021 (92%)						58,021 (125%)
2014	765,003	$8,066,906		$4,748,800		$25,945,436		$12,790,000		$6,963,628
2015	903,087 (85%) *Up to September				Discontinued	Three programs combined into Residential Electric Program. Targets remain the same			35,181 (102%)	

Figure 46: Gas Savings Results[9]

COST EFFECTIVENESS TESTING

Estimating Energy Savings

The Commission approves a series of technical manuals to provide a standard measure-specific approach to estimate the energy and demand savings.

Cost Effectiveness Requirements

Cost effectiveness is evaluated at the program level by TRC. Fast track programs that were implemented early in the cycle had to score well above a TRC of 1.0. This was done to ensure that significant energy savings would result accounting for margins of error.

Avoided Supply Costs in TRC Calculation

The benefits calculated in the TRC are the avoided supply costs. The avoided supply costs include the reduction in costs of electric energy, natural gas, generation and transmission, and distribution capacity, valued at marginal cost for the periods when there is a load reduction.

Costs in TRC Calculation

The costs calculated in the TRC are costs paid by the program administrators and participants plus the increase in supply costs for any period when load is increased.

Program Names (Targets in Dth)	Target to Date	Residential HVAC	Multifamily Low-Income	Multifamily Energy Efficiency	C&I Gas Efficient Equipment Rebate	C&I Custom Gas Efficiency
2009	31,772	203,911	90,232	779,336	304,595	202,614
2010	48,589					
2011	406,013					
2012	519,379					
2013	852,363					
2014	1,251,943					
2015	1,399,660 *Up to September 2015					

INCENTIVE RATE SETTING[2]

The incentive setting process involves collaborative discussions between the utilities, NYSERDA and other interested stakeholders. The goal is to achieve statewide uniformity in terms of qualifying technology and incentive levels. However, program designs and measures are still catered to the needs of individual utilities' customers.

EXISTING PROGRAMS

The following are programs a part of the EEPS. Major changes are expected when the CEF portfolio is introduced.

Program Analysis

Initiatives	Target Market	Incentive Setting Methodology
Residential Electric Rebate (Electric)	Residential customers looking to upgrade HVAC, water heater, or install programmable thermostats.	Rebate for HVAC systems, electric heat pump water heater, and programmable thermostat. Incentive amount set depending on efficiency. https://www.conedhvacrebates.com/assets/pdf/CE_Resi_Elec_Rebate_App_WRITEABLE.pdf
Residential Gas Rebate (Gas)	Residential customers looking to upgrade HVAC, water heater, or install programmable thermostats.	Rebate for water heaters, boilers, furnace, controls and programmable thermostat. Incentive amount set depending on efficiency. https://www.conedhvacrebates.com/assets/pdf/CE_Resi_Gas_Rebate_App_WRITEABLE.pdf
Residential Bounty (Electric)	Residential customers looking to upgrade to a more energy efficient freezer or refrigerator. Also, rebates available to	Rebate of $50 for freezer and refrigerators. Rebate of $25 for window, wall, and air conditioning units.

	customers with old window or wall or air conditioning units.	http://www.coned.com/energyefficiency/residential_bounty_program.asp
Central Air-Conditioning (Electric)	Residential or business customers looking to add a thermostat to their property. Residential customers who already own a smart thermostat.	Get a free thermostat ($400 value), and $25 thank you cheque for residential customers, or $50 for business customers. $85 if there is already an existing smart thermostat (residential). http://www.coned.com/energyefficiency/residential_directloadcontrol_program.asp
Residential Rebate (Electric)	Residential customers looking to upgrade to more energy efficient appliances.	Appliance rebate up to $75 available on refrigerators, dishwashers, clothes washer, and dehumidifier. Rebate amount depends on efficiency. https://www.conedhvacrebates.com/assets/pdf/CE_Resi_Appliance_Rebate_App_WRITEABLE.pdf
Bring Your Own Thermostat (Electric)	For residential customers who have already purchased a qualifying thermostat, that are willing to participate in a two year air-conditioner adjustment program.	$85 given with an agreement of participating in the two year program. http://www.coned.com/energyefficiency/bring_your_own_thermostat.asp
Small Business Direct Install (Electric)	Small business looking to save money and energy. http://www.coned.com/energyefficiency/businessdirect.asp	Free on-site energy efficiency survey, then have energy-saving lighting or refrigeration equipment installed. ConEd will pay up to 70% of the cost directly to the contractor. Business only pays the difference. http://www.coned.com/energyefficiency/businessdirect.asp
Neighborhood (Electric)	Delivers energy-saving and management solutions to local communities where the demand for electricity is expected to grow significantly because of the vitality in businesses and housing markets. Con Edison provides special incentives and opportunities in the neighborhoods that form part of our Neighborhood Program. Each program is constructed from groups of neighborhoods and each will have its own specific incentives and opportunities based on Con Edison's operational needs in those specific areas.	Existing neighborhood initiatives includes free lighting, water heating and refrigeration products for small businesses and free lighting products free for apartment buildings. There is also a NYSERDA partnership for combined heat and power (CHP). Con Edison will match NYSERDA's (PON 2568) base incentive up to $1,800/kW (or 100 percent of the project cost, whichever is less). http://www.coned.com/energyefficiency/Neighborhood_program.asp
Multi-family Energy Efficiency (Electric and Gas)	Customers that own/manage a multifamily building looking to make their property more energy-efficient.	Free in-unit direct installation, free common area direction installation, custom measures at $0.25 per kWh saved, or $2 per therm saved. Set incentive rates available for lighting upgrades in common areas, as well as boilers, radiator valves, insulation, building envelope, and energy management systems. http://www.coned.com/energyefficiency/multifamily-rebates.asp

Commercial and Industrial Prescriptive Rebates (Electric and Gas)	Prescriptive rebates available to C&I customers looking to upgrade their equipment.	Rebates for lighting and controls http://cdn.platform.honestbuildings.com/wp-content/uploads/sites/5/2016/02/Lighting-and-LEDs_v14.pdf HVAC, furnaces, boilers and chillers http://cdn.platform.honestbuildings.com/wp-content/uploads/sites/5/2015/12/HVAC-Furnaces-Boilers-and-other-Gas_v9.pdf Motors http://cdn.platform.honestbuildings.com/wp-content/uploads/sites/5/2015/12/Motors_v5.pdf VFDs http://cdn.platform.honestbuildings.com/wp-content/uploads/sites/5/2015/12/VFDs_v7.pdf All C&I projects capped at 50% or $250,000 for electric and $100,00 for gas for HVAC and VFD projects, whichever is less. TRC test is required and the benefit must be greater than costs.
Commercial and Industrial Performance Based Incentives (Electric and Gas)	Performance incentives available to C&I customers looking to upgrade their equipment that are not listed on prescriptive measures.	All C&I custom measures incented at $0.16 per kWh. Additional bonus incentives on super-efficient chillers. Gas incentive also available at $1-2 per therm. http://cdn.platform.honestbuildings.com/wp-content/uploads/sites/5/2016/03/Custom_v7.pdf All C&I projects capped at 50% or $250,000, whichever is less. TRC test is required and the benefit must be greater than costs.
Commercial and Industrial Energy Study (Electric and Gas)	C&I customers looking for energy saving opportunities.	Energy efficiency studies funded at $50,000 maximum or up to 50% for electric or gas. Incentive at $67,000 maximum for combined studies. Pre-approval is required. http://cdn.platform.honestbuildings.com/wp-content/uploads/sites/5/2015/12/EE-Study_v4.pdf

APPENDIX A-7: NEW YORK (NYSERDA)

SUMMARY

Jurisdictional Scan	
State/Province	New York
Utility/Agency	New York State Energy Research and Development Authority (NYSERDA)
Fuel	Electricity
Key Contact/Interviewee	Matthew Brown
Consultant	Mayuran Srikantha

JURISDICTION OVERVIEW

Electricity Market

The following entities are the key players in the electricity system in Ontario.

- New York Department of Public Service (Public Service Commission)
- New York State Energy Research and Development Authority (NYSERDA)
- New York Independent System Operator (NY-ISO)
- Electricity Utilities

New York Public Service Commission

The New York Public Service Commission regulates and oversees the electric, gas, water and telecommunication industries, as part of the Department of Public Service. In 2015, the Public Service Commission released the Reforming Energy Vision (REV) strategy. The REV initiative will promote more efficient use of energy, deeper penetration of renewable energy resources, wider deployment of distributed energy resources and energy storage. The REV is intended to encourage markets to achieve greater use of advanced energy management products, which will empower customers by providing them more choice in how they manage their electricity usage.

The Public Service Commission reviews and approves NYSERDA's plans and budgets for energy conservation programs.

New York –Independent System Operator

The NY-ISO operates the competitive wholesale markets that mange the flow of electricity across the state of New York. In addition to operating the markets, the NY-ISO prepares analyses, evaluations and forecasts to assist with system planning. This includes the assessment of reliability thresholds, identification of resource needs, evaluation of proposed projects and provision of objective market planning data.

Electric Utilities

The following electric utilities operate in the state of New York. Customers of these utilities are eligible for their own utility programs as well as NYSERDA programs. Double-dipping of incentives by customers is not allowed.

- Central Hudson (Central Hudson Gas & Electric Corporation)
- Con Edison (Consolidated Edison Company of New York, Inc.)

- National Grid (Niagara Mohawk Power Corporation)
- NYSEG (New York State Electric and Gas Corporation)
- Orange and Rockland Utilities, Inc.
- RG&E (Rochester Gas and Electric Corporation)

Electricity Generation

In 2013, electricity in New York was generated by the following resources:

Resource	Contribution
Petroleum	1%
Natural Gas	36%
Coal	1%
Nuclear	33%
Hydroelectric	22%
Other Renewables	6%

NYSERDA OVERVIEW

NYSERDA`s mandate is to promote energy efficiency and the use of renewable energy sources. The objectives are to reduce greenhouse gas emissions, accelerate economic growth and reduce customer energy bills. NYSERDA operates multi-fuel programs, though this document primarily focuses on electricity.

A key element of NYSERDA`s strategy is to work with stakeholders throughout New York including residents, business owners, developers, community leaders, local government officials, university researchers, utility representatives, investors, and entrepreneurs. These interactions ideally provide the conditions that help expand New York`s clean energy economy, allow communities, residents and businesses to benefit from energy efficiency and renewable energy, and to overcome barriers for large-scale clean energy usage.

NYSERDA is governed by a 13-member board. It was created in 1975. Recently, there has been a shift to not compete with the utility programs, but to move toward a market transformation approach.

Sources of Funding

The Systems Benefit Charge (SBC) is the primary source of NYSERDA`s funding for energy conservation programs. It was established on May 20, 1996. The funds collected from the SBC are allocated towards energy efficiency programs, research and development activities, low-income energy programs, and environmental disclosure activities. The SBC was recently extended on December 31, 2016. The SBC is used to fund the Energy Efficiency Portfolio Standard (EEPS). Recently, the EEPS has been replaced by the Clean Energy Fund (CEF).

Other sources of funding include:

- Regional Greenhouse Gas Initiative (RGGI)
- Renewable Portfolio Standard (RPS)

The RGGI is focused on energy efficiency, renewable energy and carbon abatement projects. The funding comes from the sale of carbon emission allowances. The amount of funding available is dependent on the auction price for the allowances. The RGGI covers nine Northeast and Mid-Atlantic states.

The RPS is focused on acquiring renewable energy and/or renewable energy attributes. The funds are approved by the Public Service Commission and derived from an assessment of the intrastate sales of electricity by the utilities in the state of New York.

Retail Prices of Electricity

For a representative number, the following are the retail prices for Con Edison customers in 2014:

- Residential: $0.2885/kWh
- Commercial: $0.2216/kWh
- Industrial: $0.2018/kWh

NYSERDA ENERGY EFFICIENCY PROGRAM INCENTIVE AND COST EFFECTIVENESS POLICY

Cost Effectiveness Testing

Under the EEPS, NYSEDRA was required to conduct cost effectiveness testing at the project level. The TRC is used as the cost effectiveness test. Prior to the implementation of the EEPS, the TRC was applied at the program level. Under the CEF, the TRC will again be applied at the program level.

Avoided Costs

The benefits calculated in the TRC are the avoided supply costs. For NYSERDA, the avoided supply costs include the reduction in costs of electric energy, natural gas, generation and transmission, and distribution capacity, valued at marginal cost for the periods when there is a load reduction. The avoided costs are provided by the NY-ISO.

ENERGY EFFICIENCY PROGRAMMING

Energy efficiency programs are typically set on three year funding cycles, approved by the Public Services Commission. Programs cover both the residential and commercial sectors, and cover various fuel types. The numbers below are only for the electricity conservation programs.

Previous Results (Savings, Expenditure, Cost Effectiveness)

Year	Electricity Savings	Expenditure	Cost Effectiveness
2013	Not Available	Not Available	Not Available
2014	Not Available	Not Available	Not Available
2015	Not Available	Not Available	Not Available

Future Targets

Year	Electricity Savings	Expenditure	Cost Effectiveness
2016	Not Available	Not Available	Not Available
2017	Not Available	Not Available	Not Available
2018	Not Available	Not Available	Not Available

Incentive Level Setting Methodology

One of the key considerations for incentive level setting is to match the incentive to program design. If the program design has certain objectives or uses a specific delivery structure, the incentives should match these considerations.

In the commercial program, smaller projects usually feature a prescriptive incentive that is based on a percentage cost of the measure/project. Usually, the incentives are capped at 50 percent. If a measure is being “jump-started”, there may be consideration to increase the incentive. For example, for agricultural customers, the incentive can go up to 70 percent of the cost.

For larger projects in the commercial program, there has been a move to a performance based incentive, set using a $/kWh structure. Some incentive structures are developed to reward peak load congestion in certain areas, there may be a usage of a $/kW structure, or a blended approach is used.

In the commercial programs, project costs are always recorded to track the contribution of incentives.

Incentive levels are based on historical experience. The end use is identified and the incentives are based on the experience in that area.

Incentive levels are reviewed every year for residential programs. For commercial programs, the goal is to have a review once a year, but if the measures are less used, this may not happen. Certain measures are reviewed multiple times a year. For example, LED lighting has been a challenge. The initial incentives were set at 50 percent of the cost, but prices changed so quickly that incentives ended up being much higher as a percentage of costs.

A key part of the program management and incentive setting process is to talk to customers, the supply chain and stakeholders to identify barriers. Communication is ongoing through typical program management activity. There are also program evaluations every year, which provide a formal platform for customer, supply chain and stakeholder communication.

For incentive changes, cost effectiveness is checked. Typically, incentive changes feature reductions, so cost effectiveness impact is usually positive.

During the incentive setting process, a formal document is not required to be submitted. Instead, the regular program change process is followed. If cost effectiveness is impacted negatively through a change in incentive, there would be a discussion with the Public Service Commission.

To support the incentive setting process, a measures list has been created that documents measure savings and costs. It is owned by the program evaluation group. This activity is supported by research to gauge penetration levels, and further understand savings assumptions.

- For incentive changes, do check cost effectiveness, most incentives are coming down so it is more based on product price
- Program evaluation talk to supply chain
- Not required to submit any formal document, just do regular program changes if benefit cost is better
- If benefit cost gets worse, we would discuss
- Have built measures list, owned by evaluation group, do penetration and savings level research

APPENDIX A-8: VERMONT (EFFICIENCY VERMONT)

SUMMARY

Jurisdictional Scan	
State/Province	Vermont
Utility/Agency	Efficiency Vermont (Vermont Energy Investment Corporation)
Fuel	Electricity, Gas, Heating Fuels
Key Contact/Interviewee	Robert Stephenson, Chris Gordon
Consultant	Mayuran Srikantha

JURISDICTION OVERVIEW

Electricity Market

The following entities make up the electricity system in Vermont.

- Efficiency Vermont (Vermont Energy Investment Corporation – VEIC)
- Vermont Public Services Board (PSB)
- ISO New England (ISO-NE)
- Vermont Electric Power Company (VELCO) → transmission company state owned
- 17 Electric Utilities

Efficiency Vermont was the first state-wide energy efficiency utility of its kind in North America. It was established in 1999 through regulation from the PSB. Efficiency Vermont runs through a contract between the PSB and VEIC, the current owner and operator of Efficiency Vermont. VEIC is an independent, not-for-profit organization that was started in 1986.

In 1999, the PSB decided to create a state-wide energy efficiency utility to administer electricity conservation programs for the whole state. It was believed that electric utilities have a split incentive to administer these programs since their revenue came from electricity sales, not reduction. A volumetric charge was established on electric customers' bills in Vermont to support these programs, and was to be collected by utilities who offered Efficiency Vermont's programs to their customers. Burlington Electric Department, one of the municipally owned electric utilities, chose to administer their own electricity conservation programs, which are funded through a separate agreement with the PSB. Most of Burlington Electric Department's programs are identical to Efficiency Vermont.

The PSB is a quasi-judicial board that supervises the rates, quality of service and overall financial management of Vermont's utilities (cable television, electricity, gas, telecommunications, water and large waste water companies). The board oversees Vermont's Energy Efficiency Utility (EEU) Program. It sets the Energy Efficiency Charge (EEC) that appears on utility customers' bills that fund the EEU Program. The PSB is responsible for procuring the resources to support the EEU Program, and to manage and review the performance of those resources. For the current cycle, the electricity efficiency is provided by Efficiency Vermont and Burlington Electric Department.

ISO New England (ISO-NE) is the Regional Transmission Organization (RTO) that manages New England's bulk power generation and transmission system. ISO-NE has three main objectives:

1. Ensure daily reliable operation of New England's bulk power generation and transmission system
2. Oversee and ensure fair administration of region's wholesale electricity market
3. Manage a comprehensive regional planning process

Vermont Electric Power Company (VELCO) operates Vermont's bulk transmission system and represents the utilities in power pool discussions with ISO-NE. VELCO was set up in 1956 to develop an integrated transmission system to interconnect the different electric utilities in Vermont. VELCO is regulated, and is owned and controlled by the state's electric utilities and the

Vermont Low-Income Trust for Electricity (VLITE). VELCO takes part in the regional planning process by performing and directing planning, design and construction efforts for Vermont's bulk transmission system.

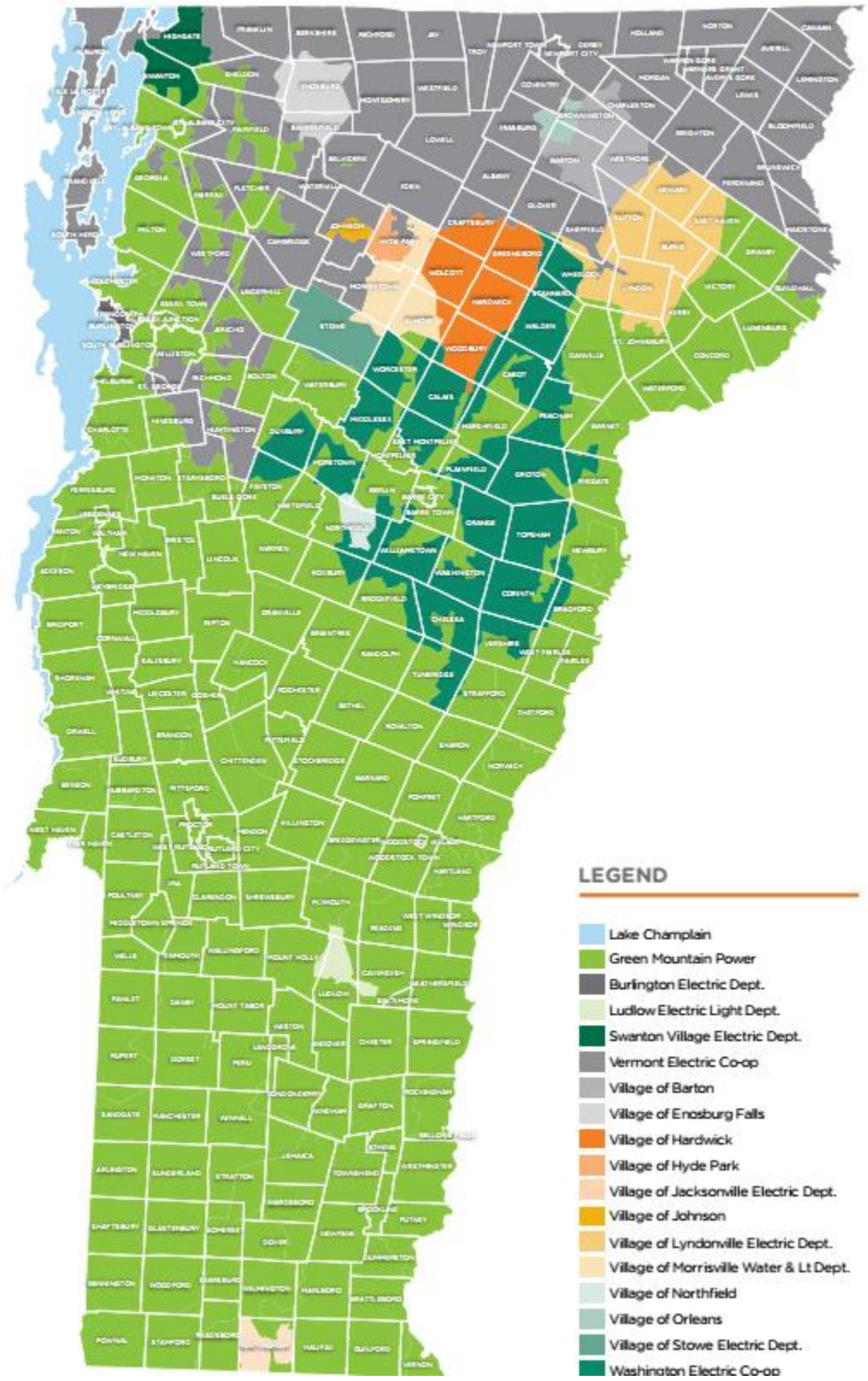
Electric Utilities

Vermont has 17 electric utilities.

- 14 municipal electric utilities
- 1 investor owned utility (IOU)
- 2 cooperatives

Vermont's utilities range in size. The smallest is Village of Orleans Electric Department with 700 customers, and the largest is Green Mountain Power with 256,000 customers. Green Mountain Power is the only investor owned utility in the state. The 2 cooperatives are Vermont Electric Cooperative and Washington Electric Cooperative. The following map illustrates their service territories[1]:

[1] http://www.greenmountainpower.com/upload/photos/201ServiceMapLarge.jpg


LEGEND
Lake Champlain
Green Mountain Power
Burlington Electric Dept.
Ludlow Electric Light Dept.
Swanton Village Electric Dept.
Vermont Electric Co-op
Village of Barton
Village of Enosburg Falls
Village of Hardwick
Village of Hyde Park
Village of Jacksonville Electric Dept.
Village of Johnson
Village of Lyndonville Electric Dept.
Village of Morrisville Water & Lt Dept.
Village of Northfield
Village of Orleans
Village of Stowe Electric Dept.
Washington Electric Co-op

Electricity Generation

In 2014, Vermont was dominated by two types of generation sources; nuclear power and hydroelectric. Nuclear power made up about 70 perent of generated electricity, with hydroelectric making up another 20 percent. The next two largest resources were wood burning and wind generation, which make up the majority of the remaining 10 percent. From its electricity generation activities, Vermont does not have a large greenhouse gas commitment from coal, oil or natural gas. The state's only nuclear power plant closed at the end of 2014.

Total Energy Production (MWh)	**6,884,910**
Hydroelectric	1,285,912
Natural gas	3,029
Nuclear	4,846,327
Other biomass	25,698
Petroleum	5,103
Solar	17,293
Wind	236,034
Wood	465,513

Vermont is summer peaking with a load of 1,255 MW. Of the 6,900 GWh of generation, over 85 percent comes from large scale generators and CHP units, while the rest comes from electric utilities. The majority of generators participate in ISO- NE's forward capacity market.

VERMONT ENERGY EFFICIENCY PROGRAM INCENTIVE AND COST EFFECTIVENESS POLICY

Vermont is viewed as one of the leading jurisdictions for promoting conservation in North America. Vermont Energy Investment Corporation (VEIC) has won multiple awards during the past twenty years from industry associations such as ENERGY STAR®, American Council for an Energy Efficient Economy (ACEEE) and Association of Energy Service Professionals (AESP).

Vermont does not have state legislation that sets energy efficiency targets for each year. Instead, it follows a policy of setting energy efficiency budgets that achieve "all reasonably available, cost effective energy efficiency". The specific budgets and targets are negotiated between the PSB and VEIC, which operates Efficiency Vermont. There is no explicit penalty for not meeting the targets, but a portion of the payments are contingent upon performance, which is subject to an Evaluation, Measurement and Verification (EM&V) process.

The budgets and targets are established in three year cycles. The current cycle, 2015-2017 has a savings target of 321,800 MWh for VEIC. This is measured in annual, incremental net savings. Efficiency Vermont is also held to a total resource benefits target of $336.3 million as indicated by the present value of the benefits of the TRC test. For scale purposes, in 2014, Efficiency Vermont achieved 91,000 MWh of savings, meaning the new cycle is more aggressive than recent results.

In addition to Burlington Electric Department's targets, the total energy savings target for Vermont for the 2015-2017 is equivalent to about 2.1 percent of sales each year.

Every three year cycle is determined through a Demand Resource Plan (DRP) process that has a 20 year horizon. This process sets the three year energy conservation savings and budget targets.

According to the latest update to the 2015-2017 Triennial Plan submitted by Efficiency Vermont, the resource acquisition budgets for electricity are as follows for 2015, 2016 and 2017 respectively: $42.35M, $39.46M and $45.56M.

The total budget for all of Efficiency Vermont's portfolio from 2015-2017, including the performance award is indicated below:

5.1.2 2015-2017 Budget by Market and Initiative

	2015 [1]	2016	2017	2015-2017
RESOURCE ACQUISITION				
Electric Efficiency				
Business Sector				
Business Existing Facilities	$ 18,420,756	$ 17,193,540	$ 21,641,426	$ 57,255,722
Customer Credit	$ 312,309	$ 1,686,279	$ 1,029,372	$ 3,027,960
Business New Construction	$ 3,207,177	$ 2,954,285	$ 3,046,426	$ 9,207,888
Sub-Total Business Sector	**$ 21,940,243**	**$ 21,834,103**	**$ 25,717,224**	**$ 69,491,570**
Residential Sector				
Efficient Products	$ 13,941,148	$ 12,525,075	$ 13,495,259	$ 39,961,481
Existing Homes	$ 3,949,947	$ 3,794,029	$ 4,284,024	$ 12,028,000
Residential New Construction	$ 2,832,331	$ 2,993,140	$ 3,088,289	$ 8,913,759
Sub-Total Residential Sector	**$ 20,723,425**	**$ 19,312,244**	**$ 20,867,571**	**$ 60,903,240**
Research & Development	$ 1,228,855	$ 2,568,977	$ 1,206,235	$ 5,004,067
Total Electric Efficiency	**$ 43,892,523**	**$ 43,715,324**	**$ 47,791,030**	**$ 135,398,877**
Thermal Energy and Process Fuels Efficiency				
Business Sector	$ 565,997	$ 1,417,372	$ 1,417,372	$ 3,400,741
Residential Sector	$ 5,103,491	$ 4,252,116	$ 4,252,116	$ 13,607,723
Total Thermal Energy and Process Fuels Efficiency	$ 5,669,488	$ 5,669,488	$ 5,669,488	$ 17,008,464
TOTAL RESOURCE ACQUISITION ACTIVITIES	**$ 49,562,011**	**$ 49,384,812**	**$ 53,460,518**	**$ 152,407,341**
NON RESOURCE ACQUISITION				
Education and Training	$ 837,950	$ 854,700	$ 871,810	$ 2,564,460
Applied Research and Development	$ 403,725	$ 411,800	$ 420,040	$ 1,235,565
Planning and Reporting	$ 415,000	$ 614,270	$ 626,570	$ 1,655,840
Evaluation, Measurement and Verification	$ 880,000	$ 897,600	$ 915,560	$ 2,693,160
Policy and Public Affairs	$ 493,025	$ 502,880	$ 512,950	$ 1,508,855
Information Technology	$ 1,501,000	$ 1,199,020	$ 1,222,500	$ 3,922,520
General Administration	$ 261,400	$ 266,630	$ 271,970	$ 800,000
TOTAL NON-RESOURCE ACQUISITION	$ 4,792,100	$ 4,746,900	$ 4,841,400	$ 14,380,400
Operations Fee	$ 972,752	$ 944,018	$ 1,030,906	$ 2,947,676
Sub-Total Prior to Performance-Based Fee	**$ 55,326,863**	**$ 55,075,730**	**$ 59,332,824**	**$ 169,735,417**
Performance-Based Fee (set-aside)	$ 1,459,129	$ 1,416,027	$ 1,546,359	$ 4,421,514
TOTAL BUDGET INCLUDING PERFORMANCE-BASED FEE	$ 56,785,992	$ 56,491,757	$ 60,879,183	$ 174,156,931

[1] The 2015 NRA budgets were modified in the digital version on 12/2/2015 and will therefore not align with the printed versions.

Cost Effectiveness Testing

Efficiency Vermont is responsible for achieving “all reasonable available, cost effective energy efficiency” within the provided budget.

The PSB conducts an annual savings verification process to compare achievement against the initial plan.

The Technical Advisory Group (TAG) contains members from Efficiency Vermont, PSB, Burlington Electric Department and other stakeholders to resolve any issues with the annual savings verification process and to track implementation of any recommendations that arise from the annual verification process.

The TRM contains a list for the prescriptive measures, which represent about 2/3 of overall electricity savings in the portfolio. It indicates the methodology for how energy savings can be calculated for each measure, along with the supporting assumptions such as incremental costs, and free ridership rates. The TRM uses deemed savings for the majority of measure contained; however the deemed savings have the algorithms and assumptions to help improve accuracy. For some measures, there are calculation-based savings that use specific input parameters such as hours of operation or efficiency level.

For the 2011-2013 period, an independent audit of Efficiency Vermont's and Burlington Electric Department's program cost effective was conducted. This review was completed in September, 2015. The findings show that the portfolio had a Societal Cost Test (SCT) of 2.66 and a Program Administrator Cost (PAC) test of 3.05. These numbers seem to be in alignment with the savings, budget and benefits targets from the 2015-2017, though they do support the premise that the 2015-2017 is more aggressive for obtaining savings, with a resulting decrease in cost effectiveness.

Efficiency Vermont uses the SCT, not the TRC, for determining cost effectiveness at the measure level and the portfolio level. PAC is only used at the portfolio level. In general, measures must pass the SCT screening, but exceptions do occur for a variety of reasons. For example, low income programs have an additional 15 percent adder for benefits to reflect the societal value of efficiency in the low income market.

Avoided Costs[2]

Any updates to the avoided costs for Vermont are led by the PSB. Periodically, the avoided costs are updated. The last update occurred in 2015, based on a report by Synapse Energy Economics, which investigated the avoided energy supply costs for New England. Before any changes are implemented, they must be reviewed and approved by the board. The avoided costs are calculated for the entire New England Region, and then separated into different geographic areas, of which Vermont is one area.

For electricity, the major categories of benefit are:

- Avoided Capacity Costs
- Avoided Energy Costs
    - These costs include the reduction in cost of renewable energy that needs to be acquired to comply with Renewable Portfolio Standards (RPS).
- Transmission and Distribution Costs
    - These are assumed at the local level.
- Capacity Demand Reduction Induced Price Effect (DRIPE)
- Energy DRIPE
- Electricity Cross-Fuel DRIPE
- Avoided Non-Embedded CO_2 Costs

EFFICIENCY VERMONT –OVERVIEW

Utility Facts

- Serves all of Vermont, other than Burlington Electric Department customers
- Over 9,500 square miles
- Services population of 500,000
- Funded through energy efficiency charge collected by participating electric utilities.

[2] Avoided Costs - http://psb.vermont.gov/sites/psb/files/projects/EEU/2013avoidedcosts/AESCReport-WithAppendicesAttached.pdf

Customer Class Breakdown

There are three types of customers:

- Residential
- Commercial – Without Demand Charge
- Commercial – With Demand Charge

Retail Prices of Electricity

In Vermont, the bundled retail prices for electricity are as follows for the different utilities[3]:

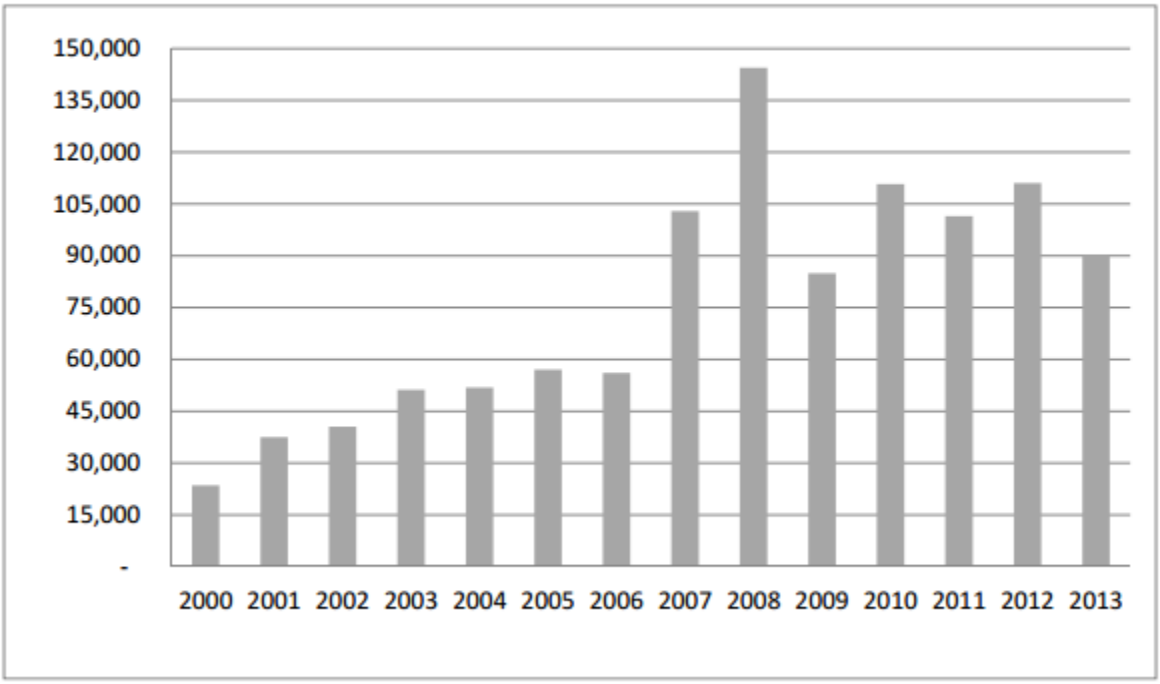
Entity	State	Ownership	Customers (Count)	Sales (MWh)	Revenues (Thousands Dollars)	Average Price (cents/kWh)
City of Burlington Electric - (VT)	VT	Municipal	20,557	338,421	47,086.0	13.91
Green Mountain Power Corp	VT	Investor Owned	258,928	4,281,682	609,832.0	14.24
Town of Hardwick	VT	Municipal	4,492	32,763	5,856.0	17.87
Town of Stowe- (VT)	VT	Municipal	4,033	74,414	11,366.5	15.27
Vermont Electric Cooperative, Inc	VT	Cooperative	38,542	446,870	74,409.5	16.65
Village of Ludlow - (VT)	VT	Municipal	3,758	47,118	7,439.0	15.79
Village of Lyndonville - (VT)	VT	Municipal	5,675	64,937	9,848.0	15.17
Village of Morrisville - (VT)	VT	Municipal	3,986	44,827	7,119.0	15.88
Village of Northfield - (VT)	VT	Municipal	1,866	29,570	3,998.8	13.52
Village of Swanton - (VT)	VT	Municipal	3,632	53,710	6,791.0	12.64
Washington Electric Coop - (VT)	VT	Cooperative	10,836	69,993	13,566.0	19.38

EFFICIENCY VERMONT - ENERGY EFFICIENCY PROGRAMMING

Vermont Energy Investment Corporation (VEIC) has been delivering energy efficiency programs since 1987. In 1999, Efficiency Vermont was created through the award of a contract from the Public Services Board to create North America's first energy efficiency utility. Programs began for customers in March, 2000. Since then, Efficiency Vermont has delivered 12.7 million MWhs in savings.

[3] http://www.eia.gov/electricity/data.cfm#sales

Figure 1. Efficiency Vermont annualized megawatt-hour savings



Savings

Efficiency Vermont programs have proven very successful at reducing energy consumption and incentivizing energy efficient behaviours and investment decisions. In the 2012-2014 period, Efficiency Vermont had the following results:

Table 1. Key results for 2012–2014

	2012	2013	2014	2012–2014 Total
Energy savings in megawatt-hours (MWh)	110,179	85,582	91,146	286,907
Total Resource Benefits[2]	$118,358,445	$83,830,177	$82,101,439	$284,290,061
U.S. tons of carbon dioxide emissions avoided through efficiency	800,000	690,000	700,000	2,190,000

Table 2. Selected QPI results for the 2012–2014 performance period[4]

Key Quantifiable Performance Indicators (QPIs)	Funding Pool	2012–2014 Goals	2012–2014 Results	% of Goal Achieved
Electric savings (MWh)	Electric Efficiency Charge	274,000	286,907	105%
Total Resource Benefits	Electric Efficiency Charge	$305,984,352	$284,290,061	93%
Statewide summer peak kilowatt (kW) demand reduction	Electric Efficiency Charge	41,920	35,979	86%
Summer peak kW demand reduction in Geographic Targeting areas—Susie Wilson Road	Electric Efficiency Charge	1,570	1,626	104%
Summer peak kW demand reduction in Geographic Targeting areas—Saint Albans	Electric Efficiency Charge	1,800	2,086	116%
Ratio of gross electric benefits to spending	Electric Efficiency Charge	1.2	2.0	163%
Million British thermal unit (MMBtu) savings	Thermal Energy and Process Fuels Revenues	155,000	168,795	109%

Budget & Spending

Efficiency Vermont's spending for 2013 and 2014 is provided below:

	Prior Year	Current Year 2014	Cumulative starting 1/1/12	Cumulative starting 1/1/12
# participants with installations	37,483	54,135	131,094	131,094
Operating Costs				
Administration	$1,440,935	$3,345,878	$6,107,129	$6,107,129
Operations and Implementation	$4,944,156	$5,077,234	$14,289,871	$14,289,871
Strategy and Planning	$1,735,071	$1,537,498	$4,652,934	$4,652,934
Subtotal Operating Costs	**$8,120,163**	**$9,960,610**	**$25,049,934**	**$25,049,934**
Technical Assistance Costs				
Services to Participants	$4,924,708	$3,987,615	$13,596,176	$13,596,176
Services to Trade Allies	$392,440	$1,559,789	$2,296,467	$2,296,467
Subtotal Technical Assistance Costs	**$5,317,148**	**$5,547,404**	**$15,892,643**	**$15,892,643**
Support Services				
Transportation	$369	$4,255	$4,623	$4,623
Targeted Implementation	$4,584	$1,407	$5,991	$5,991
Consulting	$315,962	$490,162	$911,282	$911,282
Marketing	$2,507,460	$2,177,538	$5,973,105	$5,973,105
EM&V	$146,611	$183,942	$516,438	$516,438
Policy	$35,328	$61,712	$199,017	$199,017
Information Technology	$1,218	$80,913	$82,411	$82,411
Customer Support	$207,074	$400,744	$787,512	$787,512
Business Development	$24,833	$19,090	$51,065	$51,065
Subtotal Support Services Costs	**$3,243,439**	**$3,419,764**	**$8,531,443**	**$8,531,443**
Incentive Costs				
Incentives to Participants	$15,634,949	$22,831,035	$56,723,746	$56,723,746
Incentives to Trade Allies	$36,917	$53,428	$164,974	$164,974
Subtotal Incentive Costs	**$15,671,866**	**$22,884,463**	**$56,888,720**	**$56,888,720**
Total Efficiency Vermont Costs	**$32,352,615**	**$41,812,241**	**$106,362,740**	**$106,362,740**
Total Participant Costs	$23,822,816	$22,482,896	$47,632,567	$47,632,567
Total Third Party Costs	$855,513	$963,025	$3,122,038	$3,122,038
Total Resource Acquisition Costs	**$57,030,944**	**$65,258,162**	**$157,117,345**	**$157,117,345**
Annualized MWh Savings	89,679	91,159	292,063	292,063
Lifetime MWh Savings	1,041,327	1,101,613	3,388,175	3,388,175
TRB Savings (2012 $)	$88,029,132	$82,129,788	$289,655,512	289,655,512
Winter Coincident Peak kW Savings	16,656	16,519	55,261	55,261
Summer Coincident Peak kW Savings	11,222	10,326	36,762	36,762
Annualized MWh Savings/Participant	2.393	1.684	2.228	2.228
Weighted Lifetime	11.6	12.1	11.6	11.6

Vermont 2013-2014 Incentive vs. Total Program Spending and Spending per kWh Ratios		
2013	48%	$0.36/kWh
2014	55%	$0.46/kWh

Cost Effectiveness

Efficiency Vermont is not held to a direct cost effectiveness metric, but the plan must meet associated savings, spending and total resource benefit targets. The annual savings verification process captures program to these targets. The latest independent audit of Vermont's energy efficiency portfolio for the 2011-2013 period provided the following results:

Vermont 2013-2015 Cost Effectiveness Results	
SCT	2.66
PAC	3.05

Based on analysis of the 2015-2017 program targets and budgets, it is assumed that the cost effectiveness projections will be slightly decreased, compared to historical performance.

FUTURE TARGETS

The 2015-2017 period has a savings target of 321,800 MWh, with an associated electricity savings resource acquisition budget of just over $130 million. The total budget for Efficiency Vermont's budget which included revenues collected from the efficiency charge, the Regional Greenhouse Gas Initiative and the ISO-NE Forward Capacity market as well as the performance fee is $174 million.

INCENTIVE LEVEL SETTING METHODOLOGY

Efficiency Vermont developed a new product development process about a year and a half ago. It involves a customer mapping and an engagement process that covers seven stages:

1. Idea Solicitation
2. Idea Screening
3. Concept Development
4. Market Analysis
5. Prototyping
6. Market Testing
7. Product Development
8. Product Launch
9. Post Launch Review

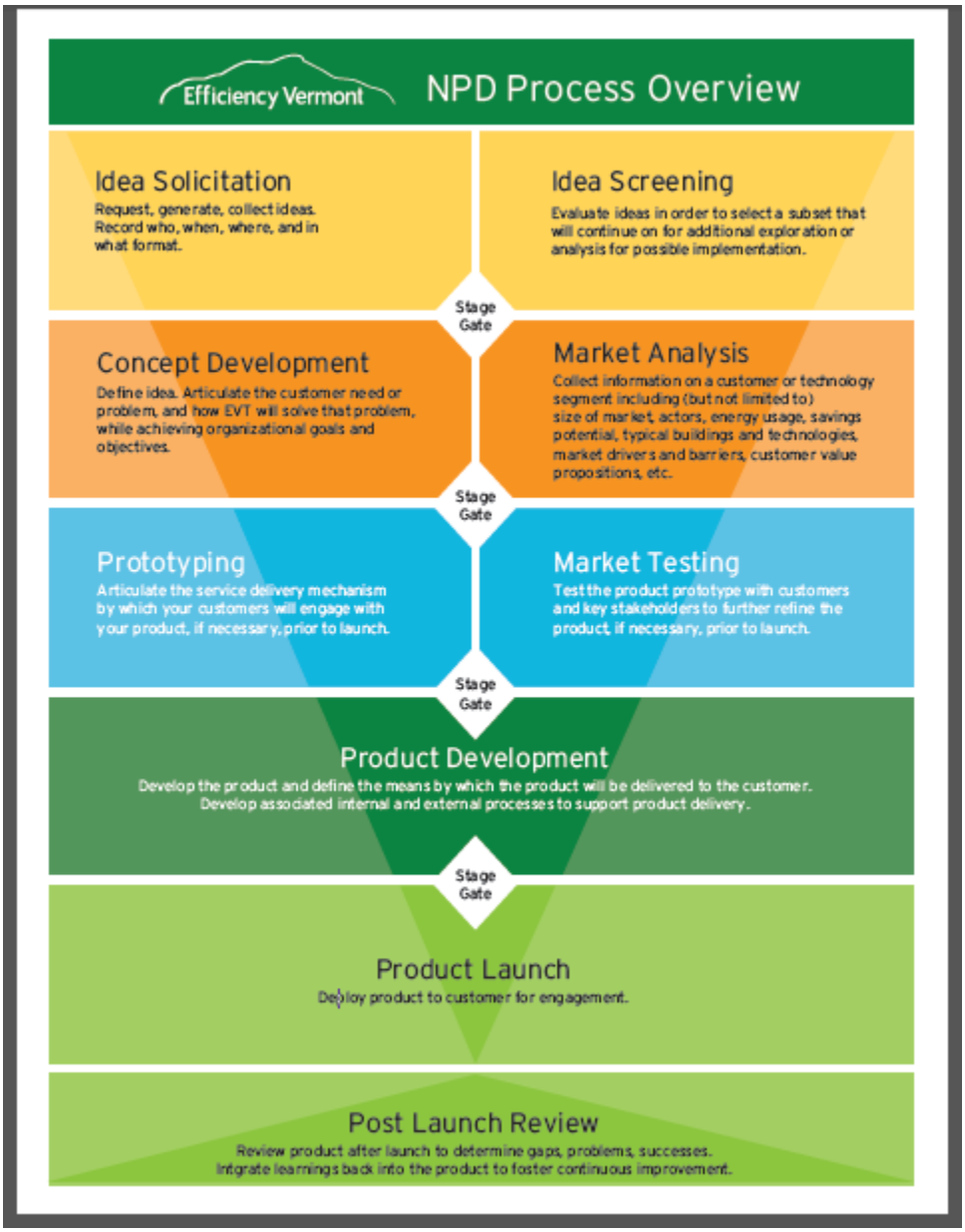


Figure 47: Efficiency Vermont New Product Development Process

If a new incentive offer or program is being designed, this process is used. If the incentive has been in place for a while, and program delivery is not changing, the process is not necessarily followed.

If there is a need for an expedited change, the process can be shortened by reducing some of the check list items.

Ideally, the NPD process is consistent between the residential and commercial markets. Usually, if there are changes to the program design, they occur on a six months to a year cycle.

Efficiency Vermont uses a strong data tracking approach for performance and opportunities. Program managers are required to provide forecast and actual data every month for the year ahead.

Cost effectiveness is performed using the societal test. There are different adders for different factors.

Incentives are typically changed based on customer behaviour; not cost effectiveness. Free-ridership is assessed for incentive levels.

Efficiency Vermont conducts market research on a project basis, but the findings are leveraged for the annual planning process as required.

Every measure has its energy savings assumptions evaluated every three years at a minimum. Usually, measures are reviewed for their savings assumptions every year or every two years.

EFFICIENCY VERMONT CORE PROGRAM OFFERINGS (RESIDENTIAL AND BUSINESS)

Program Name	Program Area	Program Measures (Prescriptive Incentives)	Links
Agricultural Equipment Rebates	Agricultural (Commercial)	• Lighting • Equipment Rebates are paid after purchase and submission of rebate form. Certain products are qualified through a qualifying product list or through provided specifications. Incentives are either prescriptive or quasi-prescriptive based on equipment characteristics.	https://www.efficiencyvermont.com/Media/Default/docs/rebates/forms/efficiency-vermont-agricultural-lighting-equipment-rebate-form.pdf
Appliances	Residential	• Dehumidifiers • Clothes Dryers • Clothes Washers • Refrigerators Rebates are paid after purchase and submission of rebate form. All rebated products are qualified through a qualifying product list.	https://contractors.efficiencyvermont.com/rebates
Electronics	Residential	• Advanced Power Strips Incentive provided through a coupon at participating retailer. All products are qualified through a qualifying product list.	https://contractors.efficiencyvermont.com/rebates
Heating, Cooling and Ventilation	Residential and Commercial	• Commercial HVAC • Heat Pump Water Heaters • Cold Climate Heat Pump • High Performance Circulator Pump • Residential Heating Systems • Residential Water Heating Rebates are paid after purchase and submission of rebate form. Certain products are qualified through a qualifying product list or through provided specifications. Some of the qualifying lists are upstream, so the incentive is provided instantly, versus through a mail-in form. Incentives are either prescriptive or quasi-prescriptive based on equipment characteristics.	https://contractors.efficiencyvermont.com/rebates
Industrial & Special Equipment		• Compressed Air • Pool Pumps Rebates are paid after purchase and submission of rebate form. Certain products are qualified through a qualifying product list or through provided specifications.	https://contractors.efficiencyvermont.com/rebates

		Incentives are either prescriptive or quasi-prescriptive based on equipment characteristics.	
Lighting	Residential	• CFLs • LEDs Incentives provided at participating retailers. Minimum prices are $0.99 for CFLs and $3.99 for LED products.	
Lighting	Commercial	• LED Fixtures • Lighting Controls Rebates are paid after purchase and submission of rebate form. Products are qualified through provided specifications. Incentives are either prescriptive or quasi-prescriptive based on equipment characteristics.	https://contractors.efficiencyvermont.com/rebates
Refrigeration and Commercial Kitchens	Commercial	• Commercial Kitchen Equipment • Commercial Refrigeration Rebates are paid after purchase and submission of rebate form. Products are qualified through provided specifications. Incentives are either prescriptive or quasi-prescriptive based on equipment characteristics.	https://contractors.efficiencyvermont.com/rebates
Residential Rental Properties	Commercial	• Refrigerators • Ventilation Systems • Boilers • Furnaces • Free Energy Efficiency Products (Aerators, Showerheads, CFLs) Rebates are paid after purchase and submission of rebate form. Products are qualified through provided specifications. Incentives are either prescriptive or quasi-prescriptive based on equipment characteristics.	https://contractors.efficiencyvermont.com/rebates
Home Performance with ENERGY STAR®	Residential	• Insulation and Building Envelope (Up to $2,000) • Heating System Incentive ($500) Participation requires hiring a trained Home Performance with ENERGY STAR contractor. After the qualifying measures are installed, the contractor reports the completed work for Efficiency Vermont for review. After review, the incentives are paid.	https://www.efficiencyvermont.com/Media/Default/docs/rebates/forms/efficiency-vermont-home-performance-with-energy-star-incentive-overview.pdf
Residential New Construction	Residential/ Commercial	• Insulation and Building Envelope • HVAC Equipment • Lighting • Appliances Up to $2,000 in incentives. The home has to be issued with a Home Energy Rating (HERS) index score.	https://www.efficiencyvermont.com/Media/Default/docs/services/brochures/efficiency-vermont-residential-new-construction-specifications-and-incentives.pdf

APPENDIX A-9: MAINE (EFFICIENCY MAINE)

GEOGRAPHIC DEFINITIONS

Efficiency Maine is the body that incents energy efficiency practices in the state of Maine, USA. They are responsible for developing, planning, coordinating and implementing energy efficiency and alternative energy resource programs in the entire state; this includes electric and gas fuel programs.

LOAD AND CONSUMPTION INFORMATION (ELECTRIC)

Electricity in Maine is distributed by ISO New England. Northern Maine Independent System Operator services northern Maine.

Maine itself has 13 electric utility suppliers. Three of these utilities are the main players in the market serving over 90 percent of the customers in state. Maine has a population of 1.33 million.

Peak Demand (2014): 2,200 MW[1]

Figure 48: Number of Customer Accounts[2]

Maine					
All sectors		805,178	806,103	806,950	819,638
Residential		709,288	710,160	710,988	721,508
Commercial		92,844	92,884	92,896	95,047
Industrial		3,046	3,059	3,066	3,083
Transportation		0	0	0	0

Figure 49: Customer Rates (2015) [3]

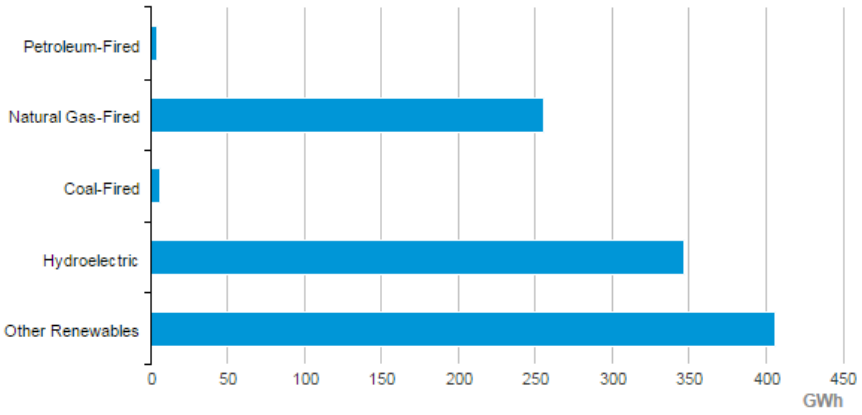
	Residential (Cents/kWh)	Commercial (Cents/kWh)	Industrial (Cents/kWh)	Transportation (Cents/kWh)
Efficiency Maine	15.67	13.15	9.06	-

[1] Maine Public Utilities Commission, "2014 Annual Report," http://www.maine.gov/mpuc/about/annual_report/documents/2014AnnualReportFinaltoPrinter.pdf (February, 2015)
[2] US Energy Information Administration, "Number of customer accounts, monthly," http://www.eia.gov/electricity/data/browser/#/topic/56?agg=0,1&geo=004&endsec=vg&linechart=ELEC.CUSTOMERS.ME-ALL.M&columnchart=ELEC.CUSTOMERS.ME-ALL.M&map=ELEC.CUSTOMERS.ME-ALL.M&freq=M&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0
[3] U.S. Energy Information Administration, "Average retail price of electricity to ultimate customers," http://www.eia.gov/electricity/data.cfm#sales (February 2015)

Figure 50: Retail Sales of Electricity (Million kilowatt-hours)[4]

	2012	2013	2014	2015
Retail sales of electricity (million kilowatthours)				
New England				
All sectors	120,456	121,357	119,983	119,311
Residential	47,208	48,369	47,212	47,397
Commercial	44,864	44,938	53,107	53,158
Industrial	27,818	27,472	19,107	18,178
Transportation	566	577	557	577
Other	--	--	--	--
Maine				
All sectors	11,561	11,855	12,003	11,955
Residential	4,481	4,662	4,661	4,624
Commercial	4,053	4,016	3,985	3,973
Industrial	3,027	3,177	3,357	3,358
Transportation	0	0	0	0
Other	--	--	--	--

Figure 51: Maine Net Electricity Generation by Source, Dec. 2015 [5]



[4] U.S. Energy Information Administration, "Retail sales of electricity, annual," http://www.eia.gov/electricity/data/browser/#/topic/5?agg=0,1&geo=o04&freq=A&start=2001&end=2015&ctype=linechart&ltype=pin&rtype=s&rse=0&maptype=0&pin=

[5] U.S. Energy Information Administration, "Maine Net Electricity Generation by Source, Dec. 2015," https://www.eia.gov/state/print.cfm?sid=ME

LOAD AND CONSUMPTION INFORMATION (NAUTRAL GAS)

Maine's gas is serviced by four gas utilities[6]:

- Northern Utilities, d/b/a Unitil
- Bangor Gas Company, L.L.C.
- Maine Natural Gas, Corporation
- Summit Natural Gas of Maine, Inc.

The Maine Public Utilities Commission (MPUC) regulates the natural gas pipelines and gas utilities[7].

Figure 52: Natural Gas Consumption (Maine) [8]

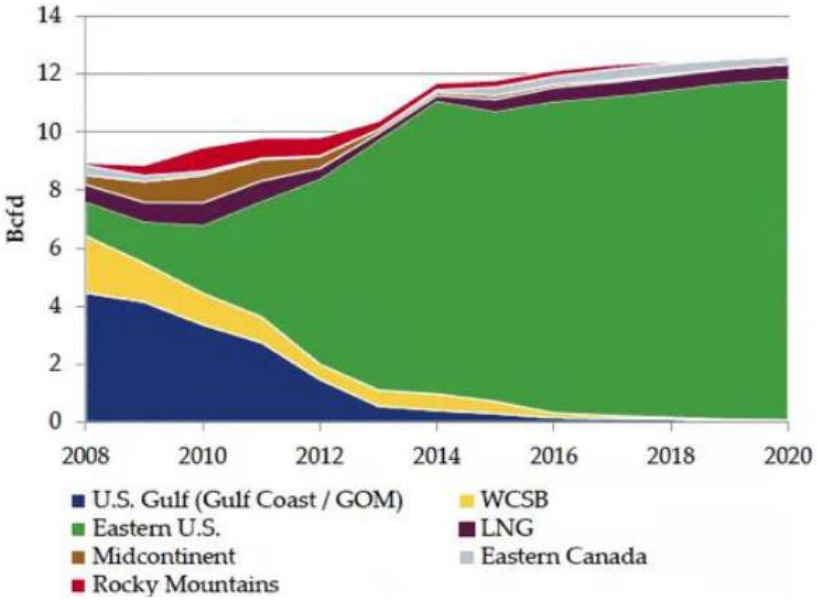
	2010	2011	2012	2013	2014	2015
Total Consumption	77,575	71,690	68,266	64,091	60,661	
Pipeline & Distribution Use	1,753	2,399	762	844	1,300	
Volumes Delivered to Consumers	75,821	69,291	67,504	63,247	59,362	NA
Residential	1,234	1,409	1,487	1,889	2,357	2,605
Commercial	5,830	6,593	7,313	8,146	9,030	9,795
Industrial	28,365	27,734	30,248	32,308	24,121	NA
Vehicle Fuel	1	1	1	*	1	1
Electric Power	40,392	33,555	28,456	20,904	23,853	17,447

Figure 53: Customer Rates (2014)[9]

	Residential ($/Cubic ft.)	Commercial ($/Cubic ft.)	Industrial ($/Cubic ft.)	Transportation ($/Cubic ft.)
Efficiency Maine	16.90	15.13	11.93	-

[6] Maine Public Utilities Commission, "Natural Gas Distributors," http://www.maine.gov/mpuc/natural_gas/distributors.html (2008)
[7] Office of the Revisor of Statutes Maine, "Title 35-A: Public Utilities," http://legislature.maine.gov/legis/statutes/35-A/title35-Ach0sec0.html (January 2016)
[8] U.S. Energy Information Administration, "Natural Gas Consumption by End Use," https://www.eia.gov/dnav/ng/ng_cons_sum_dcu_SME_a.htm (March 2016)
[9] U.S. Energy Information Administration, "Natural Gas Prices," http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_SME_a.htm (March, 2016)

Figure 54: Sources of Gas Supply in the U.S. Northeast Region, Including New England



MARKET STRUCTURE OVERVIEW

The Efficiency Maine Trust Act came in effect in 2009 and is responsible for Efficiency Maine's inception as an independent Trust. Their purpose is to develop, plan, coordinate, and implement energy efficiency/alternative energy resource programs across the state of Maine. These purposes are accompanied by 10- and 20-year energy savings aspirations which are integrated into the strategy and budgets of the Triennial Plans[7]. These aspirations include:

- Weatherizing 100 percent of residences and 50 percent of businesses by 2030
- Reducing peak-load electric energy consumption by 100 megawatts by 2020
- Reducing the state's consumption of liquid fossil fuels by at least 30 percent by 2030
- By 2020, achieving electricity and natural gas savings of at least 30 percent and heating fuel savings of at least 20 percent as defined in and determined pursuant to the measures of performance ratified by the commission under section 10120
- Capturing all cost-effective energy efficiency resources available for electric and natural gas utility ratepayers
- Saving residential and commercial heating consumers not less than $3 for every $1 of program funds invested by 2020 in cost-effective heating and cooling measures that cost less than conventional energy supply
- Building stable private sector jobs providing clean energy and energy efficiency products and services in the state by 2020
- Reducing greenhouse gas emissions [10 percent below 1990 levels by 2020] from the heating and cooling of buildings in the state

According to the act[7], Efficiency Maine, in consultation with entities and agencies engaged in delivering efficiency and weatherization programs in the state, is to develop a triennial plan. The triennial plans has to include identification of all achievable cost-effective energy efficiency savings, programs to address these savings potential and the associated costs and benefits with the basis of these costs and benefits presented. It is the MPUC's responsibility to review and approve or deny triennial plans submitted. Upon approval of the plan, the MPUC orders

the state's electric utilities to collect the applicable budget from their customers and remit it to the Trust for its programs.

An independent evaluation of each major program implemented is conducted at least every five years. This evaluation must include an accounting audit and program effectiveness of meeting its goals evaluation. These results are included in the annual report submitted. "Major" programs are defined as programs with annual budgets greater than $500,000.

The amount of funding available is determined by the budget needed to achieve the maximum achievable cost-effective (MACE) energy efficiency potential approved by the MPUC. Efficiency Maine also typically offsets some of funding through a variety of sources such as through Maine ratepayers, revenues from the Forward Capacity Market and a long-term contract with Maine utilities.

Energy efficiency has been determined to be the lowest cost energy resource in the state of Maine. The cost to save electricity through efficiency upgrades averaged 4.3 cents/kWh. The cost of saving heating fuels (heating oil, propane, natural gas, wood, and kerosene) through weatherization and high-efficiency heating equipment averaged $12.96/MMBtu.

PORTFOLIO MATURITY AND HISTORICAL PERFORMANCE

DSM programs were administered by electric utilities before 2002. Efficiency Maine was then established in 2002 to promote electricity efficiency, reduce energy costs and improve the environment statewide. During this time, Efficiency Maine was part of the MPUC. It later became an independent Trust by 2009.

Efficiency Maine Program Impacts 2004-2010[10]:

- 2004-2010 Cumulative Annual MWh Savings: **486,342**
- 2004-2010 Cumulative Lifetime MWh Savings: **4,646,248**
- 2004-2010 Cumulative Benefit to Cost Ratio: **2.92**
- 2004-2010 Cumulative Cost/kWh: **3.6 cents**

CURRENT CYCLE

Efficiency Maine began Triennial Plans in 2011 and is currently in the second triennial cycle that spans 2014-2016. Efficiency Maine also releases performance reports annually. The latest public report is 2015.

Figure 55: 2011-2015 Electric Savings Result [11]

Year	Total (GWh)
2011	173.5
2012	226
2013	134
2014	162
2015	224
Total	919.5

[10] Efficiency Maine, "2010 Annual Report," http://www.efficiencymaine.com/docs/EMO16444_AnnualReport_2010.pdf

[11] Efficiency Maine, captured from Efficiency Maine's "Annual Reports" between 2011-2015 http://www.efficiencymaine.com/about/library/reports/

Figure 56: 2011-2015 Gas Savings Result [11]

Year	Total (MMBtu)
2011	16,115
2012	1,845
2013	12,169
2014	30,839
2015	19,274
Total	80,242

Figure 57: Gross Electricity Savings [12]

Program	Annual kWh Savings	Lifetime kWh Savings	Efficiency Maine Costs	Participant Cost	Lifetime Energy Benefit	Cost/kWh (Lifetime)	Benefit-to-Cost Ratio
Business Incentive Program Electric Measures	75,285,380	872,772,692	$17,162,905	$16,564,324	$74,374,992	$0.039	2.21
Large Customer Program Electric Measures	30,760,921	438,865,951	$6,983,439	$5,124,783	$25,297,712	$0.028	2.09
Small Business Initiative	5,409,349	70,201,736	$2,732,147	$551,767	$6,330,554	$0.047	1.93
Consumer Products Program	102,318,679	550,577,702	$10,817,327	$20,287,640	$49,871,614	$0.056	1.60
Home Energy Savings Program Electric Measures	9,032,603	162,586,854	$3,564,434	$1,079,128	$16,426,509	$0.029	3.54
Low-Income Direct Install Initiative Electric Measures	1,534,180	14,065,348	$1,232,373	$0	$1,249,631	$0.088	1.01
Cross-Cutting Strategies Electric			$863,415				
Administration - Electric			$2,136,542				
TOTAL	224,341,112	2,109,070,284	$45,492,581	$43,607,642	$173,551,012	$0.042	1.95

[12] Efficiency Maine, "FY2015 Annual Report," http://www.efficiencymaine.com/docs/2015-Efficiency-Maine-Annual-Report.pdf

Figure 58: Gross Gas Savings [12]

Program	Annual MMBtu Savings	Lifetime MMBtu Savings	Efficiency Maine Costs	Participant Cost	Lifetime Energy Benefit	Cost/MMBTu (Lifetime)	Benefit-to-Cost Ratio
Business Incentive Program Natural Gas Measures	13,057	260,887	$242,991	$66,294	$1,666,517	$1.19	5.39
Low-Income Direct Install Initiative Natural Gas Measures	636	12,728	$76,138	$0	$95,369	$5.98	1.25
Home Energy Savings Program Natural Gas Measures	5,581	127,018	$307,737	$1,100,862	$2,945,103	$11.09	2.09
Maine Advanced Building Program	1,642	32,833	$113,734	$106,360	$335,424	$6.70	1.52
Multifamily Efficiency Program	15,909	276,179	$1,414,082	$1,762,481	$4,815,091	$11.50	1.52
Business Incentive Program Other Fuels Measures	31,244	409,193	$1,095,388	$6,211,805	$10,017,712	$17.86	1.37
Large Customer Program GHG Measures	26,266	374,124	$1,808,033	$1,272,598	$6,212,210	$8.23	2.02
Low-Income Direct Install Initiative Other Fuels Measures	13,700	246,606	$700,600	$1,270,337	$4,547,475	$7.99	2.31
Home Energy Savings Program Other Fuels Measures	83,224	1,894,231	$6,309,776	$22,334,064	$43,920,697	$15.12	1.53
Renewables-Demonstration Projects			$220,923				
Cross-Cutting Strategies All Fuels			$170,894				
Administration - All Fuels			$496,969				
TOTAL	191,258	3,633,797	$12,957,266	$34,124,801	$74,555,598	$12.96	1.58

Figure 59: FY2015 Payments [12]

Use of Funds	Amount ($)
Administration-General	**2,220,441**
Residential Programs	**23,913,161**
– Administration-Res. Program	229,793
– Low Income	4,390,447
– Non-Low Income	19,292,921
Business Programs	**29,865,449**
– Administration-Bus. Program	249,884
– Small/Medium	23,138,575
– Large Custom	6,476,990
Cross-Cutting and Alternative Strategies	**1,119,422**
– Administration-C.C. Program	88,239
– Education and Awareness	27,498
– Evaluation	707,203
– Alternative Energy Program	220,926
– Innovation	75,556
Other Payments	**1,747,101**
Total Use of Funds-EMT	**58,865,574**

COST EFFECTIVENESS TESTING

TRC and PACT

Both TRC and PACT tests are presented in Efficiency Maine's annual reports. However, only TRC is used to evaluate performance. PACT is used for program planning/stakeholder relationships.

TRC and PACT by Efficiency Maine is based on "Understanding Cost effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers, A Resource of The

National Action Plan for Energy Efficiency," November 2008, http://www.epa.gov/cleanenergy/documents/suca/cost effectiveness.pdf

TRC is used at the measure level based on net savings for introduction of measures and performance reviews and must be greater than 1.0.

Avoided Costs

TRC: The benefits included are the avoided costs of energy.

Efficiency Maine participated in the AESC Study Group, which partnered with Tabors Caramanis Rudkevich for a study on marginal energy supply costs that are avoided due to electricity, natural gas, and other fuels reductions from energy efficiency programs throughout New England. The avoided costs from the study are used by Efficiency Maine for cost effectiveness testing. The AESC Study is typically revised every three years with a mid-term update.

Major categories of benefits for electricity include reductions in:

- Quantities of resources required to meet electric demand and annual energy
- Local transmission and distribution infrastructure costs
- The quantities of capacity and energy that have to be acquired from wholesale energy and capacity markets which may cause prices in those markets to decline

The following estimates of the subsequent major components of avoided electricity costs were used:

- Avoided retail capacity
- Avoided retail energy
- Avoided RPS compliance costs
- Electricity DRIPE

Major categories of benefits for gas include:

- Reductions in gas production
- Marginal reductions in cost of delivering and distributing gas

Costs

TRC at the Program level:

- Costs incurred by program participants (incremental costs)
- Costs of running the energy efficiency programs (delivery and administration costs)

TRC at the Measure level:

- Costs incurred from the measure (incremental costs)

PACT at the Program Level:

- Costs incurred from the measure (incremental costs)
- Costs of running the energy efficiency programs (delivery and administration costs)
- Incentive costs

PACT at the Measure Level:

- Costs incurred from the measure (incremental costs)
- Incentive costs

Figure 60: Benefit- Cost Ratios: Electric Programs 2015 [12]

	Adjusted Gross Benefit-to-Cost-Ratio			Net Benefit-to-Cost-Ratio		
Programs	TRC	PACT	Last Evaluation	Net to Gross Ratio	TRC	PACT
Business Incentive Program Electric Measures	2.21	4.33	Note 2	0.71	1.83	3.08
Large Customer Program Electric Measures	2.09	3.62	Note 2	0.79	1.85	2.86
Small Business Initiative	1.93	2.32	Note 1	1.00	1.93	2.32
Consumer Products Program	1.60	4.61	2015	0.75	1.44	3.47
Home Energy Savings Program Electric Measures	3.54	4.61	Note 1	1.00	3.53	4.61
Low-Income Direct Install Initiative Electric Measures	1.01	1.01	Note 1	1.00	1.01	1.01
Total	**1.95**	**3.81**		**0.78**	**1.70**	**2.96**

Figure 61: Benefit- Cost Ratios: All Fuels and Natural Gas Programs 2015 [12]

	Adjusted Gross Benefit-to-Cost-Ratio			Net Benefit-to-Cost-Ratio		
Programs	TRC	PACT	Last Evaluation	Net to Gross Ratio	TRC	PACT
Business Incentive Program Natural Gas Measures	5.39	6.86	Note 3	0.66	3.48	4.51
Low-Income Direct Install Initiative Natural Gas Measures	1.25	1.25	2014	1.00	1.25	1.25
Home Energy Savings Program Natural Gas Measures	2.09	9.57	2011	1.00	2.08	9.57
Maine Advanced Building Program	1.52	2.95	Note 2	1.00	1.52	2.95
Multifamily Efficiency Program	1.52	3.41	Note 3	0.90	1.44	3.06
Maine Advanced Building Program	1.52	2.95	Note 1	1.00	1.52	2.95
Business Incentive Program Other Fuels Measures	1.37	9.15	Note 3	1.00	1.37	9.15
Low Income Direct Install Initiative Other Fuels Measures	2.31	6.49	Note 3	1.00	2.17	6.49
Home Energy Savings Program Other Fuels Measures	1.53	6.96	Note 3	1.00	1.52	6.96
Total	**1.58**	**5.75**		**0.97**	**1.54**	**5.57**

INCENTIVE LEVEL-SETTING

Note the Trust is in the middle of a transition on the process for setting incentives. At the time of writing this report, the MPUC had not yet decided on the process. For the first two Triennial plan periods, one of Efficiency Maine's responsibilities is to include establishing more granular incentive levels to reflect specific product types and efficacies. The goal was to ensure that program budgets are spent invested without market disruptions from prematurely exhausting or underspending budgets. As such, periodic reviews of the appropriateness of incentive levels were conducted and adjustments to financial incentives as needed are made. These decisions were made on a program by program basis as determined by the Trust.

The Trust has proposed a third plan to capture all cost effective electrical and natural gas efficiency however the process for adjusting incentives has not yet been agreed upon. In general the MPUC is concerned with the overall cost effectiveness of the programs by Efficiency Maine. The incentive level setting is at Efficiency Maine's discretion but there appears to be a threshold over which this is not the case.

Below is an overview of the process employed by Efficiency Maine when examining an incentive level for a new measure or proposing a significant change to an existing measure.

1. **Market Research/Stakeholder Engagement**
   The process starts by performing both primary and secondary market research in order to determine the measure performance metrics and costs. This will include data from utilities and consulting stakeholders such as contractors, vendors, customers and advocacy groups.
2. **Technical Reference Manual**

Efficiency Maine has Residential TRMs and Commercial TRMs. These are documentation for energy and demand savings calculations of energy efficiency measures along with all the typically associated technology information and assumptions.

3. **Incremental Cost Design**
   Based on the market research and technology, Efficiency Maine will attempt to incentivize the incremental cost based on what is determined as a reasonable return on investment. For “Replace on Burnout” measures the incremental cost is calculated as the difference between the measure cost and that of the standard measures. For Retrofit/Direct Install measures, the incremental cost is taken as the full measure cost including the price of labour.
4. **Incentive Rate Finalized**
   Once the incremental measure cost is finalized, Efficiency Maine will set a standard incentive using the above considerations.

INCENTIVE ADMIN SPLIT

Figure 62: Electric Program Expenditures 2015 [12]

Program	Incentive	Delivery	Total
Business Incentive Program Electric Measures	$15,642,304	$1,520,601	$17,162,905
Large Customer Program Electric Measures	$6,439,194	$544,245	$6,983,439
Small Business Initiative	$2,366,729	$365,418	$2,732,147
Consumer Products Program	$8,809,467	$2,007,860	$10,817,327
Home Energy Savings Program Electric Measures	$3,086,300	$478,134	$3,564,434
Low-Income Direct Install Initiative Electric Measures	$1,105,121	$127,252	$1,232,373
Cross-Cutting Strategies Electric		$863,415	$863,415
Administration - Electric			$2,136,542
Sub Total	**$37,449,114**	**$5,906,924**	**$45,492,581**

Figure 63: Natural Gas and All Fuels Program Expenditures 2015 [12]

Program	Incentive	Delivery	Total
Business Incentive Program Natural Gas Measures	$170,847	$72,144	$242,991
Low-Income Direct Install Initiative Natural Gas Measures	$62,304	$13,834	$76,138
Home Energy Savings Program Natural Gas Measures	$275,207	$32,530	$307,737
Maine Advanced Building Program	$51,500	$62,234	$113,734
Multifamily Efficiency Program	$1,036,508	$377,574	$1,414,082
Business Incentive Program Other Fuels Measures	$976,200	$119,188	$1,095,388
Large Customer Program GHG Measures	$1,383,469	$424,565	$1,808,033
Low-Income Direct Install Initiative Other Fuels Measures	$650,600	$50,000	$700,600
Home Energy Savings Program Other Fuels Measures	$4,104,196	$2,205,579	$6,309,776
Renewables-Demonstration Projects	$220,923	$0	$220,923
Cross-Cutting Strategies All Fuels		$170,894	$170,894
Administration - All Fuels			$496,969
Sub Total	**$8,931,754**	**$3,528,542**	**$12,957,266**

EXISTING PROGRAMS [13]

Name	Target Market	Incentive Information
Home Energy Savings Program (Residential)	Residential customers who are looking to weatherize, reduce GHG, and improve overall energy efficiency such as equipment and building envelope improvement, as well as room and water heating. http://www.efficiencymaine.com/docs/HESP-Program-Manual.pdf	Air sealing with assessment: $400, a bonus of $100 provided with one envelope or heating system measure performed with an air seal and assessment Insulation: $700 per insulation (attic, wall, and basement), limit of $2,100 per building Supplemental heating system: $500 (Pellet or wood stove, or air source ductless heat pumps) Whole house heating systems: $500 (ducted air source heat pump or furnace/boiler) Ultra-low GHG whole house heating systems: 33 percent, up to $5,000 (eligible biomass boilers/furnaces) Custom projects: Tier 1 incentive: Achieve a minimum of 20 percent projected whole energy savings through any combination of savings measures and receive $1,000 per building, representing no more than 1/3 of total project cost Tier 2 incentive: Achieve a minimum of 40percent projected whole energy savings through any combination of savings measures and receive $1,500 per building, representing no more than 1/3 of total project cost PACE and unsecured energy loans: Available to most home owners, up to 15 year repayment period, fixed rate of 4.99APR, transferrable with property sale, range of loans from $6,500 to $15,000 Additional incentives available for Unitil, Maine NG, Bangor NG customers
Low Income Home Energy Savings Program (Residential)	Residential customers who are currently participating in LIHEAP looking to participate in the Home Energy Savings Program. http://www.efficiencymaine.com/docs/LIHESP-Claim-Form.pdf	Air sealing with building performance institute (BPI) assessment: $500 Insulation with BPI assessment: $1,000 each for attic, wall, and basement insulation Other efficiency upgrades: $500 for any of; Insulate box sills, seal mobile home

[13] Efficiency Maine, http://www.efficiencymaine.com/ (2016)

Name	Target Market	Incentive Information
		underbelly, repair/insulate/seal door or hatch, seal/insulate heat ducts or pipes, additional six hours of air sealing
Heat Pump Water Heater Program (Residential)	Residential customers who are looking for a new, highly efficient way to heat water. http://www.efficiencymaine.com/at-home/heat-pump-water-heater-program/	Heat pump: $500, $300 tax credit available
Appliance Rebate Program (Residential)	Residential customers who are looking to purchase new ENERGY STAR Certified appliances. http://www.efficiencymaine.com/at-home/appliancerebate-program/	Dehumidifier: $25 Room air purifier: $50 Clothes washer: $50
Lighting Program (Residential)	Customers who are looking to replace their lighting with CFL and LED bulbs.	Efficiency Maine partners with manufacturers and retailers to reduce the price of energy efficient lighting products for Maine consumers. The price vary on the store, currently the cheapest LED blub costs $0.88 for a 9 watt, CFL bulb at $0.10 for a 13 watt. http://www.efficiencymaine.com/docs/EM-lighting-deals.pdf
Business Programs	Businesses looking to upgrade their equipment	Boilers and furnaces: Incentives between $1,250 to 12,500 Boiler controls and ancillary equipment: $0.75 to 1,325 per Mbtu/h Ductless Mini-split heat pump: $500 to 1,250 per system VRF system: $0.50 per sq ft http://www.efficiencymaine.com/docs/embp_HeatingSolutions_rev030316v2.pdf Lighting: Efficiency Maine partners with manufacturers and distributors to discount the price of energy efficient screw-in LED lighting products for Maine businesses Commercial Kitchen Fryer: $1,250 Broiler: $1,550 Convection oven: $750 Combination oven: $1,250 Steamer: $2,500 Griddle: $950 http://www.efficiencymaine.com/docs/EM-Natural-Gas-Kitchen-Measures.pdf

Name	Target Market	Incentive Information
Commercial Heat Pump Program	For businesses that are looking to upgrade their heating and cooling system with highly efficient products. http://www.efficiencymaine.com/at-work/commercial-heat-pump-program/	Ductless heat pumps: $500 to $1,250
Large Customer Program	For businesses that are looking to achieve significant electricity savings. http://www.efficiencymaine.com/at-work/competitive-program/	Funding range from minimum of $50,000 to a maximum of $1 million per facility, or up to 50 percent of the total project costs. Project should save 350,000 kWh or more to be eligible. Incentive capped at $0.28/kWh. http://www.efficiencymaine.com/docs/All-Programs-Brochure.pdf#page=2
Advanced Building Program	For Maine property owners, developers, architects, and engineers looking to achieve significant energy savings with their new construction.	Prescriptive cash incentive, at $1.50 per square foot to the building owner, and $0.25 per square foot to the lead building design team (capped at $175,000). http://www.efficiencymaine.com/at-work/maine-advance-buildings/

APPENDIX A-10: MASSACHUSETTS (NATIONAL GRID)

OVERVIEW

Jurisdictional Scan	
State/Province	Massachusetts
Utility/Agency	National Grid
Fuel	Electricity, Gas
Key Contact/Interviewee	Ellen Pfeiffer
Consultant	Mayuran Srikantha

JURISDICTION OVERVIEW

Overview of Electricity Market

The following entities make up the electricity system in Massachusetts.

- National Grid
- Massachusetts Government: Office of Energy and Environmental Affairs: Department of Public Utilities (DPU)
- Mass Save®
- ISO New England (ISO-NE)
- Energy Efficiency Advisory Council
- Other Major Electric Utilities
    - Eversource Energy
    - Unitil
    - Cape Light Compact

National Grid is an investor owned utility that operates in the United Kingdom, and in parts of Massachusetts, Rhode Island and New York in the United States. National Grid provides both electricity and natural gas to customers across these three states. In conjunction with other electric utilities and natural gas companies, National Grid submits multi-year energy efficiency plans to the Department of Public Utilities, a division of the Office of Energy and Environmental Affairs in the Massachusetts government. The plans cover National Grid's forecasted activities, and budget and savings targets for the energy efficiency programs in their portfolio.

The Department of Public Utilities is responsible for the oversight of the electric power, natural gas and water utilities in Massachusetts. The oversight includes the following activities: developing alternatives to traditional regulation, monitoring service quality, regulating safety and participating in the siting of energy facilities. The Department's mission is "to ensure that utility customers are provided with the most reliable service at the lowest possible cost; to protect the public safety from transportation and gas pipeline related accidents; and to ensure that residential ratepayers' rights are protected."

Mass Save is the public-facing brand for all of Massachusetts' efficiency programs. It is an initiative that is sponsored by Massachusetts' natural gas and electric utilities and energy efficiency service providers. These sponsors include Berkshire Gas, Blackstone Gas Company, Cape Light Compact, Columbia Gas of Massachusetts, Eversource, Liberty Utilities, Unitil and National Grid. The initiative is also supported by energy efficiency service providers and the Massachusetts Department of Energy Resources. The Mass Save portfolio covers both electricity and natural gas efficiency programs throughout Massachusetts. It helps provide consistency for Massachusetts' residential and business customers.

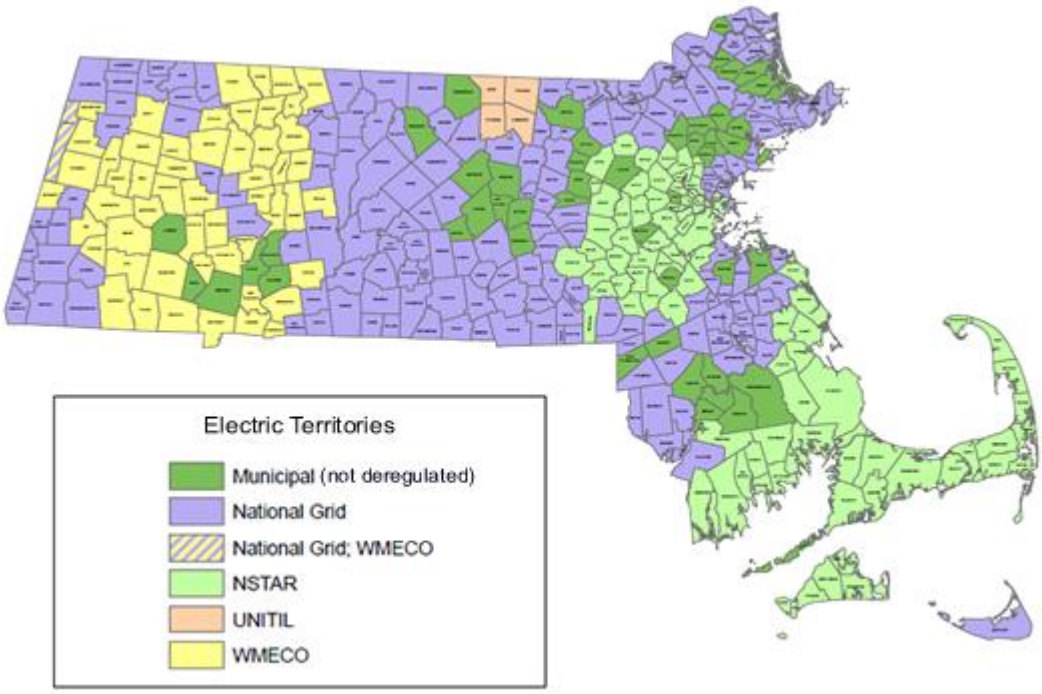
ISO New England (IESO-NE) is the Regional Transmission Organization (RTO) that manages New England's bulk power generation and transmission system. ISO-NE has three main objectives:

1. Ensure daily reliable operation of New England's bulk power generation and transmission system
2. Oversee and ensure fair administration of region's wholesale electricity market
3. Manage a comprehensive regional planning process

The Energy Efficiency Advisory Council (EEAC) is responsible for guiding the progress of energy efficiency in Massachusetts. Key activities include demonstrating continuing leadership in policy and program implementation, integration and innovation, achieving the full potential of the Green Communities Act, and generating significant and sustainable benefits for all Massachusetts' citizens. The EEAC's responsibilities include:

- Collaborating with the utilities on the submission on energy efficiency plans and updates
- Publishing annual results and reports; quarterly reports and monthly dashboards on progress
- Managing the annual EM&V process and other studies through the Evaluation Management Committee
- Holding monthly meetings to discuss progress, results, improvements and current projects

There are several other utilities that work with National Grid in submitting the energy efficiency plan, and in operating the efficiency programs under Mass Save. Each electric and natural gas utility has its own savings targets and budgets. The map below provides a rough demonstration of National Grid's service territory in Massachusetts[99].

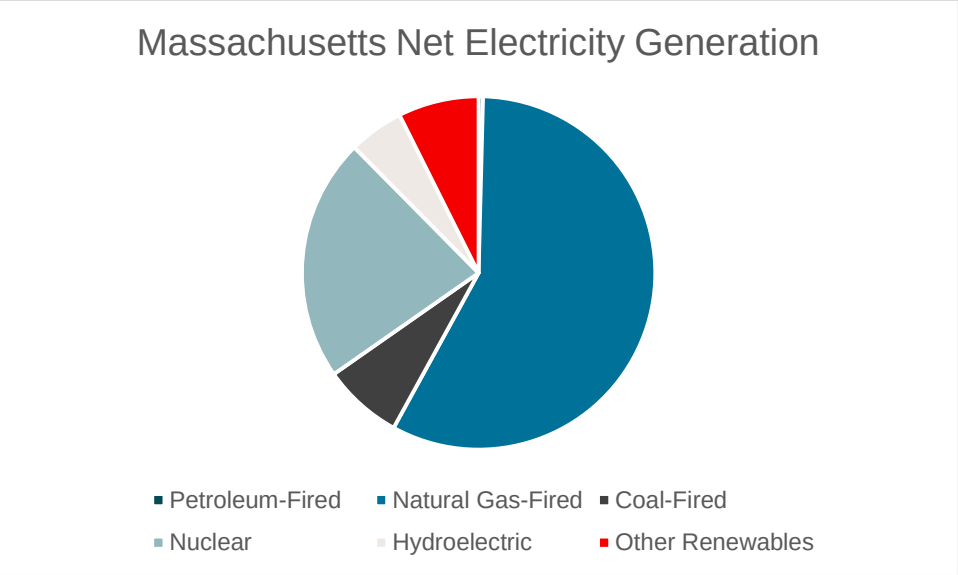


NSTAR and WMECO now operate under Eversource Energy. Cape Light Compact serves customers in Cape Code and Martha's Vineyard.

[99] http://ambitpros.com/wp-content/uploads/ambit-energy-massachusetts-electric-map.png

Electricity Generation

Massachusetts is dominated by natural gas generation[100].



Massachusetts is summer peaking with a load of 13,128 MW. Over 95 percent of the electricity generated comes from large scale generators and CHP units, while the rest comes from electric utilities. The majority of generators participate in ISO-New England's capacity market.

MASSACHUSETTS ENERGY EFFICIENCY PROGRAM INCENTIVE AND COST EFFECTIVENESS POLICY

Massachusetts is viewed as one of the leading jurisdictions for promoting energy efficiency in North America. It is ranked as the #1 jurisdiction in ACEEE's 2015 Scorecard. Massachusetts directs its utilities to design and implement programs through the Green Communities Act. The act requires electric and gas utilities to procure all cost-effective energy efficiency before more expensive supply resources. The act requires a three year planning cycle. The first cycle started in 2010. The most recent cycle (2013-2015) is expected to save 3,703 GWh by the end of 2015.

Massachusetts has the most aggressive efficiency targets in the United States, with the 2015 target being 2.6 percent of retail sales. The 2016-2018 plan calls for 4,122 GWh of savings over the three years, with a budget of $1.96 billion.[101]

National Grid's individual target and budget for 2016-2018 is 1,939 GWh and $897.6 million. The overall target is 2.94 percent of retail electricity sales.

Funding for the programs is provided through the following five sources:

1. Systems Benefit Charge ($0.0025/kWh)
2. Revenues from Forward Capacity market administered by ISO-NE
3. Revenues from cap and trade pollution control programs (Regional Greenhouse Gas Initiative)
4. Other funding sources
5. Energy Efficiency Surcharge (if required and approved by DPU)

For electricity efficiency programs, 10 percent of the total budget should be dedicated to the low income sector.

[100] http://www.eia.gov/state/?sid=MA#tabs-4
[101] http://web1.env.state.ma.us/DPU/FileRoomAPI/api/Attachments/Get/?path=15-168%2fOrder_12816.pdf

Cost Effectiveness Testing

As per the 2016-2018 plan, there are three key elements to cost effectiveness:

1. Each program is supposed to be screened for cost effectiveness. For Massachusetts, the TRC test is used for screening. There is flexibility in what is termed a "program", but there needs to justification provided to include non-cost effective elements and provide direction on how they may be cost-effective in the future.
2. Program administration (program planning and administration costs only, not delivery costs) costs should be minimized to the fullest practicable extent
3. Program administrators will use competitive procurement processes to the fullest practicable extent

Avoided Costs

Periodically, the avoided costs are updated. The last update occurred in 2015, based on a report by Synapse Energy Economics which investigated the avoided energy supply costs for New England. Before any changes are implemented, they must be reviewed and approved by the board. The avoided costs are calculated for the entire New England Region, and then separated into different geographic areas, of which is Massachusetts.

For electricity, the major categories of benefit are[102]:

- Avoided Capacity Costs
- Avoided Energy Costs
  - These costs include the reduction in cost of renewable energy that needs to be acquired to comply with Renewable Portfolio Standards (RPS).
- Transmission and Distribution Costs
  - These are assumed at the local level.
- Capacity DRIPE
- Energy DRIPE
- Electricity Cross-Fuel DRIPE
- Avoided Non-Embedded CO_2 Costs

NATIONAL GRID – UTILITY OVERVIEW

Utility Facts

- Serves portions of Massachusetts, Rhode Island and New York
- Services a population of 3.3 million electricity customers
  - In Massachusetts, it is just under 1.1 million customers

Customer Class Breakdown

There are the following types of customers:

- Residential
- Commercial

[102] Avoided Costs - http://ma-eeac.org/wordpress/wp-content/uploads/2015-Regional-Avoided-Cost-Study-Report.pdf

Retail Price of Electricity[103]

Entity	State	Ownership	Customers (Count)	Sales (Megawatthours)	Revenues (Thousands Dollars)	Average Price (cents/kWh)
City of Chicopee - (MA)	MA	Municipal	26,217	455,823	55,164.7	12.10
City of Hingham - (MA)	MA	Municipal	9,626	199,687	31,215.0	15.63
City of Holyoke - (MA)	MA	Municipal	17,315	356,024	41,924.0	11.78
City of Marblehead - (MA)	MA	Municipal	10,920	105,357	15,727.0	14.93
City of Norwood - (MA)	MA	Municipal	15,414	309,614	44,810.4	14.47
City of Peabody - (MA)	MA	Municipal	26,016	504,179	64,731.5	12.84
City of Taunton	MA	Municipal	36,877	652,064	92,611.0	14.20
City of Westfield - (MA)	MA	Municipal	17,889	366,807	50,689.0	13.82
Fitchburg Gas & Elec Light Co	MA	Investor Owned	23,748	216,304	45,001.9	20.80
Massachusetts Electric Co	MA	Investor Owned	1,078,192	10,602,381	1,762,905.5	16.63
NSTAR Electric Company	MA	Investor Owned	879,498	8,805,023	1,550,537.0	17.61
Nantucket Electric Co	MA	Investor Owned	12,645	130,682	24,821.9	18.99
Town of Belmont - (MA)	MA	Municipal	11,279	125,032	23,582.0	18.86
Town of Braintree - (MA)	MA	Municipal	16,309	361,599	49,846.0	13.78
Town of Concord - (MA)	MA	Municipal	8,092	169,281	25,419.3	15.02
Town of Danvers	MA	Municipal	13,357	310,008	44,505.0	14.36
Town of Hudson - (MA)	MA	Municipal	12,695	348,102	47,133.4	13.54
Town of Ipswich - (MA)	MA	Municipal	7,054	111,088	15,727.8	14.16
Town of Littleton - (MA)	MA	Municipal	6,575	288,532	32,929.1	11.41
Town of Mansfield - (MA)	MA	Municipal	9,773	202,928	26,173.0	12.90
Town of Middleborough - (MA)	MA	Municipal	16,301	264,432	31,789.0	12.02
Town of Middleton	MA	Municipal	3,595	93,511	13,442.0	14.37
Town of North Attleborough - (MA)	MA	Municipal	14,076	229,853	34,228.0	14.89
Town of Reading - (MA)	MA	Municipal	29,641	679,152	69,533.0	10.24
Town of Shrewsbury - (MA)	MA	Municipal	15,868	278,984	31,812.0	11.40
Town of South Hadley - (MA)	MA	Municipal	8,059	111,117	16,161.1	14.54
Town of Sterling - (MA)	MA	Municipal	3,753	60,518	8,298.1	13.71
Town of Wakefield - (MA)	MA	Municipal	12,407	194,441	26,014.0	13.38
Town of Wellesley - (MA)	MA	Municipal	10,032	242,936	31,596.9	13.01
Western Massachusetts Electric Company	MA	Investor Owned	188,299	1,825,087	296,597.3	16.25

[103] http://www.eia.gov/electricity/data.cfm#sales

NATIONAL GRID - ENERGY EFFICIENCY PROGRAMMING

Savings and Expenditure[104]

In the 2013-2015 cycle, National Grid achieved the following savings with the associated expenditures. These savings and expenditures have not been through the full EM&V process yet and have not been finalized.

National Grid 2013-2015 Savings and Expenditure			
Sector	Savings (MWh)	Total Expenditure ($)	Incentive Expenditure ($)
Residential	805,157	$290,842,401	$222,323,354
Low Income	58,040	$85,604,742	$68,824,752
Commercial & Industrial	919,015	$300,079,268	$247,234,173

National Grid 2013-2015 Incentive to Total Program Spending and Spending per kWh Ratios		
Sector	Incentive to Total Program Spending Ratio	Spending per kWh Ratio
Residential	76 percent	$0.361/kWh
Low Income	80 percent	$1.475/kWh
Commercial & Industrial	82 percent	$0.327/kWh

Cost Effectiveness

National Grid's cost effectiveness results for 2013-2015 are as follows:

National Grid 2013-2015 Cost Effectiveness Results	
Expected TRC	3.69[105]
Actual TRC	Not Available

FUTURE TARGETS

The 2016-2018 plan calls for 4,122 GWh of savings over the three years, with a budget of $1.96 billion for all of Massachusetts.[106]

National Grid's individual target and budget for 2016-2018 is 1,939 GWh and $897.6 million. The overall target is 2.94 percent of retail electricity sales.

[104] Data from Masssavedata.com
[105] 2013-2015 Plan: http://www.mass.gov/eea/docs/doer/energy-efficiency/statewide-electric-and-gas-three-year-plan.pdf

[106] 2016-2018 Plan: http://web1.env.state.ma.us/DPU/FileRoomAPI/api/Attachments/Get/?path=15-168%2fOrder_12816.pdf

INCENTIVE LEVEL SETTING METHODOLOGY

National Grid uses the following principles for incentive setting methodology for the electricity efficiency programs:

- Customer market research
- Technology research
- Supply chain and stakeholder discussion
- Top-down potential analysis
- Bottom-up participation and penetration analysis

NATIONAL GRID CORE PROGRAM OFFERINGS (RESIDENTIAL AND BUSINESS)

Program Name	Program Area	Program Measures	Links
No Cost Home Energy Assessments	Residential and Low Income	For homeowners of 1-to-4 unit homes For landlords of 1-to-4 unit homes For multifamily facilities with 5+ units For income eligible customers Online home energy assessment	http://www.masssave.com/en/residential/mass-energy-rebate
Lighting and Appliances	Residential and Low Income	• Instant Price Discounts at Participating Retailers and for Online Catalogue for qualified ENERGY STAR CFL and LED lamps and fixtures • Instant Price Discounts for Online Catalogue for qualifying advanced power strips and shower heads. • Mail-in rebate for ENERGY STAR certified room air cleaners, clothes dryers and dehumidifiers • Secondary Fridge or Freezer Retirement program	
Heating & Cooling	Residential and Low Income	• Mail-in rebate for Central Air Conditioners, Air Source Heat Pumps, Heat Pump Water Heaters and Ductless Mini-Splits • Online or mail-in rebate for wireless enabled thermostat (up to $100) and programmable thermostats (up to $25)	
Deep Energy Retrofit	Residential	• Roof upgrades ($3.00/sqft), exterior walls ($3.50/sqft) and basement insulation ($2.00/sqft) to perform better than current building code • Performance incentive of $1.75 per CFM reduced based on pre- and post- project blower door tests • Access to HEAT Loan Program if eligible (0 percent financing)	http://www.masssave.com/en/residential/offers/der-national-grid
Early Heating and Cooling Equipment Replacement Rebates	Residential	• Schedule Home Energy Assessment • Online or mail-in rebate submission after installation • Incentive details are in the Appendix	http://www.masssave.com/en/residential/heating-and-cooling/equipment-installation/early-heating-and-cooling-equipment-

			replacement-rebates
Insulation improvements	Residential	• 75 percent on costs of insulation up to $2,000 • Potential to receive no-cost targeted sealing of air leaks	http://www.masssave.com/en/residential/offers/weatherization
Wireless Thermostat and Installation Incentive	Residential	• Select from the qualifying models, purchase up to three units at the discounted price, and have them installed at no cost	http://www.masssave.com/en/residential/offers/wireless%20thermostat%20and%20installation%20incentive
Residential New Construction	Residential	• Provides incentives from $275-$7,000 per unit for energy efficiency upgrades • Have to work with Home Energy Rating System (HERS) rater or qualifying personnel • There are prescriptive incentives and performance path incentives, plus an additional ENERGY STAR incentive if the new home receives that certification • Incentive details are in the appendix	http://www.masssave.com/en/residential/offers/rnc-high-efficiency-heating-and-water-heat-rebates http://www.masssave.com/en/residential/offers/rnc-performance-path
Large Retrofit Program	Commercial	• Provides incentives for lighting and lighting controls, variable speed drives, food service equipment, gas-fired heating and water heating equipment through online or mail-in rebate submission. Provide incentives for custom measures and energy management systems • Lighting and lighting controls are prescriptive incentives • Variable speed drive incentives are quasi-prescriptive (based on hp) • Natural gas heating and water heating incentives are prescriptive/quasi-prescriptive based on size (MBH) or AFUE rating • Food service incentives cover fryers, convection ovens, steam cookers, griddles, combination ovens, rack ovens, conveyor ovens and pre-rinse spray valves. Incentives are prescriptive • Custom incentives are available for measures that don't qualify under the prescriptive stream. Incentives are based on the economics of the project and are typically up to 50 percent of the incremental costs of the higher efficiency equipment • Engineering studies to assess the savings potential are offered, with the participant receiving up to 50 percent of the costs of the study	http://www.masssave.com/en/business/incentive-programs/energy-efficiency-retrofits http://www.masssave.com/business/incentives/Energy-Management-Systems-Retrofit?p=b330695a-e24c-4929-b278-3bb1692f2612

		• Incentives are provided for the installation of qualifying energy management systems and vending miser controls	
Small Business Program	Commercial	• For customers with a demand under 300 kW, offer a free audit for identifying energy savings opportunities and up to 70 percent of the total retrofit costs for equipment such as lighting, motors, refrigeration and refrigeration controls. The program also offers a 0 percent financing option.	http://www.masssave.com/en/business/incentive-programs/small-business-energy-efficiency-program
New Construction/Major Renovation and Replacing Failed Equipment Program	Commercial	• Provides incentives for air compressors, chillers, lighting and lighting controls, variable speed drives, food service equipment, gas-fired heating and water heating equipment, and custom measures and sustainable office design. Incentives are provided on a prescriptive, quasi-prescriptive or performance basis. • Custom measures can receive up to 75 percent of the incremental cost of the installed equipment	http://www.masssave.com/en/business/incentive-programs/new-construction-renovation
Sustainable Office Design	Commercial	• The sustainable office design provides an incentive of $1.00/sqft (leased space net of common areas) for energy efficient lighting and control systems.	http://www.masssave.com/business/incentives/SOD?p=95e50217-eb39-4286-9ee3-9756c61b958e
Multi-Family Buildings Program	Commercial	• Eligible if owner or operator of residential building with 5 or more units. An energy assessment is offered that energy savings opportunities for the building envelope, as well as lighting and mechanical systems. • Participants can receive incentives for different upgrades. • Participants are encouraged to take advantage of the EPA's Portfolio Manager tool for benchmarking their building's performance	http://www.masssave.com/en/business/incentive-programs/multi-family-buildings

Appendix B – Consolidated Calculator/Tool Requirements

The requirements for the consolidated calculator/tool are as follows:

High Level Specifications

1. **Measure Library Section (from TRM process recommendation in report)**

This section should include the details of each measure in the portfolio, or measures being considered.

- Efficient Technology Name;
- Efficient Technology Description;
- Efficient Technology Wattage (if available);
- Efficient Technology Penetration Estimate;
- Forecast Efficient Technology Penetration Estimate (in 1 year);
- Efficient Technology Retail Price;
- Forecast Efficient Technology Retail Price (in 1 year);
- Sector;
- Customer;
- Application(s);
- Operating Hours;
- Base Case Technology Name(s);
- Base Case Technology Description(s);
- Base Case Technology Penetration(s);
- Forecast Base Case Technology Penetration(s) (in 1 year);
- Forecast Base Case Technology Retail Price(s) (in 1 year);
- Current Incremental Equipment Cost;
- Forecast Incremental Equipment Cost (in 1 year);
- Energy Savings;
- Expected Energy Savings Persistence;
- Any Program Dependent Parameters (*Should be clearly identified*);
    - Net-to-Gross (NTG) Ratio
- Incentive screening threshold in terms of cost to the customer;
- Incentive screening threshold in terms of the program budget and
- Incentive screening threshold in terms of cost effectiveness (From Cost Effectiveness Calculator)

2. **Cost Effectiveness Calculator Section**

This section will take the inputs from the Measure Library section, combine them with the other inputs listed below, and output a cost effectiveness forecast. This will be used to determine the incentive screening threshold in terms of cost effectiveness.

Inputs

- Avoided Supply Costs (energy and capacity);
- Local Avoided Supply Costs (energy and capacity);
- Fixed Program Administration Costs;
- Year of Implementation;
- Measure Participation;
- Variable Costs;
- Measure Energy Savings (From Measure Library);
- Measure Demand Reduction (From Measure Library);
- Measure Energy Savings Persistence (From Measure Library);
- NTG (From Measure Library);
- Measure Incremental Equipment Costs (From Measure Library);
- Discount Rate and
- Inflation Rate

Outputs

- Total Gross Energy Savings;
- Total Gross Demand Reduction;
- Total Net Energy Savings;
- Total Net Demand Reduction;
- TRC Benefits;
- TRC Costs;
- TRC Net Benefits;
- TRC Ratio;
- PAC Benefits;
- PAC Costs;
- PAC Net Benefits;
- PAC Ratio;
- Levelized Unit Cost of Energy Savings and
- Levelized Unit Cost of Demand Reduction

3. Review Protocol Section

This section will display the considerations for the frequency of review for the incentive, and help set the guidelines for the size of the incentive.

Inputs

- Incentive screening threshold in terms of cost to the customer (From Measure Library);
- Incentive screening threshold in terms of the program budget (From Measure Library);
- Incentive screening threshold in terms of cost effectiveness;
- Sector (From Measure Library);
- Program Delivery Channel;
- Financial Motivation and
- Financial Impact (from Cost Effectiveness Calculator)

Outputs

- Considerations for magnitude of incentive and review protocol;

Efficiency Nova Scotia Marketing Evaluation Plan

December 12, 2017







Prepared by

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Marketing Evaluation Plan

December 12, 2017

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Table of Contents

Executive Summary I

1. Introduction 1

2. Background 2

3. Methodology 3

   3.1. Review and Analysis 4

   3.2. Primary Data Collection 6

4. Key Performance Indicators 12

Appendix A. Logic Model A-1

Executive Summary

In late 2015 and continuing into 2016, Efficiency Nova Scotia (ENS) launched a major refresh of its brand and restructuring of its marketing and communications function. Through these activities, ENS established the following high-level marketing goals:

- Increase program participation
- Enhance customer experience through ENS's digital assets
- Improve marketing effectiveness through internal processes, tools and information systems

Research Into Action developed this marketing evaluation plan to help ENS systematically and consistently assess progress toward these goals in future years. The plan is designed to address the following overarching research questions year-over-year:

- How effective are ENS's revamped marketing guidelines, tracking systems, processes, and other resources in helping the marketing team realize its goals?
- How effective is ENS's approach at identifying and addressing overlaps and gaps in marketing activities?
- Do the marketing campaigns follow best practice guidelines to help ensure their success?

This plan describes how ENS can gauge the effectiveness of its internal infrastructure—its marketing tools, practices, tracking systems, and processes—and its external-facing marketing campaigns. It builds on the logic model and associated indicator tables, and on the best practices criteria, prepared as part of ENS's 2016/17 marketing evaluation.[1] Given the strongly positive evaluation of ENS's marketing efforts in 2016/17, ENS need not pursue a full evaluation of its marketing in the short-term.[2]

At minimum, however, based on the indicators and other findings from the 2016/17 evaluation, this plan recommends ENS conduct the following evaluation activities over the next one to three years. These activities should integrate easily with current or planned marketing processes at ENS. Whether formally or informally conducted, it will be important to document these efforts.

- **Revisit and review internal plans, guidelines, and tracking systems as needed and capture and document status toward respective goals and objectives.** Potential data sources include: brand guidelines, marketing and campaign plans, campaign development tracking systems and tools, and campaign analytics.
- **Leverage existing, ongoing market research and reporting activities to gather market insights.** Example data source(s): quarterly market research such as the Quarterly Attitudes and

1 See: *Marketing Evaluation 2016/17 Final Report* for a detailed description of the logic model and indicator tables.

2 See the conclusions and recommendations in the *Marketing Evaluation 2016/17 Final Report*.

Awareness Survey results; participant, nonparticipant, and trade ally surveys conducted for program evaluations or program-related market research.

- **Conduct primary research to gather qualitative insights on the successes and challenges of the marketing team's internal infrastructure (that is, its tools, practices, tracking systems, and processes), and its externally-facing efforts.** Example data source(s): interviews and/or check-ins with marketing and program staff. These discussions may be relatively informal.
- **Conduct periodic best practices review of a sample of campaign materials.** Example data/resources: best practices review criteria and process developed and used for the 2016/17 marketing evaluation.

Regular assessments of its infrastructure and campaign delivery will help ensure the ENS marketing team remains on track to realize its long-term goals.

1. Introduction

In late 2015 and continuing into 2016, Efficiency Nova Scotia (ENS) launched a major refresh of its brand and restructuring of its marketing and communications function. Through these activities, ENS established the following high-level marketing goals:

- Increase program participation
- Enhance customer experience through ENS's digital assets
- Improve marketing effectiveness through internal processes, tools and information systems

Research Into Action developed this marketing evaluation plan to help ENS systematically and consistently assess progress toward these goals in future years. The plan is designed to address the following overarching research questions year-over-year:

- How effective are ENS's revamped marketing guidelines, tracking systems, processes, and other resources in helping the marketing team realize its goals?
- How effective is ENS's approach at identifying and addressing overlaps and gaps in marketing activities?
- Do the marketing campaigns follow best practice guidelines to help ensure their success?

This plan describes how ENS can gauge the effectiveness of its internal infrastructure—its marketing tools, practices, tracking systems, and processes—and its external-facing marketing campaigns. It builds on the logic model and associated indicator tables, and on the best practices criteria, prepared as part of ENS's 2016/17 marketing evaluation.[3]

The next section of this document presents background information to provide context for the rest of the evaluation plan. We describe the evaluation plan methodology in Section 3, and we present the indicator tables in Section 4. For reference, we include the logic model in Appendix A.

[3] See: *Marketing Evaluation 2016/17 Final Report* for a detailed description of the logic model and indicator tables.

2. Background

ENS instigated four major changes to its marketing activities in mid-2016. ENS consolidated its marketing and communications services under a single “marketing-communications team” umbrella, and hired a new marketing-communications manager to oversee the new team. ENS also began working with a new marketing agency to refresh its corporate and energy-efficiency program marketing, and started to launch the new marketing campaigns in April 2017. These changes resulted in shifts in ENS’s marketing development and support processes, creative development, overall look and feel, positioning, marketing strategies and tactics, and marketing products.

For the 2016/2017 marketing evaluation, Research Into Action developed a logic model and provided forward-looking, near-real time feedback as ENS’s marketing team was settling in to the team’s new structure and management, building its relationship with the new agency, and developing refreshed materials. We offered feedback on ENS’s new marketing plan and assessed a sample of ENS’s marketing products against industry best practices. We also used findings from our interviews with ENS and agency staff to assess the effectiveness of the team’s new structure, communications, goals, processes, and tracking systems.

This evaluation plan builds on the 2016/17 logic model and evaluation findings. It describes the research and analysis ENS can undertake to monitor the marketing team’s progress and identify any needed refinements or course corrections in future years. Regular assessments of its infrastructure and campaign delivery will help ensure the ENS marketing team remains on track to realize its long-term goals.

3. Methodology

A comprehensive evaluation of ENS's marketing efforts, as described later in this chapter, would include these tasks:

1. Review and analysis of:
    a. ENS marketing plans and brand guidelines
    b. Marketing tracking system
    c. A sample of campaign materials
2. Primary data collection through:
    a. In-depth interviews or less formal check-ins--with ENS marketing and program staff, typically lasting 15 to 60 minutes
    b. Brief interviews—covering just a few topics with Business Development Managers (BDMs), Energy Solutions Advisors (ESAs), and participant trade allies, typically lasting 20 minutes or less
    c. Surveys—with nonparticipant trade allies, Business, Non-profit, and Institutional (BNI) and residential program participants, and BNI and residential customers
    d. Focus groups—with residential and BNI customers

Pursuing all of these evaluation activities would require a substantial commitment of ENS staff time, as well as other resources. Given the strongly positive evaluation of ENS's marketing efforts in 2016/17, ENS need not pursue all of these evaluation tasks in the short-term.[4] At minimum, however, based on the indicators and other findings from the 2016/17 evaluation, this plan recommends ENS conduct the following evaluation activities over the next one to three years. These activities should integrate easily with current or planned marketing processes at ENS. Whether formally or informally conducted, it will be important to document these efforts.

- **Revisit and review internal plans, guidelines, and tracking systems as needed and capture and document status toward respective goals and objectives.** Focus the review on documents that were completed or substantially updated in the prior year including, for example, brand guidelines, marketing and campaign plans, campaign development tracking systems and tools, and campaign analytics.
- **Leverage existing, ongoing market research and reporting activities to gather market insights.** Contribute to and review findings from quarterly market research such as the Quarterly Attitudes and Awareness Survey results, as well as participant, nonparticipant, and trade ally surveys conducted for program evaluations or program-related market research.

[4] See the conclusions and recommendations in the *Marketing Evaluation 2016/17 Final Report*.

- **Conduct primary research to gather qualitative insights on the successes and challenges of the marketing team's internal infrastructure (that is, its tools, practices, tracking systems, and processes), and its external-facing efforts.** Conduct interviews and/or check-ins with marketing and program staff. These discussions may be relatively informal.
- **Conduct periodic best practices review of a sample of campaign materials.** Apply the best practices review criteria and process used in the 2016/17 marketing evaluation to a sample of materials.

The remainder of this chapter presents a comprehensive methodology to assess the marketing function at ENS. It encompasses all the items we recommend above.

3.1. Review and Analysis

Table 1 lists all the documents and systems ENS could review for future marketing evaluations. The "representative indicators and evaluation questions" column describes how ENS can use each of the listed data sources to assess its marketing. The representative indicators shown here are condensed versions of the indicators presented in the marketing logic model. Consistent with the assumption that logic models are living documents, these indicators can change as program assumptions and conditions change.

Research Into Action reviewed some of the materials in Table 1 as part of the 2016/2017 marketing evaluation. However, since ENS was refreshing its marketing approach and materials in 2017, we did not have an opportunity to review the final versions all the materials as part of the 2016/2017 evaluation. As illustrated in Table 1, ENS could therefore consider prioritizing assessments of these materials over the next one to three years. ENS will likely be reviewing most of these materials as part of its day-to-day operations. The highest priority items to review, which are denoted in Table 1 with an asterisk (*), are:

- Brand guidelines and marketing plan
- Integrated marketing plan and specific campaign plans
- Creative brief template, creative concepts, content, media buys, traffic calendars
- Google Analytics metrics
- Marketing tracking system

In subsequent years, ENS can scale back its document review and focus on the (sections of) documents that were recently updated, verifying that the updated documents are clear, complete and responsive to user feedback, where appropriate.

Table 1. Documents and Tracking/Database System Reviews

KEY: * = Highest priority items = Full review = Review focused on updated sections

Data Source	Representative Indicators / Evaluation Questions	1 to 3 Years	Subsequent Years
Brand guidelines and management plan	• Updated documents, with rationale for changes	*	
Integrated marketing plan and specific campaign plans	• Updated documents, with rationale for changes • Include situation analysis, goals, objectives, strategies, tactics, clear call to action, customer journey, timeline, budget • Coordination with programs and stakeholders • Clear identification of target markets	*	
Organizational chart, staffing plans	• Updated documents • Staff roles, responsibilities, capabilities • Filled and unfilled positions • Overall and campaign-specific staffing allocations, with rationale		
Overall and campaign-specific budgets	• Updated documents • Overall and campaign-specific budget allocations, with rationale		
Cross-functional communications plan	• Updated documents, with rationale for changes • Communications, review, and approval processes		
Creative brief template, creative concepts, content, media buys, traffic calendars	• Updated documents • Consistent branding, messaging, brand promise, and value proposition • Checklists demonstrate adherence to guidelines and marketing best practices (e.g., target markets clearly identified)	*	
Trade ally training documents/materials	• Updated documents, with rationale for changes • Topics covered, intended audiences, number of training sessions planned/held, number of attendees (planned/actual)		
Google Analytics metrics	• Digital metrics by campaign/program • Web page views initiated from display ads; changes over time • Click-throughs; changes over time • Time spent on web page(s); changes over time • Targets identified, and met or exceeded	*	

Data Source	Representative Indicators / Evaluation Questions	1 to 3 Years	Subsequent Years
Marketing tracking system	• Reporting capabilities include current and historic marketing activities, metrics, and outcomes • Regular reporting schedule established • Guidelines for providing feedback updated, with rationale for changes	*	
Program databases	• Timing of customer inquiries and sign-ups relative to marketing campaigns • Number and percent of target populations participating; changes over time • Number and percent of customers who participate in more than one program • Identification of targeted segments reached and not reached • Average number of projects per trade ally; changes over time		

3.2. Primary Data Collection

Table 2 through Table 5 show the target groups, population sizes, sample sizes, potential stratification (where applicable), and indicators for interviews/check-ins, brief interviews, surveys, and focus groups, respectively. As discussed above, the "representative indicators and evaluation questions" consolidate information from the logic model indicator tables, and describe how the evaluator can use information gleaned through primary research to assess ENS's marketing efforts.

For each data collection activity and target group combination, Table 2 through Table 5 also show when we recommend ENS conduct the activity. In light of ENS's recent marketing team restructuring, infrastructure enhancements, and refreshed marketing campaigns, we recommend ENS conduct interviews or check-ins with its marketing managers, marketing staff, and program staff in nearer-term future evaluations. ENS can use each set of interview findings to recommend marketing infrastructure and campaign delivery refinements. We also recommend ENS conduct brief interviews with its BDMs and ESAs in future years to take maximum advantage of their knowledge from working directly with customers.

Because ENS's Efficiency Trade Network (ETN) is still in its early stages at the time of this writing, we recommend ENS wait for at least one or two years before conducting interviews with these program partners. Once the ETN is better established, we recommend conducting relatively brief and infrequent (no more than once per year) interviews with these trade allies to minimize the survey burden imposed on them.

For the surveys and focus groups shown in Table 4 and Table 5, the marketing evaluation can collaborate with other ongoing or planned research at ENS. A coordinated approach will be more efficient for ENS, minimize the burden on survey respondents (because they will not be asked to take

multiple surveys at/around the same time), and potentially increase response rates. Our coordination suggestions are:

- For nonparticipant trade allies: coordinate with research ENS is doing to expand its ETN
- For BNI and residential program participants: coordinate with program evaluators to insert marketing-related questions into program participant surveys
- For the general population of BNI and residential customers: coordinate with ENS's quarterly/annual general population market research, stratifying the sample in accordance with the general population research, and adding more detailed marketing-related questions to those surveys
- For BNI and residential customer focus groups: coordinate with research that ENS's marketing team (and perhaps its agency) is already conducting, or planning to conduct regarding messaging and branding.

Table 2. In-Depth Interviews (or Check-Ins)

Target Group	Estimated Population Size	Sample Size	Representative Indicators / Evaluation Questions	Suggested Timeframe
ENS marketing managers	2	2	• Observe that staff understand, are enthusiastic, and are motivated by branding; report it is effective • Find implementation of marketing plan smooth and effective; observe that staff understand plan, appropriately provide feedback • Appropriate workloads for staff • Good communications (verbal and electronic), and review and approval processes, within team and with program staff • Marketing and program staff are aligned on target markets; marketing managers identify targeted segments they have and have not been able to reach • Marketing tracking systems contain current information, are easy to use, produce reliable reports; reports facilitate assessment of campaigns, needed adjustments; feedback mechanism works well; requested changes and updates are promptly addressed; high overall user satisfaction; system facilitates cross-marketing efforts	1 to 3 years, then in subsequent evaluations
ENS marketing staff	4	2	• Understand, enthusiastic, motivated by branding; report it is effective • Understand team structure, roles and responsibilities; have adequate human/document resources; know where to go for help • Understand marketing plan, find implementation of plan smooth and effective, appropriately provide feedback, see feedback integrated into updates • Appropriate workloads; marketing tasks adequately covered • Good communications (verbal and electronic), and review and approval processes, within team and with program staff • Aligned with program staff on clearly defined target markets; targeted segments reached and not reached identified • Marketing tracking systems contain current information, are easy to use, produce reliable reports; reports facilitate assessment of campaigns, needed adjustments; feedback mechanism works well; requested changes and updates are promptly addressed; high overall user satisfaction; system facilitates marketing across multiple programs (if/when appropriate)	1 to 3 years, then in subsequent evaluations

Target Group	Estimated Population Size	Sample Size	Representative Indicators / Evaluation Questions	Suggested Timeframe
ENS program staff (service delivery managers and program managers)	10	6	• Understand, enthusiastic, motivated by branding; report it is effective • Understand marketing plan, find implementation of plan smooth and effective, appropriately provide feedback, see feedback integrated into updates • Good communications (verbal and electronic), and review and approval processes, with marketing staff • Questions they have heard trade allies ask about programs (to inform marketing staff outreach to trade allies) • Aligned with marketing staff on clearly defined target markets; targeted segments reached and not reached identified • Marketing t systems contain current information, are easy to use, produce reliable reports; reports meet programmatic needs, facilitate adjustments to program activities; feedback mechanism works well; requested changes and updates are promptly addressed; high overall user satisfaction system facilitates cross-marketing efforts	1 to 3 years, then in subsequent evaluations

Table 3. Brief Interviews

Target Group	Estimated Population Size	Sample Size	Representative Indicators / Evaluation Questions	Suggested Timeframe
ENS BDMs (including BDM manager)	5	3	• Percentage of customers aware of programs; changes over time • Questions trade allies have about programs • Targeted segments reached and not reached	2 to 3 years, then in subsequent evaluations
ENS ESAs (including team lead)	5	2	• Numbers of inquiries and new participants following marketing campaigns; changes over time • Customers perceive ENS as trusted advisor	2 to 3 years, then in subsequent evaluations
Participant trade allies	≈ 130 Res ≈ 170 BNI	10 Res 10 BNI	• Awareness of and attendance at trainings • ENS viewed as collaborative, trusted advisor	Coordinated with regular market research and/or program evaluations

Table 4. Surveys

Target Group	Estimated Population Size	Sample Size	Stratification	Representative Indicators / Evaluation Questions	Suggested Timeframe
Nonparticipant trade allies (contractors, service providers, consultants, and specialists who do not work with ENS programs)	TBD	TBD	TBD	• Changes in awareness and knowledge of ENS and its programs over time • Awareness of and attendance at trainings	Coordinated with regular market research and/or program evaluations
BNI participants	TBD	TBD	TBD	• Awareness and knowledge of energy use, conservation, and ENS programs; changes over time • Participation in multiple programs • Perception of ENS as trusted advisor	Coordinated with program surveys and/or program evaluations
BNI nonparticipants	> 31,000*	TBD	TBD	• Changes in awareness of ENS and its programs over time • Perception of ENS as trusted advisor	Coordinated with regular market research and/or program evaluations
Residential participants	TBD	68 per strata	TBD	• Awareness and knowledge of energy use, conservation, and ENS programs; changes over time • Participation in multiple programs • Perception of ENS as trusted advisor • Sources of information about ENS and its programs	Coordinated with program surveys and/or program evaluations
Residential: general population (participants and nonparticipants)	> 400,000 households**	68 per strata	TBD	• Changes in awareness of ENS and its programs over time • Perception of ENS as trusted advisor	Coordinated with regular market research and/or program evaluations

Table 5. Focus Groups

Target Group	Estimated Population Size	Sample Size	Stratification	Representative Indicators / Evaluation Questions	Suggested Timeframe
Residential customers	> 555,000 aged 20+	TBD	TBD	• Marketing materials consistently demonstrate compelling brand promise and value proposition • Customers find marketing engaging and motivating	Coordinated with regular market research and/or program evaluations
BNI customers	> 31,000	TBD	TBD	• Marketing materials consistently demonstrate compelling brand promise and value proposition • Customers find marketing engaging and motivating	Coordinated with regular market research and/or program evaluations

* *https://www.novascotia.ca/finance/publish/BSTAT/2009/NS_Business%20Stats_2009_January%202010.pdf*

** Source: Statistics Canada. *Census Profile, 2016 Census, Nova Scotia, Canada.*

4. Key Performance Indicators

ENS's marketing team conducts three overarching activities to help the team achieve its goals:

- Develop/enhance tools and processes
- Develop/enhance marketing tracking systems
- Deliver marketing campaigns

Table 6, Table 7, and Table 8 list the key performance indicators for these three activities, respectively. Each table shows the indicators and associated data sources and data collection approaches for the activity's outputs, short-term outcomes, and medium-term outcomes. ENS may opt to conduct informal check-ins in lieu of the formal in-depth interviews shown in Table 6, Table 7, and Table 8.

Since ENS enhanced or refreshed many of its marketing tools, processes, tracking systems, and campaign delivery approaches in 2017, ENS will want to monitor the effectiveness of these elements, and perhaps refine them in future years. ENS can use the same indicators from evaluation to evaluation to facilitate comparisons over time: consistency from one evaluation to the next will help highlight effective marketing systems and practices as well as areas in need of improvement. Assuming ENS's marketing efforts do not undergo another major refresh in the short-term, ENS can scale back some aspects of future marketing evaluations and focus on the effectiveness of any refinements ENS makes to its current marketing practices and procedures.

Table 6. Development/Enhancement of Tools and Processes: Indicators and Data Sources/Collection Approaches

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Outputs	Brand guidelines and management plan are up-to-date	• Brand guidelines are updated	• Document review of guidelines and plan • In-depth interviews (IDIs) with marketing managers and staff*
	Integrated marketing plan and specific campaign plans are up-to-date	• Integrated marketing and specific campaign plans are updated/created and include: – Situation analysis – Goals, objectives, strategies, and tactics – Clear call to action, customer journey mapping – Timeline, budget – Coordination with programs and stakeholders	• Document reviews of integrated marketing plan and specific campaign plans • IDIs with marketing managers and staff*
	Staff, funding, and training resources are appropriately allocated	• Organization chart updated • Roles and responsibilities for staff positions updated • Number of staff overall, and by campaign/program, with rationale for allocations • List of staff capabilities updated • Overall budget, campaign-specific budgets, and rationale for allocations updated • Training session plans/materials: – List of topics covered – Number of sessions planned/held – Intended audiences and anticipated/actual numbers of trainees	• Document reviews of org charts, budgets, training plans • IDIs with marketing managers and staff*
	Cross-functional/ departmental communication, review, and approval processes are up-to-date	• Cross-functional communications plan updated • Staff report plan continues to be effective re: communications, review, and approval processes	• Document review of cross-functional communications plan • IDIs with marketing managers and staff* • Program staff IDIs

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Short-term Outcomes	Organization understands and buys in to brand messaging and guidelines	• Management, marketing staff, and program staff continue to be enthusiastic and motivated by branding • Management, marketing staff, and program staff continue to exhibit shared understanding of brand messaging and guidelines; report they are effective	• IDIs with marketing managers and staff* • IDIs with program staff*
	Marketing positions are fully staffed	• Org chart showing filled and unfilled positions • Staff continue to have appropriate workloads (not over-/under-loaded)	• Document review: organizational chart • IDIs with marketing managers and staff*
	Staff have shared understanding of roles, responsibilities, reporting structure, processes, and tools	• Staff continue to have clear understanding of marketing department organization • Staff continue to have clear understanding of their own roles and responsibilities • Staff continue to report they are supported by colleagues; no "turf wars" • Staff continue to report all marketing responsibilities are adequately covered	• IDIs with marketing staff*
	Staff familiar with marketing plan and provide feedback	• Staff have clear understanding of the marketing plan and their roles in implementing it • Staff continue to demonstrate understanding of when/how to provide feedback • Staff continue to feel comfortable providing feedback	• IDIs with marketing managers and staff*
	Staff have adequate resources and know where to go for help	• Reference documents available to staff • Number of knowledgeable and approachable individuals available to support staff • Staff aware of resources, feel supported	• Document review of team's reference materials • IDIs with marketing staff*

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Short-term Outcomes	Staff effectively communicating internally, including with programs	• Regular meetings continue to occur with appropriate groupings of marketing and program staff • Staff continue to report clear verbal and electronic lines of communication: – Within marketing team – Between marketing team and program staff • Staff know how best to get quick responses from others; find others continue to be responsive (via verbal and electronic communications): – Within marketing team – Between marketing team and program staff	• IDIs with marketing managers and staff* • IDIs with program staff*
Medium-term Outcomes	Staff find management receptive to feedback on marketing plan	• Mechanisms remain in place enabling marketing and program staff to provide feedback on marketing plan • Marketing and program staff aware and continue utilizing feedback mechanisms • Marketing and program staff report their voices continue to be heard; see changes based on their feedback	• IDIs with marketing managers and staff* • IDIs with program staff*
	Management adjusts marketing plan based on feedback	• Marketing plan updated with rationale for the changes	• Document review of updated marketing plan with changes noted • IDIs with marketing managers and staff*
	Target populations are adequately addressed, gaps are identified	• Target populations are clearly identified marketing plan and specific campaigns • Marketing and program staff aligned on target populations • Program staff feedback shows marketing succeeds in addressing target populations • Marketing and program tracking show target populations reached • Marketing and program staff have mechanisms to identify underserved populations/markets	• Document review of marketing plan and campaign materials • IDIs with marketing managers and staff* • IDIs with program staff* • Marketing and program databases

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Medium-term Outcomes	Staff find marketing plan is clear; staff successfully implementing marketing plan	• Staff report implementation of marketing plan is straight-forward, plan is effective • Marketing and program managers observe smooth implementation • Marketing managers and staff report that questions/concerns with the plan are promptly discussed and resolved • Team meets or exceeds targets for digital metrics	• IDIs with marketing managers and staff* • IDIs with program staff* • Review of Google Analytics metrics
	Staff continuing to effectively communicate internally, including with programs	• Regular meetings continue to occur with appropriate groupings of marketing and program staff • Staff continue to report clear verbal and electronic lines of communication: – Within marketing team – Between marketing team and program staff • Staff know how best to get quick responses from others, when needed; find others responsive (including via verbal and electronic communications): – Within marketing team – Between marketing team and program staff	• IDIs with marketing managers and staff* • IDIs with program staff*

* ENS may opt to conduct informal check-ins in lieu of formal in-depth interviews.

Table 7. Development/Enhancement of Tracking Systems: Indicators and Data Sources/Collection Approaches

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Outputs	Marketing staff regularly communicate with program staff about campaign performance	• Marketing staff and program staff report they coordinate and communicate well with one another about campaign performance	• IDIs with marketing managers and staff* • IDIs with program staff*
	Established process for providing feedback on tracking systems and processes, and their reporting capabilities	• Written guidelines for providing feedback are updated • Managers and staff understand how to provide feedback (e.g., to report malfunctions, request enhancements)	• Review of tracking system documentation • IDIs with marketing managers and staff* • IDIs with program staff*
	Basecamp enables communication and facilitates effective campaign management	• All relevant staff regularly use Basecamp • Staff agree Basecamp is an appropriate and effective tool for campaign management	• IDIs with marketing managers and staff*
	Metrics for website traffic, social media engagement, media analytics, and conversion rates	• Digital metrics by campaign/program (website traffic or social media engagement: likes, shares) • Media analytics by campaign/program (impressions, cost-per-click) • Conversion rates	• Digital analytics (Google Analytics) toolkit review
Short-term Outcomes	Relevant staff find tracking systems and processes user-friendly	• Tracking systems continue to allow easy data entry • Tracking systems continues to provide complete and reliable outputs • High overall satisfaction with tracking systems and processes	• IDIs with marketing managers and staff* • IDIs with program staff*
	Tracking systems and processes are used regularly by all relevant staff	• Marketing and program staff continue to regularly use tracking systems and processes • Staff continue to not regularly bypass tracking systems/processes or rely primarily on alternative systems	• IDIs with marketing managers and staff* • IDIs with program staff*

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Short-term Outcomes	Tracking systems and processes meet overall and programmatic needs	• Tracking systems continue to completely and accurately capture and store needed information for all types of marketing efforts • Tracking systems and processes continue to meet analysis and reporting needs (e.g., identifying previous participants for potential reconnections) • Gaps identified in system capabilities • Users' "wish list" of system capabilities to enhance decision-making and program performance	• IDIs with marketing managers and staff* • IDIs with program staff*
	Feedback mechanism effective at identifying needed system enhancements/changes	• Users know where to go for help with systems • Marketing and program staff know how to request system updates and enhancements • Marketing and program staff continue to find system update requests are promptly addressed	• IDIs with marketing managers and staff* • IDIs with program staff*
Medium-term Outcomes	Tracking systems updated regularly in response to feedback and strategic organization/program shifts	• Users continue to report system is always "current"	• IDIs with marketing staff* • IDIs with program staff*
	Cross-program/cross-departmental collaboration facilitated by multi-stakeholder access to systems/processes	• List of programs with overlapping/similar target markets • List of programs with similar/overlapping trade allies • Frequency of cross-program marketing • Assessments of effectiveness cross-marketing efforts: successes and opportunities for enhancement	• IDIs with marketing staff* • IDIs with program staff* • Program databases

* ENS may opt to conduct informal check-ins in lieu of formal in-depth interviews.

Table 8. Deliver Marketing Campaigns

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Outputs	Finalized creative concepts, content, media buys, and traffic calendars for owned and paid channels, by target audience and geography (as applicable): – Mass media (radio, TV, print) – Direct mail – Digital and social media – Other	• Creative brief template updated • Final creative concepts, content, social media plans, media buys, editorial calendars, ad traffic calendars for owned/paid channels (as applicable) • Target markets clearly defined • Marketing-program staff feedback loop maintained	• Reviews of creative briefs, content, media plans, media buys, editorial calendars, add traffic calendars • IDIs with marketing staff* • IDIs with program staff*
	Regular reports on customer response to campaigns (e.g., program leads, enrollment, etc.) by geography and demography (as applicable)	• Regular reporting schedule established, schedule understood by marketing and program staff • Regular meetings continue to occur with appropriate groups of marketing and program staff to discuss report implications • Marketing staff continue to find reports provide needed information to assess campaign effectiveness and make adjustments, if needed • Program staff continue to find reports contain data needed to assess program status and make next-step decisions	• Document review: policies and procedures guides (including Marketing Intake Form, Approval Process, Website Governance and Updates policy, etc.), sample reports • IDIs with marketing managers and staff* • IDIs with program staff*

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Short-term Outcomes	Messaging and creative adhere to brand and communication guidelines, and best practices	• Consistent branding, messaging, and adherence to best practices in marketing materials maintained across: – Channels and platforms – Customer groups and other stakeholders	• Reviews of checklists demonstrating all marketing materials adhere to guidelines and best practices • IDIs with marketing managers and staff*
	Brand promise, value proposition, and call to action are clear across all media	• Marketing materials integrate consistent brand promise and value proposition • Staff share common understanding of brand promise and value proposition	• Reviews of checklists demonstrating all marketing materials include adhere to guidelines and best practices • Periodic snapshot reviews of marketing materials across channels and platforms • IDIs with marketing managers and staff* • Focus groups with residential and BNI customers
	Customers aware of ENS and its program offerings	• Percent of customers aware of ENS; changes from prior years • Percent of customers aware of program offerings; changes from prior years	• Surveys of residential and BNI customers
	Customers find marketing credible, engaging, and motivating	• Web page views initiated from emailed links; changes over time • Click-throughs; changes over time • Time spent on web page(s); changes over time • Customer self-reported likelihood of pursuing programs based on messaging; changes over time	• Google Analytics • Analysis of program databases: customer inquiries and sign-ups in response to marketing campaigns • Focus groups with residential and BNI customers

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Short-term Outcomes	Marketing connects customers to ENS programs; customers interested in pursuing programs	• Web page views initiated from emailed links; changes over time • Click-throughs; changes over time • Time spent on web page(s); changes over time • Numbers of inquiries and new participants following marketing campaigns; changes over time • Customer self-reported likelihood of pursuing programs based on messaging; changes over time • Program staff report campaigns continue to support program goals	• Google Analytics • Review of Energy Solutions Advisor (ESA) logs • Short-answer interviews with ESAs • Analysis of program databases: observed customer response to marketing campaigns • Focus groups with residential and BNI customers • IDIs with program staff*
	Stakeholders (e.g., trade allies) aware of and understand ENS programs	• Percentages of participant and nonparticipant trade allies (and other stakeholders) aware of programs; changes over time • Number of trade allies attending trainings; changes over time • Content of trade ally questions to program staff and at trade ally trainings • Common errors observed in trade ally program submissions; changes over time	• Baseline surveys of trade ally (and other stakeholders) • Interviews/surveys of participant trade allies • Surveys of nonparticipant trade allies • IDIs with program staff* • Short-answer interviews with BDMs • Records from trade ally trainings • Periodic review of trade ally program submissions (or summaries from program staff)

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Medium-term Outcomes	Customers participate in ENS programs	• Number and percent of target population participating; changes over time • Identification of targeted segments not being reached	• Program databases • IDIs with marketing managers and staff* • IDIs with program staff* • Short-answer interviews with BDMs
	Customers more aware of and knowledgeable about energy use, conservation, and ENS programs	• Number and percent of participants reporting they are aware and knowledgeable about energy and programs; changes over time • Number and percent of nonparticipants reporting they are aware and knowledgeable about energy and programs; changes over time	• Surveys of participants • Surveys of nonparticipants
	Program participants pursue other programs	• Number and percent of customers who participate in more than one program; changes over time	• Program databases and/or overarching customer database • Surveys of participants
	Customers value ENS	• Number and percent of participants reporting ENS is credible, trustworthy, and informative; changes over time • Number and percent of nonparticipants reporting ENS is credible, trustworthy, and informative; changes over time	• Surveys/short-answer interviews with ESAs • Review of comments/questions submitted to ESAs • Surveys of participants • Surveys of nonparticipants
	Customers share experiences and refer friends and family to ENS programs	• Number and percent of participants reporting they learned of program through family/friends; changes over time	• Surveys of participants • Program databases ("how did you hear…" questions) • IDIs with program staff (re: informal feedback, such as at program events)*

	Objective (Desired Output/ Outcome)	Indicators / Evaluation Questions	Data Sources & Collection Approaches
Medium-term Outcomes	Stakeholders increasingly engaged in ENS programs	• Number and percent of regional trade allies participating in programs; changes over time • Number and percent of regional trade allies attending training sessions; changes over time • Average number of projects per trade ally; changes over time • Nonparticipant trade ally awareness of program; changes over time	• Program databases (participant trade ally counts; counts of projects per trade ally) • Surveys/short-answer Interviews with participant trade allies • Surveys of nonparticipant trade allies

* ENS may opt to conduct informal check-ins in lieu of formal in-depth interviews.

Appendix A. Logic Model

This logic model reflects marketing efforts as of November 2017. Please note that this is a “living document” that is subject to change as marketing efforts and priorities evolve over time.

Marketing Goals:

- Increase program participation (fill the funnel + gain deeper savings per participant);
- Enhance customer experience through our digital assets;
- Improve marketing effectiveness through internal processes, tools and information systems."

Inputs: ENS staff expertise; agency expertise; program-specific and overarching marketing funding; findings from historic marketing-related research

Materials reviewed: <many>

Barriers/challenges: Ensuring continuity and consistency in messaging and creative across overarching marketing efforts and program-specific campaigns

	ACTIVITIES		
	Internal Infrastructure		
	Enhance/Develop Infrastructure-- Integrated Marketing Communications Tools and Processes	Enhance/Develop Marketing Communications Tracking Systems and Processes	Deliver Marketing Campaigns
Outputs	1. New/updated brand guidelines and brand management plan 2. Integrated marketing plan and specific campaign plans 3. Allocated resources: a. Staff b. Funding c. Training	<u>Internal Coordination/Communication</u> 1. Regular communications among marketing and program staff re: campaign performance 2. Established process for providing feedback to key stakeholders on tracking systems and processes, and their reporting capabilities	1. Final creative concepts, content, media buys, and traffic calendars for owned and paid channels, by target audience and geography (as applicable): a. Mass media (radio, TV, print) b. Direct mail c. Digital and social media d. Other

	ACTIVITIES		
	Internal Infrastructure		
	Enhance/Develop Infrastructure--Integrated Marketing Communications Tools and Processes	Enhance/Develop Marketing Communications Tracking Systems and Processes	Deliver Marketing Campaigns
	4. Cross-functional/cross-departmental (including programs) communication, review, approval processes	<u>Campaign Development</u> 3. Basecamp--to enable communication and facilitate campaign management <u>Campaign Performance</u> 4. Metrics associated with website traffic, social media engagement, media analytics, and conversion rates	2. Regular reports on customer response to campaigns (e.g., program leads, enrollment, etc.) by target audience and geography
Short-term outcomes	1. Organizational buy-in and understanding of brand messaging and guidelines 2. Marketing and communications positions are fully staffed 3. Staff have a shared understanding of roles, responsibilities, reporting structure, processes, and tools 4. Staff familiar with marketing plan(s) and provide feedback/input 5. Staff have adequate resources and know where to go for help 6. Staff effectively communicating internally at ENS, including with programs	1. Relevant staff find tracking systems and processes are approachable and user-friendly 2. Tracking systems and processes are used regularly by all relevant staff 3. Relevant staff find tracking systems and processes meet their overall and programmatic needs 4. Feedback mechanism effective at identifying needed system enhancements/changes	1. Messaging and creative adherence to brand and communication guidelines 2. Brand promise, value proposition, and call to action are clear across all media 3. Customers aware of ENS and its program offerings 4. Customers find marketing credible, engaging, and motivating 5. Marketing connects customers to ENS programs; customers interested in pursuing programs 6. Stakeholders aware of and understand ENS programs 7. Key performance indicators monitored consistently across campaigns/marketing initiatives

	ACTIVITIES		
	Internal Infrastructure		
	Enhance/Develop Infrastructure-- Integrated Marketing Communications Tools and Processes	Enhance/Develop Marketing Communications Tracking Systems and Processes	Deliver Marketing Campaigns
Medium-term outcomes	1. Staff find management receptive to feedback on marketing plan 2. Management adjusts marketing plan based on feedback (e.g., duplicative activities addressed) 3. Target populations are adequately addressed, or gaps are identified 4. Staff find marketing plan clear; staff are successfully implementing plan 5. Staff continue to effectively communicate internally at ENS, including with programs	1. Staff regularly update tracking systems and processes in response to user feedback and strategic organization/program shifts 2. Cross-program/cross-departmental collaboration facilitated by multi-stakeholder access to systems/processes	1. Customers participate in ENS programs 2. Customers feel more aware of and knowledgeable about energy use, conservation, and ENS programs 3. Program participants pursue other programs 4. Customers value ENS (e.g., perceive ENS info to be credible, trustworthy, informative) 5. Customers share experiences and refer friends and family to ENS programs 6. Stakeholders increasingly engaged in ENS programs
Long-Term Outcomes	1. Streamlined, integrated delivery across channels and platforms 2. Market changes and new opportunities identified and addressed on a timely, ongoing basis 3. All activities and campaigns align and pivot in tandem with organizational goals and objectives 4. Brand continuity across all communication platforms and programs	1. Streamlined measurement and reporting of marketing activities to all relevant staff 2. Facilitation of knowledge transfer across ENS departments	1. Customers have increasing trust in ENS 2. Customers participate in additional ENS programs 3. Customers continue to share experiences and refer friends and family to ENS programs 4. Stakeholders increasingly engaged in ENS programs 5. Exceptional customer service

Practices and Procedures Evaluations

Integrated Final Report

February 9, 2018



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Overview

Efficiency Nova Scotia (ENS) retained Research Into Action to evaluate three practices and procedures areas in their organization: Incentive Setting, Business Development, and Training and Development. Research Into Action conducted a separate study, and developed a stand-alone report, for each of these areas. This report bundles the three individual practices and procedures reports into a single, three-volume document:

- Practices and Procedures Evaluation Volume 1: contains the Incentive Setting Practices and Procedures Evaluation final report
- Practices and Procedures Evaluation Volume 2: contains the Business Development Practices and Procedures Evaluation final report
- Practices and Procedures Evaluation Volume 3: contains the Training and Development Practices and Procedures Evaluation final report

Final Report

Practices and Procedures Evaluation
Volume 1: Incentive Setting

February 9, 2018

Prepared for:

Efficiency Nova Scotia

Prepared By:

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Table of Contents

Overview i

Practices and Procedures Evaluation Volume 1: Incentive Setting

Table of Contents I

1. Introduction 1
   - 1.1. Incentive Setting Process Overview 1
   - 1.2. Evaluation Objectives 2
   - 1.3. Evaluation Approach 3
2. Experience with the Incentive Setting Workbook 5
   - 2.1. Time Required to Complete the Workbook 5
   - 2.2. Challenges with the Workbook 5
     - 2.2.1. Lack of Clarity about Needed Inputs 5
     - 2.2.2. Difficulty Finding Information 6
     - 2.2.3. Situations Not Captured 6
   - 2.3. Suggestions for Further Resources and Support 6
     - 2.3.1. Common Reference Sources 6
     - 2.3.2. Prioritization of Workbook Inputs 7
     - 2.3.3. Regulatory Staff Support 7
3. Incentive Setting Process 9
   - 3.1. Comparison of Current Process to Past Practice 9
   - 3.2. Incentive Decision Considerations 10
   - 3.3. Frequency 10
4. Compliance with Incentive Implementation Plan 11
   - 4.1. Develop an Incentive Setting Manual 11
   - 4.2. Conduct Customer and Technology Research 12
     - 4.2.1. Research Conducted Through Incentive Setting Process 12
     - 4.2.2. Formal Research 12
   - 4.3. Complete an Electronic Technical Reference Manual 13
   - 4.4. Develop a Consolidated Calculator 13
   - 4.5. Conduct Financial Simulations of Existing Incentives 13
5. Conclusions and Recommendations 15

Appendix A. Specific Feedback on Incentive Setting Workbook A-1

Appendix B. ENS Staff Interview Guide B-1

Practices and Procedures Evaluation Volume 2: Business Development

Practices and Procedures Evaluation Volume 3: Training and Development

1. Introduction

This evaluation report presents findings from an initial process assessment of the incentive setting process at Efficiency Nova Scotia (ENS), as outlined in CLEAResult's Incentive Setting Methodology report (CLEAResult report) and EfficiencyOne's Implementation Plan (Implementation Plan). ENS filed the CLEAResult report and Implementation Plan together on June 30, 2016 and most recently filed a revised version of these documents on May 11, 2017. The Nova Scotia Utility and Review Board (UARB) accepted the CLEAResult report and the Implementation Plan on July 18, 2017. In accordance with the Implementation Plan, ENS contracted Research Into Action to conduct an independent review of its progress implementing the CLEAResult report's recommendations as part of its 2017 Evaluation and Verification process. Table 1 describes the documents referred to throughout this report, including the abbreviated titles that are sometimes used.

Table 1. Document References for This Report

Title	Date of most recent modifications	Author	Description	Abbreviation
Incentive Setting Methodology	May 11, 2017	CLEAResult	Incentive best practices review and recommendations	CLEAResult report
Implementation Plan	May 11, 2017	ENS	Incentive setting process for ENS based on CLEAResult Report	Implementation Plan
Incentive Setting Manual	March 31, 2017	ENS	Guidance for incentive setting process at ENS	Manual
Incentive Setting Workbook	August 23, 2017	ENS	Excel tool to implement the incentive setting process	Workbook

This introduction describes the background and context for this project, a review of the incentive setting process, research objectives, and the key research activities that addressed those objectives. Subsequent chapters present findings related to staff experience using the Incentive Setting Workbook, the broader decision process around incentive setting, and ENS compliance with the CLEAResult report and the Implementation Plan.

1.1. Incentive Setting Process Overview

In response to stakeholder comments received through the ENS 2016-2018 DSM Resource Plan regulatory process, ENS contracted with CLEAResult to review incentive setting methodologies across North America, along with data on Nova Scotia's electricity market, regulatory environment, and existing ENS incentive setting practices. The resulting CLEAResult report included recommendations for incentive setting best practices. Based on these recommendations, ENS developed, and has put into effect an Implementation Plan, which identifies a systematic process for setting and reviewing incentives for the measures it promotes through its program components. In compliance with the CLEAResult report and

Implementation Plan, ENS developed an Incentive Setting Manual (the Manual) and an Incentive Setting Workbook (the Workbook) to detail an internal process and to guide ENS through compiling the information on which incentive decisions would be based.

ENS plans to review the incentive level for each measure on an annual basis in the second quarter of each year, so that they can draw on evaluation results finalized during the first quarter of that year. Measures that exceed the thresholds recommended in the CLEAResult report for total incentive spending will receive a second review in the fourth quarter of the year.[1] All new measures must also go through the incentive setting process before being added to the portfolio.

ENS implemented the incentive setting process on July 1, 2017. The 2017 incentive review process covered eight existing measures for which ENS spends more than $400,000 per year, as well as three new measures. After refining the process based on this initial effort, ENS plans to scale-up the incentive review to include all the incentives it offers, more than 250 in total, in the second quarter of 2018.

In accordance with the Manual, as of Q2 2018, program managers and their teams will be responsible for reviewing all individual measures, and an internal Incentive Process Reviewer will be responsible for overseeing the overall process. Each measure will be subject to a single incentive review. Where the measure is offered through multiple program components, the Incentive Process Reviewer will assign one program manager to lead the incentive review across the program components. The lead reviewer will consult, as needed, with managers of the other affected program components during this process.

In addition to developing this process for incentive setting for new measures and for conducting ongoing reviews of existing incentives, ENS conducted financial simulations to analyze the current level of incentives in relation to thresholds recommended in the CLEAResult report. ENS is also undertaking the market research efforts specified in its *2017-2018 Market Research Plan* to gather data to inform the incentive setting process. We describe the financial simulations and market research efforts further in Section 4.5.

1.2. Evaluation Objectives

This evaluation investigated and documented the experience of program managers and their team members completing the incentive setting process in Q3 and Q4 2017. The goal of this research was to evaluate the implementation of the process and to identify opportunities to improve the process so ENS can effectively scale it up for all measures in 2018. The evaluation's research objectives fall into three categories: the incentive setting *process*, the *decisions* resulting from that process, and compliance with key aspects of the Implementation Plan. The research objectives were to identify answers to the following questions.

- Incentive setting process
  - How easy/difficult is it for program team members to obtain the information the Workbook asks them to provide?

[1] Measures for which incentive spending exceeds $400,000 per year for at least two years will receive these biannual reviews.

- What elements of the incentive setting process are most time-consuming for program team members?
- How long does it take for program team members to complete the Workbook for each measure? What factors explain variation in the time required between measures?
- To what extent is the process likely to become easier for program team members once they have developed a base of experience and initial information on each measure?
- Is the process more compatible with certain types of measures and/or incentive structures than others? How could it be adapted to better fit a wider range of incentive types?
- Does the structure of the incentive setting process provide sufficient information to, and allow for sufficient oversight by, all the relevant actors within ENS?
- Do program team members feel the annual or biannual incentive review cycles are justified?

〉 Incentive setting decisions

- How do program team members use the information collected in the Workbook to determine/review optimal incentive levels for measures?
- What information is most valuable in program team members' decisions to set incentive levels for measures? What information is less valuable?
- How does the information collected in the Workbook differ from the information program team members previously collected as inputs to their incentive-setting decisions? What effect do these differences have on the previous incentive levels?

〉 Compliance with the Implementation Plan

- How well does the new process comply with five specific areas of the Implementation Plan?

1.3. Evaluation Approach

This evaluation draws on three key data sources to address the research objectives listed above:

〉 **A review of relevant documents.** Documents included the CLEAResult Report, the Implementation Plan, the Manual, and the Workbook. These documents provided background for other data collection activities and analysis, and were central to the review of compliance with the Implementation Plan.

〉 **Workbook feedback.** The evaluation team worked with ENS to develop questions about program staff experience with the Workbook. ENS included these written questions in the Workbook for staff to address as they worked through the process. The evaluation team received written feedback about seven measures from four program staff.[2] A fifth staff member reviewed further measures but did not provide written feedback; however, this staff member did participate in an in-depth interview.

[2] Four program staff reviewed eight measures as part of this incentive setting process, but only provided feedback on seven measures.

- **In-depth interviews with Program Managers and other ENS staff.** The evaluation team conducted hour-long interviews with all five program staff members who completed incentive reviews. These interviews gathered staff member experience with the Workbook as well as broader feedback on the incentive setting process. In addition to these interviews, the evaluation team met with other ENS staff members for demonstrations of the Workbook and the Electronic Technical Reference Manual (eTRM).

2. Experience with the Incentive Setting Workbook

This section describes the experience of program staff in completing the Workbook, based on their written feedback in the Workbook and through in-depth interviews. It explores the time required to complete the Workbook, the challenges staff faced in completing the Workbook, and the resources needed to make the process easier.

2.1. Time Required to Complete the Workbook

Three program staff reported that it took them approximately one full day of work to complete a review of a single measure in the Workbook. However, one of these same three staff reported in written notes, and a fourth staff reported in an interview, that it could take three to four days to complete one review. One staff, elaborating on this longer timeframe, noted it was sometimes necessary to complete the Workbook multiple times for a single measure to capture values for different program components or different incentive tiers. This person said, "For your calculations, you have to enter each incentive separately. [Our team] had eight products, but 100 different spreadsheets we had to fill out." Staff most often reported the "Existing Measures" and "Inputs & Calcs" tabs were the most time consuming because they had to search for information their program components did not track.

All five staff members reported the current incentive setting process takes more time than the process they previously used. One staff member noted that they could previously review all of the measures within a product category in roughly the time it took to review one single measure under the current process. They also reported that the time required to complete the Workbook, and the burden it would place on program staff, were their greatest concerns about scaling up the process to the full portfolio of measures. They noted their workloads are typically at capacity, making it difficult to add in the task of completing reviews for all the measures in the portfolio.

2.2. Challenges with the Workbook

The challenges respondents reported in completing the Workbook fall into three categories: a lack of clarity on the types of inputs expected, difficulty finding the requested inputs, and products or incentive structures the Workbook was not designed to capture. The following sections provide additional detail about each of these challenges. Specific fields that program staff reported were unclear or posed technical challenges are listed in Appendix A.

2.2.1. Lack of Clarity about Needed Inputs

All program staff reported that some aspects of the task had been unclear. In some cases, the lack of clarity reflected the Workbook being a new process. For example, three staff reported they were uncertain of the level of detail expected in the input fields, or the extent to which assumed values were acceptable. A fourth reported being unsure of how to respond to many of the questions because a

reference was not available for the desired finished product. In other cases, program staff cited specific fields for which the type of input desired or the unit of analysis was not clear. For example, one staff wondered whether the "Estimated Participation Level" field on the "Summary & Decision" tab referred to individual measures or unique projects (which may include installation of multiple instances of the measure). Similarly, another wondered whether "Base Case Energy Consumption (gross @ meter)" on the "Inputs & Calcs" tab referred to measure- or building-level consumption.

2.2.2. Difficulty Finding Information

All respondents reported they had difficulty finding the information the Workbook asked them to provide, particularly on the "Existing Measures" and "Inputs & Calcs" tabs. The inputs program staff cited as difficult ranged from information about the broader market, such as the number of buildings that could benefit from the technology, to measure information such as baseline product costs. Program staff also noted that the "Customer Findings" tab was difficult to complete in some cases because ENS evaluation reports did not present findings at the measure level.

2.2.3. Situations Not Captured

Interview findings suggest that the Workbook works best for measures where each program component offers a single, per-unit incentive, but is less compatible with more complex incentive structures. For instance, some measures are incented on a per unit basis (for example, per lamp or fixture, per level of insulation, etc.) with a cap limiting the total incentive for the project to a set dollar amount or proportion of the overall project cost. Two staff noted that the Workbook did not factor these incentive caps into its calculations. As a result, the Workbook may indicate that a proposed incentive is not cost effective based on the per unit amount, not recognizing that the cap prevents it from exceeding acceptable thresholds for any given project. Other staff noted that the process was cumbersome for measures that offered different incentive levels for different efficiency tiers, requiring program staff to complete a new instance of the Workbook for each tier. Finally, two staff noted that their program components use multiple program delivery models for some measures, but the Workbook allows them to select only one.

2.3. Suggestions for Further Resources and Support

Program staff discussed three types of resources they thought would make the incentive setting or review process easier: a central reference source for information common across multiple measures, greater prioritization of the fields in the Workbook, and additional support from the ENS regulatory staff.

2.3.1. Common Reference Sources

Respondents noted that some of the information the Workbook asks them to provide applies across multiple measures. For example, the number of buildings that could benefit from a measure is likely to be similar for multiple measures within a category (e.g. most buildings that could benefit from linear lamps could likely also benefit from LED downlight fixtures). Managers suggested that a central reference source for this type of information would both speed the process of completing the Workbook and increase consistency of inputs across measures.

All program staff reported that one of the most difficult aspects of completing the Workbook was to find information their program components did not currently track and which they had not been expected to know for past incentive setting efforts. They most often said finding market-level and base case pricing information was difficult. Some reported that providing these types of information required them to make assumptions that reduced their confidence in the Workbook's outputs. They suggested that a central resource for these types of information, or a list of acceptable assumptions if data are not available, would be beneficial. According to one staff member, "We don't have this data; we don't know how to find it. Are there assumptions that are acceptable to use to get the most accurate result?"

Respondents also expressed concern that values for a common input may vary between measures. For example, in feedback on the Workbook, one staff member wrote that "when asked about number of businesses that could benefit from the measure, each person completing the incentive review pulled different information." Three staff also suggested a need for coordination in outreach to market actors and stakeholders, noting that these actors are likely to speak about a product category as a whole. In addition to preventing multiple program staff from contacting the same market actors, staff noted that coordination could help to avoid placing too great a burden on market actors involved in evaluation, measurement, and verification activities.

2.3.2. Prioritization of Workbook Inputs

The program staff suggested that all the information gathered in the Workbook is potentially beneficial to the incentive setting process, but some of the fields may not be necessary for every measure, and the level of detail needed to develop an appropriate incentive may vary by measure. For example, one program staff noted that a measure like LED lighting, for which the technology and the market are changing rapidly, may need a more detailed review than a measure like commercial cooking equipment that is more technologically stable and has a more stable market. Staff expressed a desire for guidance on which fields are most important for each measure. One staff member stated that this type of prioritization could help to reduce the burden program staff perceive completing the Workbook will require, saying "You don't want folks to be overwhelmed as soon as they open the Workbook."

2.3.3. Regulatory Staff Support

Respondents thought regulatory staff would be better equipped to complete some portions of the Workbook than program staff were. Two program staff expressed a desire for increased support in the process, with one noting in particular that it would be beneficial to have one-on-one discussions with regulatory staff about the best way to interpret Workbook data.

Two others expressed a desire for regulatory staff to take responsibility for portions of the Workbook. One program staff explained that they believed regulatory staff collect and could more easily access much of the information required for the "Existing Measures," "Specialty Research," and "Customer Findings" tabs. Another program staff advocated for a dedicated staff member who, with the support of a team and input from program staff, would be responsible for all incentive reviews. The two program staff members who advocated for regulatory staff to take responsibility for certain portions of the Workbook reported that completing those portions required skills that program staff may not have. For example, one said, "The program manager is not necessarily a research and survey expert." Most of the interviewed staff did not predict that completing the Workbook would become significantly easier as they gained more experience, with one noting that the volume of information required made the process time-consuming.

Two interviewed staff members suggested that updates to measures for which they had already completed the Workbook would be easier, particularly if much of the market data had not changed in the time between reviews.

3. Incentive Setting Process

This section describes the process by which program staff made incentive-setting decisions, whether reviewing existing incentives or setting incentives for new measures. It begins with a review of the current incentive-setting process in relation to past practices and then describes the most important considerations for program staff in setting incentives. Finally, it reviews program staff opinions about the appropriate frequency of incentive reviews.

3.1. Comparison of Current Process to Past Practice

Prior to the launch of the current incentive-setting process, program staff said they primarily drew on program tracking data to make decisions about incentives, especially reports from retailers and distributors working in conjunction with ENS. The current incentive setting process continues to capture these inputs, along with a wide range of additional data. In reviewing these data, program staff said they focused on the cost of efficient products, with two also noting they considered what incentive levels consumers would find attractive.

Several program staff elaborated on how they previously tackled incentive setting. One staff member stated that a large proportion of projects reaching the program's incentive cap at 50% of project costs would be an indicator that an incentive review was necessary, while another noted that, as a rule of thumb, they seek to limit incentives to no more than 30% of the product cost. A third staff member noted that, for products with multiple tiers, shifts in the distribution of incentives across tiers could also indicate a need to change program incentives or requirements. Two program staff noted that they typically reviewed incentive levels from other jurisdictions in incentive setting or revisited incentive levels prior to the launch of the current process.

In contrast, respondents said the current process requires them to consider a broader set of parameters than they did previously, including prices of baseline products and estimates of market potential. As previously noted, these types of inputs were among the data points program staff most often found challenging.

While program staff noted they did not consistently approach incentive setting and review decisions prior to the current process, all those with incentive setting experience reported they had documented and justified the decisions they made. Two program staff noted their approaches were acceptable under the prior process and that their documentation ranged from written reports shared with their supervisor and that person's manager, to spreadsheets documenting calculations and notes. Nonetheless, the interviewed program staff described the consistency of information considered and documentation as key benefits of the new incentive setting process.

The program staff reported that during the new incentive review process they had worked closely with managers of other program components with measures similar to those they were reviewing, and with staff who were reviewing similar measures. Program staff also reported reaching out to the regulatory team during the process because they thought regulatory staff were better able than program staff to track and access some of the required fields. Two of the interviewed program staff noted they were not sure who within ENS would review the new Workbooks.

3.2. Incentive Decision Considerations

Reflecting the Workbook's greater focus on gathering market data relative to previous incentive setting approaches, program staff reported considering market characteristics in their incentive setting decisions than they had in the past. Specifically, two staff reported that conversations with contractors or distributors provided valuable insight to their incentive decisions.

The respondents reported the information on the "Inputs & Calcs" tab of the Workbook had the greatest influence on their incentive level decisions. Two program staff reported that it was helpful for them to adjust the values on the "Inputs & Calcs" tab to determine how different incentive levels would influence program cost effectiveness as they made their decisions. In fact, two program staff suggested that the "Inputs & Calcs" tab was so influential in their decisions that focusing on that tab alone may be a way to streamline the incentive review process. According to one of these staff, "There might be some different insights for each measure, but when it's just the "Inputs & Calcs" that is giving you a pass/fail on each measure, why don't we just have a spreadsheet that has that information on it? You can dive deeper into those certain measures that potentially don't pass."

Consistent with program staff reports about the importance of the "Inputs & Calcs" tab in their incentive decisions, the completed Workbooks that the evaluation team reviewed rarely listed information from other tabs in the field where program staff provided a brief rationale for their decision. Most often, program staff cited the cost effectiveness of the proposed incentive level.

All program staff reported that the incentive levels they ultimately chose (whether maintaining, changing, or setting a new incentive) did not differ notably from the incentives they likely would have chosen without using the Workbook. All program staff also noted their current incentive levels or the levels they had been considering were below the maximum incentive level the Workbook calculated. Two stated they were skeptical of the Workbook's calculations due to uncertainty in their input estimates and because the Workbook did not account for incentive caps.

3.3. Frequency

Program staff suggested that the frequency with which incentive reviews occur should reflect the pace of change in the market for each measure. For instance, they said that the lighting market has been changing rapidly in recent years, and the scheduled semi-annual reviews are consistent with the pace at which they had been reviewing lighting incentives prior to the current process. The managers noted, however, that not all measures change as quickly as lighting. For some measures, even annual reviews may be too frequent. For example, two program staff cited kitchen equipment as a measure type that changes relatively slowly, with one saying "Not much is going to change in terms of dishwashers every year. It's not going to change enough [to justify] us to do this kind of detail every year."

One program staff noted that reviewing, and potentially changing, incentive levels too frequently could be detrimental to program components as it could make program offerings less stable, increasing the effort required for participants and trade allies to stay up-to-date with the program. Another program staff suggested that incentive reviews could follow the same schedule as program evaluations since evaluations will provide many of the inputs to the Workbook.

4. Compliance with Incentive Implementation Plan

This section describes the results of the evaluation team's review and assessment of five key steps, described in the sub-sections that follow, included in executing the Implementation Plan.

4.1. Develop an Incentive Setting Manual

Objective	Review ENS's Incentive Setting Manual to ensure that it meets each expectation specified in the Implementation Plan.

The Implementation Plan describes the Key Features to include in the Manual. Table 2 summarizes these features and our assessment as to whether these key features were sufficiently supplied in the Manual. Overall, we found the Manual effectively documents the steps ENS took to implement the new incentive setting process. We also found adding more detailed and explicit instructions on how to use the tools would improve the Manual.

Table 2. Incentive Setting Manual Requirements

Expectation	Verified	Notes
Definition of roles and responsibilities with respect to incentive design and revision	✓	The manual lists separate roles for the "Lead for Incentive Review" and the "Program Manager." Since, in many cases, the program manager will be the lead for incentive review, it would be helpful to note that these roles may overlap.
Definition of requisite approval levels for making incentive changes for various types of measures	✓	The manual defines approval processes for new and existing measures, in which Program Managers and Service Delivery managers are responsible for determining final incentive levels. This approval process is the same for all types of measures.
Practices and processes to be followed when designing or revising incentives	✓	The manual describes the practices and processes.
Required documentation with respect to incentive revision	✓	The Workbook provides this documentation.
Storage of incentive documentation	✓	The Workbook saved on ENS's internal server provides this storage.
Internal controls and monitoring of practice and process compliance	⊘	While the Manual makes clear that the Incentive Process Reviewer is responsible for oversight of the Incentive Review Process, it does not describe what oversight entails.
Roles and responsibilities with respect to the administration and updating of the incentive Manual and associated practices	✓	The Manual specifies that the Incentive Process Reviewer is responsible for updating the incentive manual and associated practices.

4.2. Conduct Customer and Technology Research

Objective	Confirm that research was conducted/is being conducted in two forms: (a) via the incentive setting process; and (b) via formal research as specified in ENS's *2017-2018 Market Research Plan*.

The evaluation team verified that ENS is conducting the customer and technology research as laid out in the Implementation Plan, both via the incentive setting process and through formal research.

4.2.1. Research Conducted Through Incentive Setting Process

As described in the Manual, leads for the incentive setting process are required to conduct research on market characteristics, customer insights, and supply chain and stakeholder insights. The Workbooks the evaluation team reviewed demonstrate that this research has occurred.

4.2.2. Formal Research

ENS's Two-Year Incentive Setting Research Plan commits up to $150,000 annually for formal research that will inform incentive setting. The research, which will focus on price sensitivity analysis and was slated to begin in Q3 2017, covers these five measures:

- Residential LEDs
- Commercial LEDs
- Residential mini-split heat pumps
- Commercial mini-split heat pumps
- Residential insulation

ENS initially considered conducting conjoint analysis in addition to price sensitivity analysis, but, based on recommendations from research experts, determined they did not need conjoint analysis to achieve valid outcomes. ENS is currently on track to meet its planned deadline of concluding this research in late 2017 or early 2018.

4.3. Complete an Electronic Technical Reference Manual

Objective	Verify that ENS has completed its electronic TRM.

ENS completed its eTRM on September 30, 2017. The purpose of the eTRM is to "centrally organize and administer characterizations of the organization's portfolio of Demand Side Management (DSM) measures. Critical information regarding both prescriptive and quasi-prescriptive measure characterizations is stored within the eTRM."[3,4] By maintaining an electronic TRM, rather than a print version, the data can be directly integrated into other data management systems. ENS has begun the process of integrating program components into the Dynamic Demand Side Management System, which stores the inputs and outputs of the eTRM. The regulatory technical team expects all program components to be integrated by mid to late 2018.

4.4. Develop a Consolidated Calculator

Objective	Verify that ENS created a Consolidated Calculator and document the extent to which it is being used in the incentive setting process.

The Consolidated Calculator is integrated into the Workbook (on tab titled "Inputs & Calcs"), which was completed on March 31, 2017. The purpose of this calculator is to provide thresholds for ENS staff to consider when setting incentive levels. Users are expected to duplicate the calculator by program, only if assumptions differ. The interviewed program staff reported that the Consolidated Calculator was helpful in making incentive decisions, although they reported difficulty finding some of the required inputs.

4.5. Conduct Financial Simulations of Existing Incentives

Objective	Verify and document that ENS conducted financial simulations and report on what ENS did/plans to do with the results.

In preparing its report, CLEAResult conducted financial simulations for two program components: Instant Savings and Custom. The purpose of these simulations was to evaluate current incentive levels. CLEAResult recommended that ENS conduct financial simulations for all program components, and check the most current incentives against the following screening thresholds:

- Cost to participants
- Program budget
- Cost effectiveness

[3] Prescriptive measures represent those measures whose energy and demand savings are largely independent of the specific installation conditions, or can be accurately represented using average conditions. These measures generally have "deemed" energy and demand savings. Quasi-prescriptive measures represent those measures whose calculation methodology is independent of specific installation conditions, but use installation-specific inputs to the energy and demand savings methodology.

[4] Q3 2017 Demand Side Management Report – Attachment 2. eTRM Overview.

ENS completed these recommended financial simulations on June 30, 2017. The purpose of the simulations was to review all existing incentives to gauge their level of appropriateness and provide a baseline upon which to do future reviews.

Through this exercise, ENS staff found that the simulations worked better for some measures and program components than others. Below are descriptions of lessons learned that can be used to inform future financial simulation efforts:

- The thresholds work best for measures that are purely prescriptive. For measures that are quasi-prescriptive, the application of thresholds requires the use of average incentives and savings for each measure. This finding indicated to some ENS staff that more data needs to be collected before justifying an incentive change due to exceeding a threshold. By using averages, ENS also does not gain insight into the cost-effectiveness of a measure in each one of its actual application circumstances, because there are so many.
- Program components with more complex incentive calculations cannot be reasonably modeled using the recommended thresholds. Examples include the whole home program components (Home Energy Assessment and New Home Construction).
- Custom incentives are, by definition, customized and use incentive-setting algorithms which are structurally similar to the thresholds recommended by CLEAResult. Therefore, they were not included in the simulation.
- Some program components also have project-level or measure-level incentive caps, which provide an additional level of security in terms of potential over-spending.

5. Conclusions and Recommendations

Conclusion 1: While the five "beta" program staff members who tested the new incentive-setting Workbook process saw strength in its consistent and broader approach, they also suggested several fruitful areas for streamlining and improving the process. The need for such improvements is based on the following factors:

- The program staff reported they needed at least one full work day to complete inputs for a single measure, and that most program components have multiple measures. They noted the new process took significantly longer than the past incentive setting process and voiced concerns about where staff would find the extra time to complete the Workbooks, given already busy schedules.
- Beyond the time needed, the program staff reported they did not feel prepared to conduct the research needed to address various inputs in the Workbook that asked for information outside of program tracking data and beyond what they have been asked to provide in the past.
- The program staff were particularly concerned about providing reliable market level and pricing assumptions. These concerns resulted in them relying mostly on measure-level quantitative data in the "Inputs & Calcs" tab and not making use of the broader set of inputs asked for in the Workbook.
- Program staff also reported a lack of clarity about what level or type of data was required to complete a number of inputs.
- In addition, program staff noted the Workbook performed well for straightforward measures, but did not always accommodate more complicated measure and incentive structures.

Our recommendations focus on providing greater support for gathering data that had not been previously tracked for program components.

Recommendation 1-1: Determining the highest priorities for inputs to the incentive-setting Workbooks, and focusing on making sure the instructions for those inputs are clear and actionable (i.e., cover all measure and incentive structures) for the 2018 efforts. This review should consider how frequently each measure should be revisited, and the specific issues program staff noted in their test runs and as catalogued in Appendix A. Less essential inputs, which may vary from measure to measure, could be deferred until 2019, allowing for program staff to be better prepared and confident.

Recommendation 1-2: Training, over time, for program staff in how to reliably design, conduct and analyze the research needed for Workbook inputs, and to improve their understanding of and confidence in the Workbook output. Regulatory staff and others might be tapped as trainers. Preferably program managers would first receive training, and then have time to do or to arrange the research. The benefits, over time, to program managers in orchestrating this research will be that they will have a first hand, more complex view of the markets and target audiences they serve, and how product pricing and other factors are changing over time.

Recommendation 1-3: Providing market specialists to work with program staff to take on specific aspects of researching markets and pricing and to provide data and insights back to the program staff, especially in those areas that would benefit multiple program components or which would be difficult for program staff to undertake on their own.

Recommendation 1-4: Over time, creating a repository of common information that program staff can draw upon, rather than creating that information from scratch.

Recommendation 1-5: Continue tracking progress with using the Workbooks, including how much time is required to complete them, the confidence of program staff in the accuracy and consistency of the inputs they provide, the breadth of the parameters they use in determining incentives, and their greater understanding of their markets, target audiences, and technologies.

Conclusion 2: Overall, the Incentive Setting Manual effectively documents the steps ENS took to implement the new incentive setting process, but more detailed descriptions and instructions on how to use the tools could improve the Manual.

Recommendation 2-1: For the Manual, better define overlapping roles and better describe what is entailed in the incentive oversight process.

Recommendation 2-2: For the Consolidated Calculator, further clarify instructions about where to find the required inputs.

Recommendation 2-3: For future financial simulations, consider the lessons learned in the applicability of the simulations to all measure situations, and determine if any improvements to the simulations can be made.

Appendix A. Specific Feedback on Incentive Setting Workbook

Table A-1 below is a summary of detailed, technical feedback the evaluation team received on the Workbook.

Table A-1. Technical Issues with Incentive Setting Tool

Across Tabs	〉 **Permissions:** Many (4 of 5) users noted that the current permissions on the tool make it impossible to enter data in certain sections, add notes, or wrap text so that cells with a lot of text can be fully read. 〉 **Efficiency**: Three users discussed multiple ways the spreadsheet could improve its efficiency by having information auto-populated or readily available: • One user suggested having the measure information and incentives entered in one place and auto populate where else needed. • Another user suggested improvements for dealing with multiple spreadsheets for multiple incentives, noting that it would be helpful to add multiple calculations tabs without creating formula errors. 〉 **Redundancies:** 4 of 5 users provided examples of places where information was redundant, including: Measure Name, Incentive offerings, and measure information. 〉 **Notes Section:** Two users reported that for many tabs it would be helpful to have a notes section they could use to document the assumptions made.
Existing Measures Tab	〉 **Structure:** Staff suggested Market Characteristics should be separated by program name rather than only BNI and Residential, as inputs may differ between programs within a single market sector 〉 **Unmerged Cells:** One user reported that cells that should be merged were not, specifically noting cells for 'Measure Name', 'Program Offerings and Incentive' and 'Incentive Offering(s)' are not merged.
Inputs & Calcs Tab	〉 **Multiple Programs:** More than half (3 of 5) of users noted that the "Inputs & Calcs" tab, does not work for multiple programs, and the calculations break when users copy the tab as instructed. 〉 **Program Delivery Models:** One user mentioned that the drop-down options for the Program Delivery model only allow for one selection, while some programs use multiple delivery models for a single measure. 〉 **Additional Inputs:** Two users suggested having a place to insert the energy savings potential, instead of the base case consumption, and have that be calculated based on efficient case and the delta. 〉 **Unfamiliar terminology:** One staff member noted they were not familiar with some of the terminology the tab used.
Summary & Decision Tab	〉 **Formula References:** One user noted a potential oversight or calculation error on the "Summary & Decision" tab, reporting that information for "Program 1" appears to reference only BNI data, and therefore does not work if the program is residential. 〉 **Rounding:** The same user also reported that the incentive field rounds up, and because some incentives values are not whole numbers, the cell needs 2 decimal places.

Appendix B. ENS Staff Interview Guide

B.1. Introduction

Thank you for taking the time to talk with me today. We have reviewed the feedback you included in the incentive setting workbook, and got a lot of good, specific information about people's experience using the tool. Today we would like to talk about your experience to both get a broader perspective on your experience with the tool and how it fit into your ultimate decision about the proper incentive level. We would also like to make sure we are really clear on all of the issues or challenges you faced using the tool as well as opportunities to improve it. The main objective of this call is to inform recommendations on how to improve the process, for when it becomes more widely used next year.

Before we start, I want to mention that we often use quotes from our interviews – without names attached – in our reports. We use these quotes to illustrate key points and make the reports more interesting and readable. At the end of our conversation, we can discuss how you would like us to approach quotes from this conversation. We can:

1. Quote you anonymously
2. Quote you anonymously and provide you an opportunity to review and approve the quotes before we use them
3. Not quote you at all.

Everything you say is confidential. We won't share our notes from the conversation unless we are legally required to, and we will not report findings in a way that would identify any individual respondent. I'll be taking notes as we talk, but I'd also like to record the call, just to help with my notetaking. Is that OK with you?

B.2. Background [ASK ALL]

Q1. First, please tell me about your role at Efficiency Nova Scotia?

Q2. And what is your role in the incentive-setting process, specifically?

1. For which measures, if any, did you complete the incentive-setting workbook?

B.3. Incentive Setting Process [ASK ALL]

I'd like to know a little bit about your experience completing the incentive setting workbook.

Q3. Was this the first time you had been involved in setting or reviewing incentives at ENS?

Q4. [*If respondent has prior experience with incentive setting:*] What are the most important ways that this incentive setting / review process differs from the way you set incentives in the past?

1. How did you document the rationale behind your incentive decisions in the past?

2. What types of information the workbook asked for did you already collect, and what types were new information that you had to seek out or compile?
3. For the information you had used in the past, how did the level of detail the workbook required compare to what you had previously collected?
4. Did you work with people within ENS differently under this process than when you set incentives in the past? [*If yes*] How so?

Q5. [*If respondent has completed workbook:*] About how many hours did it take you to complete the workbook for each measure?

1. And how many days did you spread that work over?
2. How did the time required to set incentives through this new process compare to the time it took you to set or review incentive levels in the past?

Q6. [*If respondent completed workbook for multiple measures:*] Did it take more time to complete the workbook for some measures than it took for others?

[*All other respondents:*] Do you think it would take more time to complete the workbook for some measures than others?

1. Which measures took/would take longer?
2. Why do you think those measures took/would take longer?

Q7. Assuming the workbook doesn't change, how do you think the amount of time it takes you to complete the incentive setting workbook when you review these measures next year will compare to the time it took this year? Why do you say that?

1. Given the outcome of the incentive setting process, do you think this amount of time is appropriate?

Q8. In the feedback on the incentive setting workbook, we received the most comments about the "Existing Measures," and "Inputs and Calcs" tabs. Let's start with Existing measures: From your perspective, what is the most challenging part of that tab?

1. What, if anything, might make it easier for you to provide the information that tab was asking for?
2. Do you think it will become easier to provide the information that tab asks for in the future? [*If needed:*] For example, will it get easier as you gain experience finding the information? Could you change the way the program collects data to more effectively capture that information?

Q9. Now let's move on to the "Inputs and Calcs" tab. What was most challenging on that tab?

1. What, if anything, might make it easier for you to provide the information that tab was asking for?
2. Do you think it will become easier to provide the information that tab asks for in the future? [*If needed:*] For example, will it get easier as you gain experience finding the information? Could you change the way the program collects data to more effectively capture that information?

Q10. What about the other tabs in the workbook, what else stands out as challenging to complete? [*If not mentioned, probe on the "Customer Findings" tab.*]

B.4. Incentive Setting Decision [ASK ALL]

Thanks, now I would like to talk about how you ultimately decided what incentive level to set, or for measures that already had incentive levels, the decision on whether or not to change the current incentive, based on information obtained through the process.

Q11. Thinking about all the information the incentive setting workbook asked you to provide, what was most influential on your decision to select/change/maintain the incentive level you ultimately chose? Why do you say that?

Q12. What information, if any, played a role in your decision that you might not have considered if the incentive setting workbook had not asked you to provide it?

Q13. Of all the information in the incentive setting workbook, what, if anything, did you not find helpful in setting an appropriate incentive level? Why wasn't it helpful?

Q14. How, if at all, does the information you need to effectively set/change/maintain incentive levels differ between measures?

1. [*If needed:*] Do you think the new process will work better for some types of measures and/or incentive structures than others?
2. How could the new process be adjusted to better fit more measures/incentive types?

Q15. [*If respondent has prior experience with incentive setting:*] How, if at all, do you think the incentive level you set/changed/maintained would have been different if you had continued setting/reviewing incentives the way you did previously, rather than completing the incentive setting workbook?

1. To what extent do you think the incentive level you selected will allow the program to more efficiently engage with the market? Why do you say that?
2. To what extent do you think the incentive level you selected is more defensible? Why do you say that?

Q16. Under this new incentive-setting process, do you think that all of the relevant actors within ENS had the right level of information about, and oversight on, the incentive levels you set/changed/maintained?

1. [*If needed:*] Who, if anyone, do you think should have been better-informed?
2. [*If needed:*] Who, if anyone, do you think was more closely involved than they needed to be?

B.5. General Assessment of Process [ASK ALL]

I'd like to close with a few general questions about your thoughts on the incentive setting process as a whole.

Q17. What do you think will be the most beneficial aspect of this new process? Why do you say that? [*Probe on who benefits from the process (i.e. program staff, regulatory compliance, evaluation, planning, etc.)*]

Q18. What do you think will be the most challenging aspects?

Q19. How, if at all, do you think the process will need to change for ENS to successfully roll it out across the entire portfolio of measures next year?

Q20. Do you think that the planned schedule of annual reviews for all measures and biannual reviews for certain high-impact measures is justified? Why or why not?

1. What types of measures do you think should be reviewed more frequently? Why?
2. What types of measures do you think should be reviewed less frequently? Why?

Q21. As ENS has committed to ensuring that incentive levels are not higher than required, do you have any alternate or additional suggestions on the best ways to ensure the proper checks and balances are in place?

Q22. Those are all the questions I have prepared. Is there anything we haven't discussed that you think is important for me to know about the incentive setting process?

Q23. Before we close, I want to check with you about using your quotes – anonymously – in our report to illustrate key points and make them more interesting and readable. We will do everything we can to protect your confidentiality. Please tell me if you:

1. Agree to being quoted anonymously
2. Agree to being quoted anonymously, subject to your review and approval of the quote(s)
3. Do not want to be quoted

Thank you very much for your time.

Final Report

Practices and Procedures Evaluation
Volume 2: Business Development

January 22, 2018

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Efficiency Nova Scotia

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Table of Contents

Overview i

Practices and Procedures Evaluation Volume 1: Incentive Setting

Practices and Procedures Evaluation Volume 2: Business Development

Table of Contents I

1. Introduction 1
2. Methods 3
   - 2.1. Business Development Team Interviews 3
   - 2.2. Other Key ENS Staff Interviews 3
   - 2.3. Consultant Interviews 4
   - 2.4. Participant Interviews 5
3. Findings 7
   - 3.1. Effectiveness of Internal Collaboration 7
     - 3.1.1. Collaboration between BDMs and Program Staff 7
     - 3.1.2. Collaboration between BDMs and Other ENS Staff 8
     - 3.1.3. Effectiveness of Data Management 9
   - 3.2. Effectiveness of Outreach 9
     - 3.2.1. Outreach Approach and Priorities 9
     - 3.2.2. Effectiveness of Coordination with Marketing 11
     - 3.2.3. Effectiveness of Response to Specific Market Segments 12
   - 3.3. Effectiveness of the Sales Process 13
4. Conclusions and Recommendations 16
   - 4.1. Internal Collaboration 16
   - 4.2. Outreach 16
   - 4.3. Salesforce Process 17

Appendix A. Business Development Manager In-Depth Interview Guide A-1

Appendix B. ENS Staff In-Depth Interview Guide B-1

Appendix C. Retrofit Service Consultant In-Depth Interview Guide C-1

Appendix D. Retrofit Service Participant Interview Guide D-1

Appendix E. Business Energy Rebates Participant Interview Guide E-1

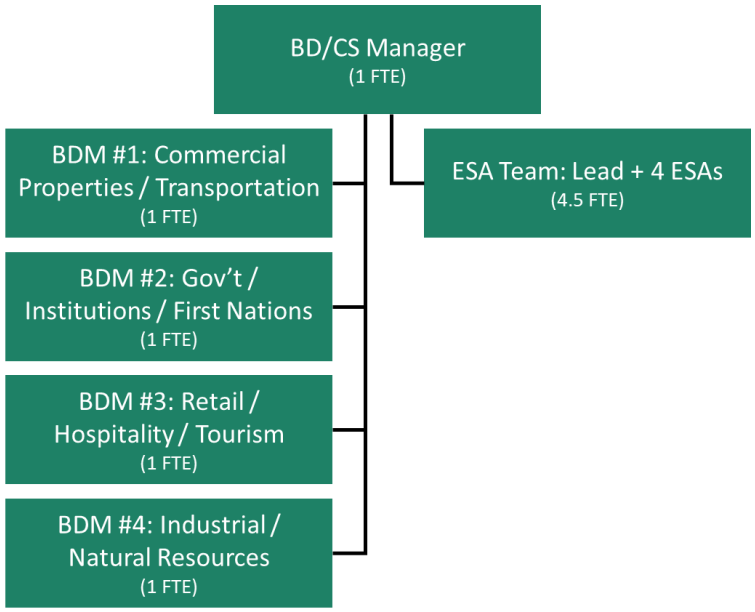
Practices and Procedures Evaluation Volume 3: Training and Development

1. Introduction

Efficiency Nova Scotia's (ENS) Business Development (BD) team is responsible for: informing business, non-profit, and institutional (BNI) customers and other market actors about ENS offerings; generating energy-efficiency project leads; helping turn those leads into energy-efficiency projects; and helping guide those projects to completion. To accomplish these ends, the BD team collaborates with ENS program managers, the ENS marketing team, and the ENS Efficiency Trade Network (ETN) manager, as well as external consultants, service providers, and specialists (referred to in this report as consultants).

As shown in Figure 1 below, ENS's BD team consists of five full-time equivalent (FTE) staff: one Business Development/Customer Solutions (BD/CS) Manager who oversees the BDMs (as well as Energy Solutions Advisors, or ESAs),[1] and four FTE Business Development Mangers (BDMs). Each BDM is responsible for overseeing specific customer vertical markets within the BNI sector.

Figure 1: Business Development Team Structure



ENS engaged Research Into Action to address the following research questions in order to assess the effectiveness of the BD team's ongoing work:[2]

- **Internal Collaboration**. How effective is collaboration between the BDMs and other ENS groups, including program staff, marketing staff, and ESAs? How can communication and collaboration be improved?

1 Most inquiries fielded by the ESAs relate to residential customers; only a small portion relate to the medium and large BNI customers with whom BDMs interact.

2 Subcontracting to Econoler, Research Into Action is also serving as the process evaluator for ENS program components.

- **Outreach**. How effectively are outreach efforts and projects prioritized for BDMs? How could the outreach prioritization process be improved?
- **Salesforce Process.** How effective is the customer sales process for BDMs? How can the sales process be improved?

Chapter 2 of this report describes the methodology we used for this evaluation; Chapter 3 presents findings from the research; and Chapter 4 presents conclusions and recommendations based on evaluation findings.

2. Methods

Research Into Action began the evaluation by talking with ENS BD staff to get an overview of the BD team's history and current operations and by reviewing documentation ENS provided about the team's structure.

With this background information in mind, we interviewed four groups of individuals:

1. All members of the BD team
2. Other key ENS staff who interact with the BD team
3. Consultants who have worked on projects in the Retrofit service[3]
4. BNI program participants

We developed a separate interview guide for each group in order to: gain insight into how the BD team interacts with other ENS staff, consultants, participants, and potential participants; assess the BDMs' effectiveness in the BNI market; identify the processes that have been effective at driving projects; and identify adjustments to BDM practices that could improve the BDMs' effectiveness and potentially yield greater numbers of projects.

We analyzed all of the interviews using *MS Excel* and *NVivo* qualitative analysis software.

The following subsections describe our data collection process for each group of contacts.

2.1. Business Development Team Interviews

We scheduled one-hour interviews with each of the four BDMs as well as with the BD/CS manager. Our purpose in conducting these interviews was to assess the effectiveness of ENS's internal collaboration related to business development, the BDMs' outreach, and the BDMs' sales process.

Specific topics included BDMs' collaboration with other ENS staff and consultants, their outreach and work with businesses, and their perspectives on the team's successes, challenges, and opportunities for improvement. The document we used to guide our discussions with the BDMs is presented in Appendix A.

2.2. Other Key ENS Staff Interviews

As with the BDM interviews, we scheduled one-hour interviews with ENS staff who work with BDMs. We spoke with the following individuals, for a total of six interviews:

- The program manager of the Custom program component

[3] The Retrofit service is part of the Custom program component delivered by ENS. The Custom program component also consists of the New Construction service and the Building Optimization service.

- Two technical specialists of the Custom program component
- One efficiency specialist of the Business Energy Rebates (BER) program component
- One ESA
- One marketing team representative

Topics for these interviews ranged from the respondents' interactions with BDMs, to the depth of the respondents' collaboration with BDMs, their satisfaction working with the BD team, and their suggestions for improving their collaboration with the BDMs. The interview guide we used for our discussions with other key ENS staff is presented in Appendix B.

2.3. Consultant Interviews

To inform our understanding of BDMs' role in identifying and supporting energy efficiency projects in the BNI sector, we interviewed ten Retrofit service consultants. Participants in the Retrofit service typically hire these consultants to serve as the technical lead on projects, providing technical assistance and analysis from project initiation through project completion.

We conducted the consultant interviews for the BD evaluation in coordination with the consultant interviews conducted for the Retrofit service process evaluation. To develop our respondent list, we started with the ENS-provided list of the 37 consultants involved in Retrofit service projects that were completed, or were close to completion, in 2017. After removing duplicates and records with unusable contact information, the list consisted of 27 eligible contacts. Table 1 presents the dispositions of the consultants we contacted for interviews.

Table 1: Consultant Disposition Summary

Disposition	Count
Complete	10
Refusal	1
Unsuccessful attempt	13
Not attempted (reached quota before calling)	3
Total eligible	*27*
Duplicate contacts	3
Unusable contact information	7
Total ineligible	*10*
Total	**37**

Striving to minimize the burden on consultants, we developed a single interview guide that covered both research efforts (the Retrofit service process evaluation and the BD process evaluation). During the BD portion of the interviews, we asked consultants about the degree to which they interact with BDMs, their satisfaction with the support they receive from BDMs, and their ideas for how BDMs could better support

their efficiency efforts. The interview guide we used for our discussions with consultants is presented in Appendix C.

2.4. Participant Interviews

To further enhance our understanding of BDMs' role in BNI energy-efficiency projects, we also gathered input from the participant perspective: we interviewed 15 Retrofit service participants, as well as three BER program component participants.

We developed the Retrofit service participant list from the list of 40 Retrofit projects provided by ENS. As shown in Table 2, after removing duplicate contacts, and a record with unusable contact information, 29 eligible contacts remained. We completed interviews with 15 of these Retrofit service participant contacts.

Table 2: Retrofit Service Participant Disposition Summary

Disposition	Count
Complete	15
Refusal	1
Unsuccessful attempt	11
Unavailable during interview period	2
Total eligible	*29*
Duplicate contacts	10
Bad contact information	1
Total ineligible	*17*
Total	**40**

The purpose of the interviews was to acquire a deep understanding of the BD team's practices and procedures using a statistically representative sample of participants. The sample size of 15 participants we interviewed provides a 80% confidence level with a +/- 10% margin of error. Notably, as of September 2017, the Retrofit service respondents represented close to half of the Retrofit service projects, and more than half of the service's savings and incentives paid from January through September, 2017 (Table 3).

Table 3: Comparison of Retrofit Service Population (Jan. to Sept. 2017) to Sample

	Population	Sample	Sample as Percent of Population
Contacts	29	15	52%
Projects	40	18	45%
Savings	10,965,393	6,041,791	55%
Incentives	$902,544	$521,712	58%

For the BER participant interviews, ENS provided us with a list of 12 participants that had gone through the BER program component but had not participated in the Retrofit service. We contacted all 12 of these participants and, as shown in Table 4, completed interviews with three of them.

Table 4: BER Participant Disposition Summary

Disposition	Count
Complete	3
Refusal	1
Unsuccessful attempt	8
Total	**12**

To minimize the burden on Retrofit service participants, the BD evaluation team coordinated with the Research Into Action team conducting the Retrofit service process evaluation, and developed a single instrument covering topics specific to the BD process evaluation and topics related to the Retrofit service process evaluation. The questions in the BD portion of the Retrofit service participant interview guide were very similar to the questions in the BER participant guide to allow responses to be compared across the two groups.[4] Both guides included questions about BDMs' role in promoting the program components to potential participants, how BDMs support participant needs and requests, and how BDMs could more effectively promote ENS's program components and support businesses in their energy-efficiency endeavors.

The interview guide we used for our discussions with Retrofit service participants is presented in Appendix D, and the guide we used for our discussions with BER participants is presented in Appendix E.

[4] We developed the BER participant guide exclusively for the BD evaluation.

3. Findings

This chapter is based upon the results of our interviews with BDMs, other key ENS staff, consultants, and participants in BNI program components at ENS. The first section addresses the effectiveness of internal collaboration among staff members at ENS, while the second section discusses how well BDMs serve the BNI market, including their collaboration with consultants, outreach priorities, and sales of energy-efficiency projects to BNI customers.

3.1. Effectiveness of Internal Collaboration

BDMs report they regularly collaborate with ENS program staff and, to a lesser degree, with ESAs, BNI marketing staff and On-Site Energy Managers (OEMs) at BNI facilities.[5]

3.1.1. Collaboration between BDMs and Program Staff

BDMs typically initiate new projects in the course of making and maintaining contact with businesses in their respective vertical markets. When BNI customers decide to embark on an energy saving project, the BDMs help them identify appropriate program components – most commonly Custom, BER, or Small Business Energy Solutions (SBES) – help connect them with applicable ENS staff, and assist them in navigating program options and approval requirements. Overall, respondents agreed that projects in all program components often result from the consistent and ongoing communication that BDMs have with the BNI customers in their vertical markets.

The vertical market each BDM serves, coupled with project and program requirements, affects how, and how much, he or she works with program staff. The following bullets describe the roles that BDMs play for each of the main program components BDMs are involved with.[6]

- **Custom:** When a business elects to complete a Custom component project, the BDM often connects program staff, such as a technical or efficiency specialist, with the business to carry out the project's technical oversight, such as reviewing feasibility studies and measurement and verification (M&V) plans. The BDM also checks in with the business and program staff throughout the course of the project, prompts the business to act if they have been slow to respond to program needs, and addresses any issues that arise from the participant's perspective.
- **BER:** Both BDM and participant interviews reveal that BNI participants have varied levels of involvement with their BDMs. For example, a commercial property owner may receive an ENS rebate for lighting equipment and simply have their staff install it without help from their BDM.

[5] Under the OEM initiative, ENS places energy managers within large organizations. Each OEM is tasked with identifying new energy efficiency projects and supporting the organization in advancing these projects. OEM services are paid for by the organization, in part through reduced project incentives. Energy savings from the OEM service are tracked within ENS's BNI program.

[6] The BNI sector also includes Energy Management Information Systems (EMIS) and Strategic Energy Management (SEM) program components. BDMs are tangentially involved in these components through their role recruiting businesses into these components. Participation in EMIS and SEM is generally most appropriate for large facilities.

On the other hand, in the case of national accounts, which are common in the retail, hospitality and tourism markets, the BDM works with regional or national level staff to promote the BER and other program components, and may also work with that business's vendor to ensure they are installing efficient equipment.

- **SBES:** Although most BDMs report they typically spend limited time with SBES projects, the BDM servicing retail, tourism and hospitality businesses noted that about half of SBES projects naturally fall within those three verticals. The BDM works directly with some of these accounts; where small businesses are part of national chains, BDMs may have both direct and indirect influence over projects.

All BDMs and program staff indicated that collaboration between the two groups works well. The sole improvement they recommended is the development of new software to make project tracking easier – specifically the integration of tracking project opportunities with project management. ENS is in the process of implementing new software—ENS's Dynamic DSM, or DDSM, which will incorporate customer relationship management and project management—to address this need. The DDSM is discussed in more detail later in this chapter (Section 3.1.3).

3.1.2. Collaboration between BDMs and Other ENS Staff

ESA Staff. Both BDMs and ESAs reported they most often collaborate when a BNI customer calls the ESAs and they refer that customer to the appropriate BDM. Prior to this hand-off, which may be in person, but more often is via email, the ESAs attempt to vet the BNI customer's project interest, size, industry, and energy usage. The ESA representative noted ENS plans to develop more linkages between BDMs and ESAs. For example, the ESA and BDM teams may hold a joint training session where BDMs walk ESAs through how they work with projects, and ESAs discuss calls they have received and talk about the best ways to serve those customers.

OEMs. BDMs play a major role in placing OEMs at client organization sites, including working with senior management on OEM agreements. The BDMs also maintain regular contact with the client sponsor and site energy team to ensure there is a direct link to ENS and to resolve issues, enhance strategic requirements, planning and contract extensions or changes. The BDMs report, however, that they have infrequent interactions with ENS's eight OEMs themselves. Once on-site, OEMs tend to identify and shepherd projects through program components, so the OEMs need little outreach and oversight from BDMs at that point. However, BDMs still occasionally check in with OEMs, and work with them on issues such as strategic planning and contracts. BDMs also noted that OEMs:

- Provide BDMs and program staff with more in-depth information about the site—including the program components and measures that could work best at the site—compared to sites without OEMs.
- May call BDMs for advice about what program component would work best for a site.
- Are often on the cutting edge of energy management technology. As a result, BDMs try to learn from the OEMs and use them as a technical resource.
- Together with BDMs, provide an enhanced relationship that results in driving deeper savings opportunities, increased client satisfaction, and better insights for the client organization.

Marketing Team. Collaboration between the marketing team and BDMs tends to be concentrated in the fall when the two groups discuss their outreach plans and work to align their efforts. Typically, the BDM team prioritizes outreach efforts based on specific vertical markets and the marketing team identifies ways to support outreach for those markets. Section 3.2 provides more detail about the marketing team's role and effectiveness in outreach efforts.

3.1.3. Effectiveness of Data Management

Seven respondents reported a need to improve the current project management system so that it better facilitates communication among BDMs, program staff, participants, and service providers. All seven respondents also said they were encouraged by the new DDSM system coming online in 2018. As one BDM explained:

> *"I hope to be able to track my projects more effectively [with the new system], and track my communications with different customers and service providers on different projects more effectively – how Salesforce works.*[7] *You can very easily and quickly link communications and documents with a project folder/location, making it easier to understand all of the history of what is happening with one customer's project… rather than searching eight different locations to see if forms have been signed or what the last correspondence was."*

Four BDMs and three program staff noted the existing system does not regularly alert key groups about the status of the projects and that it is hard for staff to know what projects need attention unless a participant or consultant contacts them directly. In addition, staff cannot go to one place to see a project's history and progression, from when it is first identified as an opportunity, through implementation, and finally through M&V. Still, staff, while looking forward to the new system, reported they had, in the meantime, developed somewhat effective—but not ideal—work-arounds for these issues.

3.2. Effectiveness of Outreach

A key role BDMs play is to conduct outreach to the 100 or more businesses in their respective verticals. The next sections describe how BDMs prioritize outreach, their work with the marketing team to support outreach, and which market segments need additional outreach.

3.2.1. Outreach Approach and Priorities

All BDMs reported spending most of their time on outreach efforts. Outreach typically consists of the following activities:

- Bi-annual, quarterly, or more frequent meetings and other communications,[8] with past and current participants to discuss future project opportunities. These interactions are the primary component of BDMs' jobs.

[7] Salesforce is a company that provides a leading customer relationship management software.

[8] We use the term "meetings" here to mean face-to-face discussions as well as communications via phone, email, WebEx, and other methods.

- Calls to new businesses that have not participated to explain program opportunities and how program components work. This can involve reaching out to single-site businesses or multi-site businesses like national accounts and chains.
- Presentations to business and civic groups to increase awareness of ENS's program and opportunities for energy savings.

Outreach can range from working with a production manager at a single industrial facility to reaching out to representatives from national accounts or government agencies to encourage program participation across a portfolio of buildings. For example, a BDM described working with a national chain with multiple sites in Nova Scotia to ensure that all those sites can participate in ENS's program components with limited attention from the BDM at the site level. In these cases, the BDM checks in with the national chain representative regularly to ensure projects are going smoothly, but does not directly oversee those projects. Another example of province-level outreach is a BDM who is working with a provincial government department to support funding of an OEM for a large group of properties.

BDMs reported they use different strategies to balance the demands for continuous outreach with other job duties such as project management or administrative tasks, and some find this balance hard to achieve. As one BDM put it:

> *"That's a constant struggle back and forth, because it's not something I think consciously about, but I'm constantly doing – [it] can become overwhelming. You want to keep the outreach going and the [project opportunities] funnel full. And you're talking to lots of people, but you do understand that you have to be on top of your existing projects and make sure they're moving ahead."*

Outreach and project management, however, can also intersect according to BDMs. For example, one BDM noted that project management activities can result in opportunities to tell businesses about new technologies and to describe and promote the non-energy benefits (NEBs) of efficient equipment. Such discussions can, in turn, solidify BDM-client relationships and lead to future projects.

Some BDMs reported they prioritize outreach based on the size of the organization, meeting quarterly with large customers such as universities and large industrial facilities. Otherwise, BDMs meet with clients and potential clients as often as they can without burdening the clients. In addition to face-to-face meetings, the BDMs are in regular contact through other channels, such as phone, email, and WebEx, to keep clients informed about new initiatives and opportunities for their business.

The locations of some businesses can prove challenging for conducting face-to-face outreach. One BDM stated:

> *"The more remote a customer is (from Halifax), the less likely it is I am going to drop in for a face-to-face meeting."*

That said, BDMs are always available to meet with a client organization at the organization's site: the frequency of in-person meetings is driven by the client's need and their participation potential. Most BDMs noted that when they travel to a remote part of the province, their goal is to see as many potential participants as possible, checking-in with each to see if the organization needs assistance or is considering a new project. Nonetheless, BDMs are able to stay engaged with clients in remote locations by relying more heavily on other modes of communication. One BDM commented that meetings outside the

province – for example to hold face-to-face discussions with the senior leadership of national accounts or with government organizations – is an area the BDM team may focus more attention on in the future.

3.2.2. Effectiveness of Coordination with Marketing

Respondents reported that coordination between BDM outreach efforts and the marketing team has increased notably over the course of 2017, including the addition of these important core activities:

1. BDM and marketing staff met multiple times to discuss ways to align the objectives of the two groups.
2. BDMs worked with marketing staff to build a marketing plan for each specific vertical market.
3. BDMs and marketing staff collaborated on events and presentations.
4. Marketing staff supported BDMs by providing collateral materials for BDMs to use with current and prospective clients.

Overall, our interviews also indicate greater alignment is occurring between the marketing team and BDM efforts in the marketplace. Respondents noted these recent or upcoming activities across four market segments:

- According to a BDM and the marketing team, new construction participants wanted more recognition for the energy saving qualities of their buildings, but reported traditional certifications are too expensive. In response, in 2017 the marketing team developed temporary signage that new BNI construction sites can post to show they are participating in an ENS service. Developers and building owners can use this signage to demonstrate commitment to constructing energy-efficient buildings and to protecting the environment.. The signage also enables ENS to enhance its brand recognition in the community. ENS's marketing team is also considering a new construction recognition initiative for the future that BDMs could use to generate interest from other developers in the market.
- In 2018, BDMs and marketing will work together to develop marketing materials to promote program components to municipalities, and to identify publications in which to advertise.
- Marketing has assisted and will continue to assist the BDMs with information about groups to present to and places to advertise ENS services. For example, marketing staff arranged for the hospitality sector BDM to be interviewed by a trade publication.
- To improve outreach to the agriculture sector, ENS created an OEM position and marketing is working with the agriculture BDM to identify groups who would benefit from presentations, to identify the typical customer journey, and to see if there are places where marketing can support customer actions.

Still, interviews suggest the BD team's outreach priorities and marketing team efforts deserve further alignment. Some respondents noted ENS has traditionally focused on residential customer research and on more general brand-building, but hoped BNI customer insights would become a higher priority. To improve participation and understand if additional BNI markets could benefit from ENS services, one BDM suggested conducting market research. Currently, according to this respondent, evaluations of market

need in some vertical markets are largely based on reports from BDMs, rather than on more formal research.

All BDMs and marketing staff reported that the development of a three-year BNI focused marketing plan (currently in progress), more regular communication between BDMs and the marketing team via meetings, and specific actions like those described above should result in a stronger marketing and outreach strategy for the BD team.

3.2.3. Effectiveness of Response to Specific Market Segments

Interview findings suggest the BD team has identified the correct vertical markets to serve given the resources they have. In addition, respondents noted the team proactively identified specific market segments to target and reorganized and adjusted their services to better serve those segments. They provided the following examples of how recent changes in staff responsibilities led to improvements in serving various markets.

- **New Construction:** Until 2016, there were few new construction projects coming into the Custom program component because of a lack of awareness about it among builders and developers. By responding to the building boom in Halifax and by realigning the BD team to have one BDM concentrate on this market, BDMs report that the number of new construction projects increased considerably.
- **Fisheries Sector or Industry:** Fish and lobster farms were underserved markets before 2016 due to a lack of program awareness among these businesses and their consultants. The BD team assigned a BDM to increase outreach to fisheries, and program staff encouraged a technical specialist to develop a niche understanding of the technical needs of these facilities. This increased attention led to an increase in fisheries projects. In addition, a consultant working in this sector reported an increase in awareness of ENS program components over the last two years.
- **National Accounts:** In the last year, one BDM changed their role within ENS to work with national accounts, typically retail, restaurant, and hospitality businesses. Adding a dedicated BDM to serve these vertical markets resulted in greater program participation, especially for the BER program component. To further build this market, marketing staff noted BDMs need to continue to work with representatives from national and regional firms, often not located in Nova Scotia.
- **Schools and First Nations:** To ensure participation among schools and First Nations, BDMs have actively sought to generate interest in program components among these groups. ENS has engaged several school districts and supported First Nations and it plans to continue these efforts.

ENS's increased attention to the BNI market has led to an increase in awareness of and participation in program components, as well as satisfied participants. Participant interviews revealed they are aware of, make use of, and are highly satisfied with ENS resources, particularly the support from BDMs. Thirteen of the 15 participants referenced their BDM by name during the interview; the two who did not had limited experience with ENS. One of these two participants reported they would like to have regular contact with someone like a BDM to help their organization identify additional projects.

All 13 of the participants who recalled working with a BDM reported they were satisfied with the services they received, describing them as "timely," "responsive," and "helpful." Ten of the 13 reported regular interactions with their BDM via check-in meetings, phone calls, and emails where BDMs inform them

about the latest program changes and participants share their ideas for upcoming energy saving projects. If a project is underway during these meetings, the BDM and participant may discuss it, but typically the conversations are about upcoming projects. These interactions have been so successful for one participant that they decided to apply for an OEM.

Fourteen of the 15 participants indicated they are planning to complete additional ENS projects in the near future including lighting, HVAC, pumps, and air audit projects. The one participant who did not voice an interest in future projects stated that they had a small facility and their recent completed Retrofit service project addressed their one major energy using piece of equipment.

As further evidence that ENS is responding to the market, Custom program component staff noted that they hope to increase participation and do more non-lighting projects. They plan to continue to identify measures that may appeal to specific markets and to support those measures with staff specialists. The Custom program component staff reported they would like to recreate what they have successfully done in the fisheries industry where they identified refrigeration measures used in that market and worked with consultants and BDMs to generate interest in those measures.

In addition, ENS technical specialists have been encouraged to focus on market niches and that has in turn led to new participants. Currently, the program team has or plans to develop specialists with expertise in new construction, refrigeration, building optimization, and industrial applications including compressed air. According to program staff and Retrofit service participants, the current specialists have helped support participants in these specific areas.

One possible way ENS could better respond to the market would be to develop better participation pathways for business too big for SBES but too small to warrant participating in a Custom program component which requires completing a feasibility study. According to these respondents, any financial advantage of participating in the Custom program component is eroded by the cost of completing this study.

3.3. Effectiveness of the Sales Process

To understand if improvements in the sales process are needed, we reviewed feedback from BDMs, consultants, and participants about their interactions with one another.

Working with Consultants. All ten consultants indicated high levels of satisfaction with the BD team; they reported that they interact with BDMs regularly about program updates, project management, and future project opportunities. To manage specific projects, consultants generally interact with BDMs at the beginning of the project to explain procedures and manage expectations, and consultants and BDMs interact again toward the conclusion of the project when M&V is complete. Four noted that BDMs occasionally attend project initiation meetings with participants. Three noted that BDMs sometimes provide participants with a list of consultants/service providers or refer clients to the ETN, although the BDMs do not promote specific consultants over others. Consultants and program staff reported they work together on the technical aspects of Custom program component projects such as reviewing the feasibility study and the M&V plan and results. All consultants reported that ENS has increased the number or scope of projects they complete.

All BDMs, especially those that do a large proportion of their work with Custom program component projects, reported they work closely with consultants to:

- **Ensure participant satisfaction with the program.** BDMs work to ensure consultants understand program component expectations, especially around the feasibility studies and the M&V reports. BDMs communicate with consultants to ensure the consultants follow program processes and completely and successfully resolve issues with clients. Furthermore, BDMs work with program staff to troubleshoot any issues that may arise between the consultant and their BNI clients.
- **Build a relationship with consultants who in turn can help promote ENS program components to other businesses.** Having satisfied consultants working in the market on behalf of ENS is "like having an additional 50 [people] in the field" said one BDM.
- **Recruit more contractors to the Efficiency Trade Network (ETN).** BDMs encourage non-ETN members to join the ETN, but consultants say they have limited interest in joining, and are generally not aware of its benefits. The consultants did not suggest ways in which they could be enticed to join. All BDMs suggested that the ETN needs to increase consultant education and training that demonstrates the value of joining the ETN. Several BDMs specified that the ETN needs to host training or information sessions on new technologies and program changes to encourage consultants to join. Currently, consultants receive information about program requirements and services on an ad hoc basis which the BDMs report is time consuming.

Working with Customers. The process of BDMs and customers working together varies based on the size of the organization and the responsibilities of the individual the BDM works with. All sites require individualized attention from the BDM and large organizations with multiple sites often require BDMs to work with multiple representatives within an organization to drive projects due to:

- **Business representatives serving different vertical markets.** For example, a large property management firm may work in a variety of markets such as retail, condominiums, and rental apartments. Each market may have their own representative requiring the BDM working in the property management vertical to work with a different representative for each aspect of the property management firm.
- **Multiple representatives at a single site.** For instance, a facilities manager at a manufacturing site may be the key contact for a BDM for one site but is unable to make decisions for another site in the province, even though the sites are with the same company. That BDM must develop relationships with the managers of other sites within the company.
- **Representatives having different responsibilities for multiple sites.** For example, a government may own many properties and those properties are served by engineers, a sustainability office, an accounting department, and other departments. In this case, the BDM may be working with an engineer on developing a specific project while simultaneously working with a different person on strategies for implementing future efficiency projects and working with a third person to present the financial case for completing a project.
- **Representatives having regional responsibilities across multiple sites.** In cases like national accounts and chains, there may be a key decision maker the BDM needs to reach to facilitate efficiency projects at sites across the province. However, these decision makers are often not located in Nova Scotia and may be difficult to find. Identifying these key decision makers can help with implementing efficiency projects at many sites as the ENS program can be integrated into the organization's processes for maintaining and updating their facilities.

Smaller organizations with one site and small staffs typically require less back and forth between the organization and the BDM. For example, a BDM working with a site owned and managed by one person can help that site implement a Custom program component project in a relatively short time frame.

The BDMs reported using a variety of strategies to find and appeal to the decision makers most appropriate to their respective verticals, including:

- **Working with key staff to drive influence.** Several BDMs reported they often leverage one contact in an organization to reach others in the organization. As one BDM stated, "if I'm regularly working with the maintenance manager or production manager, I'm asking them who is making decisions on the finances, who do you talk to about the payback requirement?" Working to understand the complexity of decision making at each site is critical to BDM success.
- **Being persistent.** Several BDMs reported continual attempts to contact decision makers and trying multiple approaches to reach decision makers as a key way to recruit participants. For instance, one BDM reported attempting to go through corporate level staff, site level staff, and others to identify a person that could be persuaded to participate in ENS program components. Once a BDM identifies that person, they can help persuade others.
- **Using "Insight Selling."** To appeal to decision makers, one BDM reported using the Insight Selling strategy. This strategy not only addresses the "pain points" a customer brings forward, but also gives the customer deep insights into their business as it relate to ENS's services. Insight Selling ideally provides the customer with information they did not already know, and presents solutions ENS can offer to meet the customer's previously unrecognized needs. Insight Selling may include energy management as well as other benefits, thereby helping the customer bring their business to the next level.
- **Promoting NEBs.** One BDM stated that BDMs are increasingly including benefits other than energy savings—such as increased productivity, increased health and safety, decreased operating and maintenance costs, and improved aesthetics—in their discussions with potential participants. Identifying and explaining the NEBs associated with efficiency upgrades helps clients recognize the total value of participating in ENS program components.

4. Conclusions and Recommendations

Overall, Research Into Action's evaluation found that the BD team effectively collaborates with other ENS staff and with external market actors, generates BNI project leads, helps ensure the leads result in energy efficiency projects, and supports the projects from their early stages until completion. The following conclusions and recommendations suggest how the BD team, and ENS as a whole, can further build on the team's success in driving BNI customers to complete energy saving projects.

The conclusions and recommendations address the three major topics that guided this research: the effectiveness of internal collaboration, outreach, and the salesforce process. Notably, some of the conclusions and recommendations pertain to more than one research topic.

4.1. Internal Collaboration

Conclusion 1: Collaboration between BDMs, program staff, marketing staff, and ESAs is effective. All ENS respondents reported functional and effective relationships with their colleagues. ENS staff support one another by identifying ways to effectively deliver energy savings and, at the same time, serve participants. Results indicate that when issues or problems arise, ENS teams work together to resolve the issues. For example, when the ESA and BD teams identified the need to share information better, the teams created a more formal structure to share information.

Continuing to increase collaboration and align priorities across departments will serve the BD team and ENS well. For example, continuing to increase the BD and the marketing teams' collaboration that began in 2017 will continue to benefit both teams. If not already instituted, these steps will increase collaboration between the BD team and the marketing team.

> **Recommendation 1-1:** Establish a regular meeting schedule when the BD team and relevant marketing staff can share ideas, provide updates to relevant ongoing projects and program changes, and collectively plan for new projects that will benefit both teams. For example, the BD team could request tailored collateral from the marketing team to help the BDMs broaden their reach in specific target markets, or the BD team can supply content, insights, and stories for BNI marketing.
>
> **Recommendation 1-2:** Ensure the BD and marketing teams continue to collaborate and provide input to the ENS staff responsible for market research to better understand markets in the BNI sector. Further, once research is conducted, BD and marketing staff will have a common understanding of ENS's BNI customer segments and can apply these learnings to improve the marketing and outreach strategies for specific segments.

4.2. Outreach

Conclusion 2: Results show that the BD team has been proactive in identifying underserved verticals and organizing to better serve those verticals. For instance, the BD team drove more projects in new construction, fisheries, national accounts, and schools after it reorganized to better serve these markets.

Recommendation 2-1: BDMs should continue to assess their outreach efforts and work with the marketing team to increase service to any underserved markets. Specifically, the BD team could work with ENS staff responsible for market research to assess whether businesses that are too large to qualify for the SBES program component, but too small for the Retrofit service, are an under-served market. Also the BD team and other ENS departments could continue to proactively assess the evolving BNI market to identify other underserved market segments. If possible, ENS should dedicate staff to these segments to generate leads and help instigate energy efficiency projects, since this approach has proven successful in the past. Finally, the BD team should work with the marketing team to develop strategies and materials to reach under-served markets.

Conclusion 3: The ETN is relatively new to ENS and the benefits of membership in the ETN are not yet well known and understood by BNI consultants. BDMs can benefit from a larger pool of high-quality partners who help promote ENS's program components and collaborate on energy-efficiency projects.

Recommendation 3-1: The BD team should use any market intelligence they gain, while working directly with consultants, to inform ETN staff about the education and training topics and strategies the consultant community would find most useful. For example, if the BD team can help the ETN staff identify new technologies useful to some verticals, the ETN staff could host/support training about that technology. Or, the BD team may find out about specific learning modalities, such as face-to-face sessions and distance learning events like webinars and online sessions, that consultants prefer.

4.3. Salesforce Process

Conclusion 4: Results indicate that the BD team has a well-developed and effective process for selling efficiency to their vertical segments. Their existing processes will only be enhanced with the implementation of the new DDSM system in 2018. The new DDSM will help the BD team and program staff better track projects from initial leads through the implementation phase. In addition to improvements in project tracking noted by respondents, this system has the potential to hone BDM's outreach.

Recommendation 4-1: Embrace the new DDSM and think creatively about what improvements to existing processes the system can provide. For instance, customer relationship management data collected by the new DDSM system, such as communications with consultants and potential participants, will help better target outreach efforts; it will allow BDMs to more systematically track their communications with potential leads and prioritize follow-up efforts with potential participants.

Appendix A. Business Development Manager In-Depth Interview Guide

A.1. Introduction

Thanks for taking the time to talk today. I work for Research Into Action and we have been asked by Efficiency Nova Scotia (ENS) to evaluate the Business Development team's practices and procedures. As part of that, we are interviewing Business Development staff such as yourself so we can make sure we understand the existing policies and procedures.

Our talk will take about 30 to 60 minutes.

I'd like to audio record this interview so I can refer to it later to ensure the accuracy of my notes. We will use the recording internally at Research Into Action; we will not provide it to Efficiency Nova Scotia. Is it OK for me to record the interview?

If you want to refer me to specific documents to answer any of my questions, that's great – I'm happy to look things up if I know where to get the information.

Do you have any questions before we get started?

A.2. Roles and Responsibilities

Q1. Let's start with a bit about you. Can you please tell me your title and briefly describe your role and responsibilities at ENS? How do your responsibilities vary by program?

Q2. Have your job title or Business Development responsibilities changed in the last year? If so, how?

Q3. [ASK IF BD RESPONDENT = BD/CS LEAD] What changes have there been in Business Development team staffing in the last year?

Q4. [ASK IF BD RESPONDENT = BD/CS LEAD] Are there any other changes in staffing, responsibilities, or reporting structure planned for the near future? If so, what are they?

Q5. [ASK IF BD RESPONDENT = BD/CS LEAD] Do you think the BD team's current structure effectively covers all BNI customer segments? Why do you say that?

Q6. Do you have any guidelines or other documents that describe how BDMs work with other ENS teams, service providers/consultants/specialists, and customers? [*If so*] What is that document? [*PROBES: a) Does it provide an adequate overview of your key responsibilities? b) Do you follow these guidelines? If no: Why not?*]

A.3. BDM Collaboration with Other ENS Staff

A.3.1. Program Staff

Next I'd like to ask you about your collaboration with program staff, including program managers, coordinators, and supervisors.

Q7. Please describe how you work with program staff on specific projects, from the time a project lead comes in to ENS until the time the project is completed. What information do you share with program staff at each phase of a project, and vice versa? How is that information communicated? [*Probes: a) Do you work with program staff on a regular basis? b) What form does your collaboration with program staff take (e.g., do you meet with the programs team on a regular basis, meet with individual program staff on a regular basis, email individual staff on a daily basis, and/or coordinate in another manner)? c) Who at ENS serves as the customer's primary contact? Does that change during the course of the project?*]

Q8. What could improve collaboration between BDMs and program staff? [*Probes: a) Is there any additional support program staff could provide to make it easier for you to reach and persuade customers to pursue efficient projects. b) What, if anything, could be done to better support customers throughout a project?*]

A.3.2. BNI Marketing Team, Energy Solutions Advisors, Onsite Energy Managers

Now let's talk about your collaboration with other staff at ENS, starting with the business, non-profit, and institutional, or BNI, marketing team.

Q9. Do you work with ENS's BNI marketing team on a regular basis? How so? [*Probes: What form does your collaboration with the BNI marketing team take? Please describe how you work with BNI marketing staff on specific projects, starting with the time a project lead comes in to ENS?*]

Q10. What, if anything, could improve the collaboration between BDMs and the BNI marketing team? [*If needed: Is there any additional support the marketing team could provide to make it easier for you to reach and convince customers to do efficient projects? Is there anything you could do to provide additional support to the marketing team?*]

Q11. How do you collaborate with Energy Solutions Advisors, or ESAs? [*Probes: How you work with ESAs on specific projects, starting with the time a project lead comes in to ENS? What information do you share with ESAs, and vice versa? How is that information communicated?*]

Q12. What, if anything, could improve the collaboration between BDMs and ESAs?

Q13. How do you collaborate with Onsite Energy Managers, or OEMs? [*Probes: How you work with OEMS on specific projects, starting with the time a project lead comes in to ENS? What information do you share with OEMs, and vice versa? How is that information communicated?*]

Q14. What, if anything, could improve the collaboration between BDMs and OEMs?

A.4. Service Providers/Consultants/Specialists

Now I'd like to learn about your collaboration with service providers, consultants, and specialists.

Q15. Please describe how you work with consultants/service providers/specialists on projects.

[*If not addressed in Q15:*]

a. How often do service providers/consultants/specialists come to you with project opportunities?
b. How often do you contact service providers/consultants/specialists to ask about project opportunities?
c. In which customer segments do you work collaboratively with service providers/consultants/specialists to promote efficient projects?
d. What roles and responsibilities do you take on? What roles and responsibilities do the service providers/consultants/specialists take on?
e. After the initial contact, how do you follow-up and stay in touch with partners about projects (e.g., do you both meet in person with the client, email, and/or coordinate in another manner)?
f. Do you think this communication is sufficient to keep you informed about a project's status? Why or why not?
g. What could you or others do to improve your communication with service providers/consultants/specialists to help you stay better informed about the status of projects and project opportunities?

Q16. Is there any difference in how you work with Efficiency Trade Network (ETN) partners and partners who are not part of the ETN?

Q17. What, if anything, could improve the collaboration between BDMs and these project partners? [*If needed: Is there information trade allies could provide that would make it easier for you to reach and persuade customers to pursue efficient projects?*]

A.5. Outreach to Customers

Q18. How many customers do you have in [INSERT VERTICAL MARKET SEGMENT]?

Q19. What program's customers do you typically work with? About what percentage of the time do you spend with customers of each program? [*If needed? Custom, SBES, BER, any others?*]

Q20. About what percentage of the time do you spend conducting outreach to customers to bring more customers and projects into the program versus project management (reviewing Custom applications, visiting Custom participants on-site, etc.)?

Q21. How do you typically learn of new project opportunities? [*If needed: Do customers come to you with a project in mind? Do consultants or service providers contact you? Does it depend on the program?*]

Q22. How do you follow-up and stay in touch with customers?

Q23. How do you prioritize your outreach efforts and project management? [*If needed: Do you think this approach is effective in reaching all customer segments? Are any segments underserved?*]

Q24. How do you think your outreach priorities compare to the BNI marketing team's priorities and activities? [*Probe: Do they overlap one another? Complement one another? Are they ever at odds with one another?*]

Q25. Do you typically have one key contact at each customer's organization, or do you work with more than one individual? How does this vary for local versus international organizations?

Q26. Is/are the key contact/s typically in decision-making positions? Do you have difficulty identifying key decision makers at customer organizations? [*If so*] What do you to identify the key decision makers when this happens?

Q27. What additional support do you think would help you more effectively promote ENS's programs to customers? How does this vary for local versus international organizations?

A.6. Customer Satisfaction

Q28. Please think now about your interactions with customers. Are there aspects of working with ENS that customers have told you they appreciate, other than the rebates ENS provides? What are those services?

Q29. How, if at all, can ENS improve a customer's experience with ENS? [*If needed: use list below to probe about specific project phases*]

a. Internal project review
b. Project approval
c. Providing technical assistance
d. Scheduling inspections
e. Processing rebate payments
f. Communications between ENS and customer throughout experience
g. Reporting turn-around times to improve customers' experiences

A.7. Data Management

Q30. I understand ENS has a relatively new data management system. How, if at all, has the new system affected how you communicate and work with other ENS staff, trade allies, and customers?

A.8. Successes, Challenges, and Opportunities

To wrap-up I have a few general questions for you.

Q31. What do you see as the BD team's key successes over the last year or two? [If needed] Can you think of any measurements or stories that show some of the team's successes?

Q32. What key challenges do you think the BD team faces over the next year or two?

Q33. Is there anything else about the BD work that we have not discussed that you would like to mention?

Those are all the questions I have for you.

Thanks for your time.

Appendix B. ENS Staff In-Depth Interview Guide

B.1. Introduction

Thanks for taking the time to talk today. I work for Research Into Action and we have been asked by Efficiency Nova Scotia (ENS) to evaluate the Business Development team's practices and procedures. As part of that, we are interviewing ENS staff such as yourself so we can make sure we understand the role of the Business Development team and how they work with other ENS staff.

Our talk will take about 20 to 30 minutes.

I'd like to audio record this interview so I can refer to it later to ensure the accuracy of my notes. We will use the recording internally at Research Into Action; we will not provide it to Efficiency Nova Scotia. Is it OK for me to record the interview?

If you want to refer me to specific documents to answer any of my questions, that's great – I'm happy to look things up if I know where to get the information.

Do you have any questions before we get started?

B.2. [ASK ALL] Roles and Responsibilities

Q1. Let's start with a bit about you. Can you please tell me your title and briefly describe your role and responsibilities at ENS?

Q2. Have your job title or responsibilities changed in the last year? If so, how?

[PROGRAM STAFF ONLY] Program Staff Collaboration with BDMs

Q3. What role do BDMs play in outreach for your program?

Q4. Please describe how you work with Business Development Managers (BDMs) on specific projects, from the time you first learn about a project until the time the project is completed. What information do you share with BDMs at each phase of a project, and vice versa? How is that information communicated? [*If needed, refer to project phases below. Additional probes: a) What form does your collaboration with BDMs take (e.g., do you meet with the BD team on a regular basis, meet with individual BDMs on a regular basis, regularly email individual BDMs, and/or coordinate in another manner)? b) how frequently do you communicate with BDMs? c) Who at ENS serves as the customer's primary contact? Does that change during the course of a project?*]

[Project phases:

- Internal project review
- Project approval
- Providing technical assistance

- Scheduling inspections
- Processing rebate payments
- Communications between ENS and customer throughout experience
- Reporting turn-around times to improve customers' experiences?]

Q5. [*If not already answered*] What customer segments does your program aim to reach?

Q6. Are there particular customer segments that you have found especially challenging to reach and to persuade to do efficiency projects? Have BDMs helped you reach these customers and convert them from nonparticipants to participants? If so, how?

Q7. Do you ever interact directly with customers? [*If so*] How do you typically interact with them (e.g., phone, email, meetings, etc.)? Are BDMs also involved in these phone calls/emails/meetings? [*If so*] What role do you play, and what role does the BDM play, when you are working directly with customers?

Q8. What additional support from BDMs could help you more effectively promote your program to customers?

Q9. What additional support could BDMs provide to help improve participants' experiences with your program? [*Probe for additional support with internal project review and approval, reporting turn-around times.*]

Q10. Is there anything else you think could help improve your collaboration and communication with BDMs? [*If needed*] This could be additional information or support BDMs provide to program staff, as well as additional information or support program staff provide to BDMs.

B.3. [MARKETING STAFF ONLY] Marketing Staff Collaboration with BDMs

Q11. Can you please provide a general description of how you and the other BNI marketing staff work with BDMs?

Q12. How would you define your marketing priorities for the BNI sector? Overall, how well do you think the BD team's priorities align with your marketing priorities? Why do you say that?

Q13. I understand that each BDM is responsible for one or more specific market sectors. How do BDMs assist in your outreach and marketing to these sectors?

- Properties/transportation
- Government/institutions/First Nations
- Hospitality/tourism
- Industrial/natural resources

Q14. [IF NOT APPARENT FROM PREVIOUS QUESTION] Does the extent to which the BDMs work with the marketing team depend on the sector they serve? How so, and why do you think that is?

Q15. Are there any customer segments you would like to see the BDMs focus more attention on? Which segments? Why do you think these segments warrant more BDM attention? Why do you think the BDMs are not currently focused on them?

Q16. What additional support from BDMs could help you more effectively market BNI programs to customers?

Q17. Is there anything else you think could help improve your collaboration and communication with BDMs? [*If needed*] This could be additional information or support BDMs provide to marketing staff, as well as additional information or support marketing staff provide to BDMs.

B.4. [ESA LEAD ONLY] Energy Solutions Advisors' Collaboration with BDMs

Q18. Can you please provide a general description of how you and the other ESAs work with BDMs?

Q19. What additional support from BDMs could help you be more effective in your role as an ESA?

Q20. Is there anything else you think could help improve your collaboration and communication with BDMs? [*If needed*] This could be additional information or support BDMs provide to ESAs, as well as additional information or support ESAs provide to BDMs.

B.5. [ASK ALL] Customer Interactions

Q21. What feedback, if any, have you heard from customers about their interactions with BDMs?

B.6. [ASK ALL] Successes, challenges, and opportunities

To close I have a few general questions about your coordination with the BD team.

Q22. What do you see as the BD team's successes over the last year or two? [*If needed*] Can you think of any measurements or stories that show some of the team's successes?

Q23. What key challenges do you think the BD team faces in the next year or two?

Q24. Is there anything else about the BD team's work that we have not discussed that you would like to mention?

Those are all the questions I have for you. Thanks for your time.

Appendix C. Retrofit Service Consultant In-Depth Interview Guide

C.1. Introduction

Thanks for taking the time to talk today. I work for Research Into Action, part of the Econoler evaluation team, and we have been asked by Efficiency Nova Scotia, or ENS, to conduct the process evaluation for the Custom - Retrofit program. As part of that, we are talking with people who are involved with the program so we can make sure we understand how it is working.

Our talk will take about 30 minutes.

I'll be audio recording this interview, to insure the accuracy of my note taking. [*If asked whether the audio will be provided to Efficiency Nova Scotia say: We do not identify any respondent in our reporting, and it is research best practices not to provide the audio or notes to Efficiency Nova Scotia, unless legally required to do so.*] Is it ok that I record the interview?

Do you have any questions before we get started?

C.2. Roles and Responsibilities

Q1. Let's start with a bit about you. Can you please tell me your title and briefly describe your role with your company?

Q2. What is the principal type of work your firm does? [PROBE: Lighting, HVAC, motors, etc.]

Q3. How long have you worked with ENS's Custom program?

Q4. How did you first become aware of the Custom program?

Q5. I understand you have completed [# of CUSTOM-RETROFIT PROJECTS HERE] in 2017, as of October. Does that sound right? If not, how many have you done?

C.3. Program Outreach and Sales

Q6. How often do you identify custom retrofit projects using each of the following sources:

a. Working with your existing customers (either you propose projects or they call you)?
b. Cold calls to potential customers?
c. Referrals or leads from ENS' Business Development Managers (BDMs)?
d. Some other way? (describe)

Q7. How often do customers ask you about participating in the Custom program instead of you telling them about it? When customers bring up the program, what do they say interests them or what

do they want to know about it? [if needed: energy savings, electricity cost savings, improvements in production, comfort, etc.]

Q8. What information or benefits about the Custom program do you emphasize in your sales process? [PROBES: Do you discuss savings, non-energy benefits of participating, etc.?

Q9. What materials, if any, does your firm use to reach out or inform customers about opportunities with the Custom program? If not mentioned: Do you use any materials from ENS in talking with customers about the program? What do you use and how do you use them?

Q10. How do you handle a situation where a customer wants one type of custom project – say a lighting project – but you notice other projects – say an HVAC upgrade?

C.4. Program Services

Q11. In general, a Custom project has five phases. Please describe how you are typically involved in each phase. Let's start with the first phase…

1) Confirming eligibility
2) Scoping study
3) Feasibility study
4) Implementation
5) Measurement and Verification (M&V)

For each phase, I'd now like to know what is working well and what could use improvement – both for you as the consultant and for your customers.

Q12. Let's start with the first phase, <u>confirming eligibility</u> for your customers.

1) What problems or issues, if any, have <u>you</u> faced?
2) What has worked well for you?
3) What problems or issues, if any, have your customers faced?
4) What has worked well for your customers?

Q13. How about the <u>scoping study</u>?

1) What problems or issues, if any, have <u>you</u> faced?
2) What has worked well for you?
3) What problems or issues, if any, have your customers faced?
4) What has worked well for your customers?

Q14. How about the <u>feasibility study</u>?

1) What problems or issues, if any, have <u>you</u> faced?
2) What has worked well for you?
3) What problems or issues, if any, have your customers faced?
4) What has worked well for your customers?

Q15. How about the implementation (installation) phase?

1) What problems or issues, if any, have you faced?
2) What has worked well for you?
3) What problems or issues, if any, have your customers faced?
4) What has worked well for your customers?

Q16. How about the M&V phase?

1) What problems or issues, if any, have you faced with M&V procedures?
2) What has worked well for you with the existing M&V process?
3) What problems or issues, if any, have your customers faced with M&V procedures?
4) What has worked well for your customers?
5) How satisfied are you with the M&V tools provided by ENS? What makes you satisfied or dissatisfied with the tools? What could be improved? What should not be changed?

Q17. What reasons do customers most often give when they decide to a lesser project? [*Probe if needed: What other reasons (besides money)?*]

Q18. What reasons do customers give when they decide not to go forward and complete a project? Is there a typical phase when developing a project at which customers opt out?

Q19. What approaches or strategies you use that encourage customers to complete a Custom project when they get stopped in the process?

C.5. Support from ENS

Q20. I want to understand more about your working relationship with Efficiency Nova Scotia. How often do you communicate with someone from Efficiency Nova Scotia about the Custom program? For what reasons? How, if at all, could those interactions be improved?

Q21. [If they said they get referrals from BDMs] You mentioned you sometimes get referrals or leads to Custom projects from ENS Business Development Managers (BDMs).

1) How does the referral process from BDMs work? Would you suggest any improvements for the referral process?

Q22. Do you (also/ever) work with BDMs during the sales process? [If needed: By sales process I mean when you first interact with the customer and discuss possible project elements] How does working with BDMs affect selling a project to customers? Would you suggest any improvements for coordinating with BDMs during the sales process?

Q23. How about working with a BDM during the project development process – do you do that? [If needed: By project development I mean when you are scoping out project details and doing a feasibility analysis]. How does that work? Would you suggest any improvements for coordinating with BDMs on the project development process?

Q24. What services or support, if any, have you received from ENS during the installation of Custom projects?

1) [Do you also work/Have you worked] with BDMs to get Custom projects installed? What support does the BDM provide?
2) In what ways could BDM support for installing projects be improved?

Q25. What additional services or support, if any, would you like to see from Efficiency Nova Scotia to help you complete more Custom projects?

Q26. Are there any additional measures that ENS should make eligible for Custom projects?

C.6. Consultant Satisfaction

Q27. Has the Custom program helped you get projects you may not have otherwise gotten? How so? [Probe for influence of BDMs]

Q28. How satisfied have you been with the program in terms of the requirements asked of you? Why?

Q29. Overall, how satisfied have you been with Efficiency Nova Scotia in terms of providing you with the service and support you need to deliver Custom rebated projects to your customers? What improvements would you like to see in ENS support?

C.7. Successes, Challenges, and Opportunities

Q30. How, if at all, has the Custom-Retrofit program benefited your firm?

Q31. How, if at all, has the Custom-Retrofit program created challenges for your firm?

Q32. Other than increase incentives, what could Efficiency Nova Scotia do to make the Custom - Retrofit program more effective?

Q33. Is there anything else about the program that we have not discussed that you would like to mention?

Appendix D. Retrofit Service Participant Interview Guide

D.1. Introduction

Thanks for taking the time to talk today. I work for Research Into Action, part of the Econoler evaluation team, and we have been asked by Efficiency Nova Scotia to conduct the process evaluation for the Custom - Retrofit program. As part of that, we are talking with people who are involved with the program so we can make sure we understand how it is working.

Our talk will take about 30 minutes.

I'll be audio recording this interview, to insure the accuracy of my note take. [If asked whether the audio will be provided to Efficiency Nova Scotia say: We do not identify any respondent in our reporting, and it is research best practices not to provide the audio or notes to Efficiency Nova Scotia, unless legally required to do so.] Is it ok that I record the interview?

If you want to refer me to specific documents to answer any of my questions, that's great – I'm happy to look things up if I know where to get the information.

Do you have any questions before we get started?

D.2. Roles and Responsibilities

Q1. Let's start with a bit about you. Can you please tell me your title and briefly describe your role with your company?

Q2. What is the principal type of work your firm does? [PROBE: Food service, Industrial, etc.]

Q3. Approximately how many square feet is your facility? [If needed: I am just looking for a rough way to understand the size of facilities that participate in the custom program].

D.3. Program Outreach

Q4. How did you learn about the Custom program? [If needed: Was it through a consultant, experience with ENS programs, seeing ads, or experience with a Business Development Manager?]

Q5. [If Q4 = Through a consultant] Was this a consultant you had worked with previously?

Q6. What was your motivation to complete the Custom project [Measures included _____, _____, and _____]? Were you primarily interested in saving energy long-term, fixing a problem such as poor ventilation, meeting corporate energy saving goals, something else?

Q7. When you were preparing to start this project, did you have an idea of how extensive it would be? For example, you may have started out wanting to do a lighting project and then opted to complete other measures such as HVAC.

D.4. Program Services

In general, there are five key phases of a Custom project. They are….

1) Confirming eligibility
2) Scoping study
3) Feasibility study
4) Implementation
5) Approval (including any verification of savings) and receiving your incentive

Q8. What problems or issues, if any did you or your firm face with each phase? Let's start with the first phase…

1) Confirming eligibility
2) Scoping study
3) Feasibility study
4) Implementation
5) Approval (including any verification of savings) and receiving your incentive

Q9. What worked well for you, if anything, during each phase? Let's start with the first phase…

1) Confirming eligibility
2) Scoping study
3) Feasibility study
4) Implementation
5) Approval (including any verification of savings) and receiving your incentive

Q10. What suggestions, if any, do you have for improving each phase?

1) Confirming eligibility
2) Scoping study
3) Feasibility study
4) Implementation
5) Approval (including any verification of savings) and receiving your incentive

D.5. Support from Consultant

Q11. How often did you communicate with your consultant about your participation in the Custom program?

Q12. What did you communicate with your consultant about?

Q13. Was there one phase of the project where you interacted with your consultant more often than the others? Which phase was that and why was their more interactions?

Q14. Was there any service or support you would have liked to see from your consultant that you did not receive? What support was needed?

Q15. Overall, how satisfied were you with the following aspects of your consultant?

1) The service you received throughout the process
2) [IF APPLICABLE] The information you received about the installed products
3) [IF APPLICABLE] The quality of the final installation

Q16. Did the consultant identify additional energy saving projects than what you initially intended to complete? For example, perhaps you intended to upgrade some motors and when providing the bid, the consultant suggested upgrading lighting, or some other device. If so, did you undertake the additional work the consultant suggested? Why?

D.6. Support from ENS

Q17. How often, if at all, did you communicate with someone from Efficiency Nova Scotia about your participation in the Custom program?

Q18. How often, if at all, do you work with ENS Business Development Managers (BDMS)? [If needed: A BDM assists clients by identifying areas of energy efficiency opportunities and helps the client navigate the process with ENS programs, services and rebates]

Q19. [IF they work with BDMS] What do you typically work on with the BDMs?

Q20. [IF they work with BDMS] Do you ever work with BDMs and consultant to discuss technical aspects of a project you are interested in? How does that typically occur?

Q21. [IF they work with BDMS] Overall, how satisfied are you with your interactions with BDMs? Is there any service or assistance that you would like to see BDMS offer firms such as yours? What are those services and why would they be helpful?

Q22. [If communicated with ENS] What did you communicate with ENS about staff and were you able to get your questions answered well and in a timely manner?

Q23. What service or support, if any, did you receive from ENS to help you complete your project?

Q24. What service or support, if any, would you like to see from Efficiency Nova Scotia to help you complete Custom projects in the future? Why?

Q25. Are there certain measures or services ENS should provide for Custom projects that are not currently supported?

Q26. Overall, how satisfied have you been with Efficiency Nova Scotia in terms of providing you with the service and support you needed to complete your Custom project? Why?

D.7. Opportunities, Successes, and Challenges

Q27. Do you have any plans to do additional Custom program projects in the coming year or two? If so, what projects are you considering and why are you considering the projects?

Q28. Are there other potential Custom program projects you would like to do in the coming year or two but don't have the time money or other resources to do? What are those projects and what are the specific barriers to doing those?

Before we end this call, I have just a couple overarching questions about your participation.

Q29. How, if at all, has your participation in the Custom-Retrofit program been a success for your firm?

Q30. How, if at all, has your participation in the Custom-Retrofit program been a challenge for your firm?

Q31. Other than increased incentives, what could Efficiency Nova Scotia do to make the Custom Retrofit program more effective, if anything?

Q32. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Appendix E. Business Energy Rebates Participant Interview Guide

E.1. Introduction

Thanks for taking the time to talk today. I work for Research Into Action, and we have been asked by Efficiency Nova Scotia (ENS) to review the Business Development portion of their work. As part of that, we are talking with people who have worked with ENS's Business Development team members so we can make sure we understand how the Business Development team is working with customers such as yourself.

Our talk will take about 15-20 minutes.

I'll be audio recording this interview to insure the accuracy of my notes. [If asked whether the audio will be provided to ENS say: We do not identify any respondent in our reporting, and it is research best practices not to provide the audio or notes to ENS, unless legally required to do so.] Is it ok that I record the interview?

Do you have any questions before we get started?

E.2. Roles and Responsibilities

Q1. Let's start with a bit about you. Can you please tell me your title and briefly describe your role with your company?

Q2. What is the principal type of work your firm does? [*PROBE: Food service, Industrial, etc.*]

Q3. Approximately how many square feet is your facility? [*If needed: I am just looking for a rough way to understand the size of facilities that participate in the Business Energy Rebates program*.]

E.3. Program Outreach

Q4. How did you learn about the Business Energy Rebates (BER) program that provided your incentives? [*If needed: Was it through a consultant, experience with ENS programs, seeing ads, or experience with a Business Development Manager (BDM)?*]

Q5. [*If Q4 = through a BDM*] Was this a BDM you had worked with previously?

Q6. What was your motivation to complete the BER project [*Measures included _____, _____, and _____?*] Were you primarily interested in saving energy long-term, fixing a problem such as poor ventilation, meeting corporate energy saving goals, something else?

E.4. Support from ENS

Q7. How often, if at all, did you communicate with someone from ENS about your participation in the BER program? Who did you communicate with?

Q8. How often, if at all, do you work with ENS BDMs (BDMS)? [*If needed: A BDM assists clients by identifying energy efficiency opportunities and helps the client navigate the process with ENS programs, services and rebates*.]

Q9. [*If they work with BDMs*] What do you typically work on with the BDMs?

Q10. [If they work with BDMs] Do you ever work with BDMs and consultant to discuss technical aspects of a project you are interested in? How does that typically occur?

Q11. [*If they work with BDMs*] Overall, how satisfied are you with your interactions with BDMs? Is there any service or assistance that you would like to see BDMS offer firms such as yours? What are those services and why would they be helpful?

Q12. [*If communicated with ENS*] What did you communicate with ENS staff about? Were you able to get your questions answered well and in a timely manner?

Q13. What service or support, if any, did you receive from ENS to help you complete your energy saving project?

Q14. What service or support, if any, would you like to see from ENS to help you complete energy saving projects in the future? Why?

Q15. Are there certain measures or services ENS should provide for BER projects that are not currently supported?

Q16. Overall, how satisfied have you been with ENS in terms of providing you with the service and support you needed to complete your project that received BER incentives? Why?

E.5. Service Provider Support

Q17. Did you work with a service provider when completing the project that received BER incentives?

Q18. How did you work with your service provider? Did the service provider complete the BER paperwork? Did the service provider interact directly with ENS staff?

Q19. Overall, how satisfied were you with the following aspects of your service provider?

1) The service you received throughout the process
2) [IF APPLICABLE] The information you received about the installed products
3) [IF APPLICABLE] The quality of the final installation

Q20. Did the service provider identify additional energy saving projects, other than those you initially intended to complete? For example, perhaps you intended to upgrade some motors and when providing the bid, the consultant suggested upgrading lighting, or some other device. If so, did you undertake the additional work the consultant suggested? Why?

E.5.1. Opportunities, Successes, and Challenges

Q21. Do you have plans to do any additional projects with ENS support in the coming year or two? If so, what projects are you considering and why are you considering the projects?

Before we end this call, I have just a couple overarching questions about your participation.

Q22. How, if at all, has your participation in the BER program been a success for your firm?

Q23. How, if at all, has your participation in the BER program been a challenge for your firm?

Q24. Other than increased incentives, what, if anything, could your Business Development Manager (BDM) do to make the BER program more effective?

Q25. Is there anything that we haven't already discussed that you would like to mention?

Thank you very much for your time.

Final Report

Practices and Procedures Evaluation
Volume 3: Training and Development

January 15, 2018

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Efficiency Nova Scotia

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Table of Contents

Overview i

Practices and Procedures Evaluation Volume 1: Incentive Setting

Practices and Procedures Evaluation Volume 2: Business Development

Practices and Procedures Evaluation Volume 3: Training and Development

Table of Contents I

1. Introduction 1
   - 1.1. Training and Development Overview 1
   - 1.2. Research Objectives and Report Organization 1
2. Methods 3
   - 2.1. Best Practices Research 3
     - 2.1.1. Literature Review 3
     - 2.1.2. Best-Practice Interviews with Other Organizations 4
   - 2.2. ENS Staff Interviews 5
3. T&D Best Practices 7
   - 3.1. Support Big Picture Thinking 7
   - 3.2. Communicate Clearly and Frequently 8
   - 3.3. Demonstrate Respect for All Employees 9
   - 3.4. Provide Ample T&D Opportunities 9
   - 3.5. Use Individualized T&D Plans 10
   - 3.6. Consider Modalities When Selecting T&D Activities 11
   - 3.7. Conduct Post-Participation Assessments of T&D Activities 11
   - 3.8. Train for Leadership 12
4. ENS's Current T&D Practices and Procedures 13
   - 4.1. ENS Working Environment and T&D 13
   - 4.2. T&D Plan Development Process 13
   - 4.3. Level of Follow-up on T&D Plans 15
   - 4.4. Prioritization of T&D at ENS 16
   - 4.5. Level of Post-T&D Knowledge Sharing and Assessment 16
   - 4.6. Efficacy of Different T&D Formats 17
5. Conclusions and Recommendations 18

Appendix A. References A-1

Appendix B. Other Organization Interview Guide B-1

Appendix C. ENS Staff Interview Guide C-1

1. Introduction

1.1. Training and Development Overview

Based upon Research Into Action's review of Training and Development (T&D) materials and conversations with Human Resources (HR) staff, Efficiency Nova Scotia (ENS) strives for a "high performance, high engagement" culture in which employees are current in their knowledge, skills, and capabilities, and are well prepared for future challenges. To foster this culture, ENS actively encourages staff to take advantage of T&D opportunities, and develops an appropriate annual T&D budget to support these opportunities.

Since the establishment of Efficiency Nova Scotia Corporation (now Efficiency Nova Scotia, or ENS), employees have participated in a wide variety of T&D opportunities. Many have pursued technical training for specific job-related technologies or software, attended industry conferences, or participated in job cross-training;[1] these training opportunities directly apply to the employees' work at ENS. Other employees have pursued broader enrichment opportunities that they can use at ENS as well as in other aspects of their lives, such as a French language and wellness classes.

The T&D process at ENS calls for employees and their managers to work together to develop, at the beginning of each year, annual T&D plans. Human Resources (HR) staff at ENS, who track and manage the T&D budget and approve all employee requests for training and conferences, review each employee's T&D plan and grant final approval. The process then calls for employees to work with their managers throughout the year to ensure that they are on track with their T&D plans.

To gauge employee engagement, ENS retains a research firm to conduct an employee survey each year which asks, among other questions, how well ENS is meeting staff T&D needs and career aspirations. Results of this survey in 2017 show that ENS has an overall employee engagement rating of 90.3%, which the research firm describes as "what could be considered a 'Best in Class' standard for employee engagement research." In 2017, 89% of staff who responded to the survey felt they were given a fair opportunity to pursue training associated with their job (compared to an average of 69% according to the research firm's database), and 71% believed their career aspirations could be achieved at ENS.

1.2. Research Objectives and Report Organization

Given the high value of employee engagement at ENS, and ENS's commitment to ensuring a robust T&D culture, ENS engaged Research Into Action to work with them to conduct evaluation research to address the following overarching questions regarding T&D activities:

- How effectively do the T&D practices and procedures prepare staff to meet current and future ENS business challenges and opportunities?

[1] Cross-training is defined as training employees to do tasks outside of their specific job as a way to teach them other skills and make them better-rounded. See: Marks, M. A., et. al. (2002).

- How effectively do T&D practices and procedures contribute to staff achieving their career aspirations?
- How can ENS use best practices to improve its T&D program?

Chapter 2 of this report describes the multi-pronged methodology we used for this evaluation. Chapter 3 presents findings from the best practices research we conducted outside of ENS, and Chapter 4 presents findings from the research we conducted with ENS employees. Chapter 5 provides our conclusions and recommendations based on the evaluation's findings. A list of the documents we reviewed for this evaluation, along with the interview guides we used to conduct the research, are included in the appendices.

2. Methods

Research Into Action conducted these tasks for this evaluation:

- Best practices research including:
  - An in-depth literature review of best T&D practices
  - Interviews with representatives from Canadian organizations known for their T&D best practices
- Interviews with ENS staff

The following sections describe our approach to these tasks.

2.1. Best Practices Research

2.1.1. Literature Review

To initiate the evaluation, Research Into Action conducted a literature review of best T&D practices for "knowledge workers" in business settings.[2] We sought to document the T&D practices and procedures that are currently considered most effective in helping employees stay up-to-date in their jobs, prepare for the future, and realize their career aspirations.

To gain the broadest and most up-to-date view possible from well-respected sources, we explored large data reports, meta-analyses,[3] and other documents, including those from:

- Gallop Inc.
- Pew Research Center
- Harvard Business Review
- The Society for Human Resource Management (SHRM)
- Google Scholar

A relevant meta-analysis known as the "Gallop Q^{12} Employee Engagement Survey"[4] found 12 factors that predict employee engagement *and* that employee engagement strongly predicts key organizational outcomes, such as productivity, quality, turnover, absenteeism, profitability, and safety. Because ENS puts

2 The term "knowledge worker" was coined by Drucker, P. (1989). Knowledge worker may be defined as: "…workers whose main capital is knowledge." Examples include architects, engineers, scientists, design thinkers, software engineers, lawyers, physicians, and other white-collar workers whose line of work emphasizes non-routine problem solving and requires creative thinking. See also Collins & Smith (2006).

3 A meta-analysis is "a research study that combines and analyzes statistics gathered from multiple independent studies," where, on their own, the individual studies may contain small sample sizes or idiosyncrasies that could distort interpretation of the results. See: Collins (2018).

4 Harter, J. K., et. al. (2013).

high employee engagement at the heart of its organizational culture, we frequently cite this data source in our findings in Section 3.

Several of the data sources listed above directed us to additional relevant materials about T&D best practices. A complete list of the data sources we reviewed and used in our analysis is provided in Appendix A. We summarize findings regarding the best T&D practices in Section 3 of this report.

2.1.2. Best-Practice Interviews with Other Organizations

To build on the literature review findings, and to better understand how theory is applied to real-life organizations, Research Into Action talked with three organizations that were recently recognized in Canada for having outstanding T&D opportunities for their employees. We used Canada's Top 100 Employers for 2018 to compile a list of organizations that received an A or A+ rating for their T&D activities and that employ mostly knowledge workers.[5] Of the 16 organizations that met these criteria, our priority was to talk with smaller organizations, like ENS, because they would likely have similar resources available for T&D. For the purposes of this evaluation, we characterized small organizations as those with fewer than 500 employees.[6] Table 1 shows the prioritization approach for the 16 organizations.

Table 1. Prioritization Scheme for Interviews with Other Organizations

Priority	Organization Characteristics	Number of Organizations with these Characteristics
1	• A or A+ T&D rating • Primarily knowledge workers • < 500 Canadian employees	4
2	• A or A+ T&D rating • Primarily knowledge workers • 500 to 2,000 Canadian employees	11
3	• A or A+ T&D rating • Industry related to ENS, largely knowledge workers • > 2,000 Canadian employees	1

Research Into Action completed interviews with three of the four "priority 1" organizations in late-December 2017 and early-January 2018. In each case, we spoke with staff who are responsible for, and knowledgeable about, T&D at their respective organizations. During the interviews, we asked respondents about their organization's T&D philosophy, approaches, and areas for improvement. We also asked for their feedback about the T&D best practices we identified through the literature review. The telephone interviews ranged from 25 to 55 minutes.

5 Mediacorp Canada, Inc. (2017).

6 At approximately 100 employees, ENS has fewer staff than the four small "Top 100" organizations we examined (these organizations ranged in size from roughly 240 to 500 employees). While these four organizations may be able to allocate more resources to T&D than can ENS due to their larger size, they nonetheless are the most similar to ENS of the organizations on the "Top 100" list.

The document we used to guide our discussions with other organizations about T&D best practices is presented in Appendix B.

2.2. ENS Staff Interviews

Research Into Action interviewed ENS employees to gather information about current T&D practices and procedures, T&D best practices (based on findings from the literature review) already in place at ENS, and opportunities to enhance T&D practices and procedures. We worked with ENS evaluation staff to develop a sample of employees that approximated the total employee pool at ENS in terms of age (grouped by generation—Generation Z, Millennial, Xennial, Generation X, or Younger Boomer), level (entry level, middle, or senior), and function (corporate or program).[7] We also wanted to ensure that Millennials comprised a good portion of the sample, regardless of their level or function, since this group will make up a good portion of the ENS workforce in the future. Table 2, Table 3, and Table 4 show that the final sample of eight employees roughly mirrors ENS's total employee pool for the selected criteria.[8]

Table 2. Generation of All ENS Staff and of Interviewed Employees

	Generation Z	Millennial	Xennial	Generation X	Younger Boomer
ENS Staff (n=95)	4% (n=4)	37% (n=35)	25% (n=24)	25% (n=24)	8% (n=8)
Interviewed Employees (n=8)	0% (n=0)	38% (n=3)	25% (n=2)	25% (n=2)	13% (n=1)

Table 3. Level of All ENS Staff and of Interviewed Employees

	Co-op	Entry	Middle	Senior
ENS Staff (n=95)	1% (n=1)	69% (n=66)	22% (n=21)	7% (n=7)
Interviewed Employees (n=8)	0% (n=0)	63% (n=5)	25% (n=2)	13% (n=1)

[7] ENS had 95 active employees when we conducted this research in October, 2017. The 95 active employees include 73 employees engaged in demand-side management activities, 16 employees engaged in Province of Nova Scotia activities, and 6 On-Site Energy Managers.

[8] Nonetheless, due to the very small sample sizes, the interview responses are not necessarily statistically representative of any of these groups. Interviewing enough employees to obtain statistically representative samples would have necessitated a greater budget than was available for this research.

Table 4. Function of All ENS staff and of Interviewed Employees

	Corporate	Program
ENS Staff (n=95)	53% (n=50)	47% (n=45)
Interviewed Employees (n=8)	63% (n=5)	38% (n=3)

We worked with ENS evaluation staff to schedule one-hour telephone interviews in November 2017. Interview topics included: staff experience developing their T&D plans; T&D activities pursued and desired; the ENS working environment as it relates to T&D; and the effectiveness of T&D in enabling staff to realize their career aspirations and to ready the organization to meet future industry challenges.

Given the number of respondents and in-depth nature of our interviews, our analysis is qualitative. While we asked specific questions, responses were open-ended and often organic. Thus, our reporting focuses on overall themes and insights, while at the same time providing a sense of the proportion of respondents who weighed in on each topic (e.g., “all,” “most,” “one-half,” or “a few”).

The ENS staff interview guide is presented in Appendix C.

3. T&D Best Practices

This chapter describes T&D best practices based on our in-depth literature review and the interviews we conducted with representatives of organizations recognized for their outstanding T&D programs. It is organized by the eight best practice themes we identified through our research:

1. Support big picture thinking
2. Communicate clearly and frequently
3. Demonstrate respect for all employees
4. Provide ample T&D opportunities
5. Use individualized T&D plans
6. Consider modalities when selecting T&D activities
7. Conduct post-participation assessments of T&D activities
8. Train for leadership

Please note that many of these best practices apply not just to T&D practices, but to the broader ENS value of fostering strong employee engagement. We have briefly mentioned these connections where they are relevant to the narrative.

3.1. Support Big Picture Thinking

The literature shows that T&D has the greatest impact when an employee, with guidance from their manager, develops their T&D plan with these three factors in mind: the organizational mission and overarching goals, a broad view of the industry, and the employee's longer-term career goals. To ensure such impactful plans, the organization needs to proactively keep employees abreast of the organization's mission and vision and to regularly communicate anticipated industry changes to employees. The literature also points out that employees who are aware of and understand the organization's mission feel a sense of purpose and meaning within the organization, which in turn fosters employee engagement.[9]

One respondent from a leading T&D organization said they operationalize big picture thinking through communicating the organization's mission/vision at large company meetings, retreats, and smaller group meetings. In addition, respondents said that employee attendance at conferences helps employees gain a broader perspective of the industry because they learn about the work others in their field are doing and the directions that other similar organizations are pursuing.

"Futuring," a more recent concept in business and organizational development, is another big picture activity. It is a process where mangers consider the future of the organization and the industry to inform

[9] Harter, J. K., et. al. (2013).

current decisions, encompassing organizational structure, business development, and T&D. Best practice for futuring is to consider how employees at all levels will adapt to and meet possible future challenges and predicted changes, and to develop employees' T&D plans based on these considerations.[10,11, 12]

As part of futuring, management may also consider skills obsolescence when guiding the development of employees' T&D plans.[13] To avoid skills obsolescence, organizations need to keep employee skills up-to-date, so that they can be effective in their current and future work. For example, as technology changes, the organization needs to enable employees to learn new systems or new software.

To operationalize futuring, management may develop forecasts about possible scenarios the organization could encounter, plan for how challenges associated with these scenarios will be met, and consider what T&D employees need to best prepare them for these potential conditions. Best practice indicates the strongest results come from continual improvement approaches —for example, yearly training on new advances in data analytics—as opposed to one-time large changes.

3.2. Communicate Clearly and Frequently

Clear and frequent communication between managers and their staff is recurrently cited in the literature as T&D best practice and is a key component of T&D at top organizations. Our best practice research found that T&D planning is most effective when T&D planning guidelines are accessible and clear to employees. Once the T&D plan is developed, interviewees from top organizations informed us that each employee's T&D plan is always available for them to refer to. In addition, the Gallop meta-analysis found that employee knowledge of what is expected of them at work is a strong predictor of employee engagement.[14] In practice, this means that managers should ensure that staff know where and how to access their T&D plans, and that the activities in the plan are clearly delineated.

Literature about organizations that provide job "previews" to potential employees also illustrates the importance of clear communication.[15,16] Specifically, research shows that providing realistic previews to potential employees before they are hired, including the especially difficult and unpleasant aspects of a job, reduces job turnover and increases work satisfaction among employees who accepted a position. The literature suggests that realistic job previews lead new employees to consider how they might deal with future challenges before the challenges actually arise. Thus, employees are prepared to draw on their planned coping mechanisms when they encounter challenges.

Our literature review also found that frequent communication between staff and their manger enhances the efficacy of T&D. The top organizations we spoke to highlighted the importance of frequent communication about T&D. They explained that they hold regular meetings where staff can update their manager about new and desired training opportunities, and ask managers questions and voice concerns about T&D planning and implementation. Of equal importance, frequent communication provides the

10 Millett, S. M. (2006).
11 Wilkinson, A., & Kupers, R. (2013).
12 Ballard, D. W. (2017).
13 Eggers, W. D., et. al. (2012).
14 Harter, J. K., Schmidt, et. al. (2013).
15 Phillips, J. M. (1998).
16 Heath, C., & Heath, D. (2013).

opportunity for the manager to better understand the staff member's career goals and any gaps in skill or knowledge that may need to be addressed.[17]

Regular communication helps to ensure that staff issues are addressed promptly and that employees feel valued and included, factors that strongly predict employee engagement.[18] The literature indicates that Millennials desire frequent communication with their managers,[19] and Gallop's research found that Millennials, in particular, are more likely to be engaged when their manager holds regular meetings with them.[20] One organization indicated that they hold T&D-related meetings at least every six months, and sometimes more frequently.

3.3. Demonstrate Respect for All Employees

A large body of research shows that feeling respected is a large predictor of employee engagement and, consequently, of productivity.[21,22,23,24] For T&D, demonstrating respect for employees means learning about an employee's career goals and taking those goals into account when developing their T&D plan. Showing respect also includes learning about the T&D opportunities employees would like to pursue and understanding what they hope to accomplish by engaging in those activities. Managers also show respect when they make working with staff on their T&D plans, and associated career goals, a priority. This involves scheduling meetings with employees specifically to discuss T&D and career planning, and allotting sufficient time for these discussions.

3.4. Provide Ample T&D Opportunities

> *"Two managers are talking about training their employees. One says, 'What if we spend all this money to train them, and they just leave?' The second responds, 'What if we don't train them, and they stay?'"*

Although the origins of the above quip are unknown, its use is ubiquitous in business and management circles for good reason: the saying highlights the common pitfall of focusing on retention at the expense of employee development. The literature suggests that developing employees, while acknowledging they may leave, benefits organizations more than retaining undertrained and less competitive staff. The literature shows that T&D leads to less turnover and greater retention,[25] and that training and the opportunity to develop one's career is especially important to Millennial employees.[26]

17 Durkin, D. (2016).
18 Harter, J. K., Schmidt, et. al. (2013).
19 The Center for Generational Kinetics. (2015).
20 Gallop Inc.
21 Porath, C. & Conant, D.R. (2016).
22 Harter, J. K., et. al. (2013).
23 Kompaso, S. M., & Sridevi, M. S. (2010).
24 Sorenson, S. (2013).
25 Kampkötter, P., & Marggraf, K. (2015).
26 Bresman, H. (2015).

T&D can also happen by teaching others. One of the interviewees from another organization explained that their organization operationalizes this concept by having employees present the information they glean from training opportunities and conferences at team lunch-and-learns. Preparing and presenting newly-learned materials to colleagues not only reinforces the attendee's own understanding of the information, but also provides the rest of their team with an additional T&D opportunity.

3.5. Use Individualized T&D Plans

Best practices literature indicates that T&D is most effective when it is employee-driven.[27,28] In practice, employee-driven T&D planning means that employees are empowered to select the T&D opportunities they would like to pursue including, but not limited to, in-house training, day-long workshops, and conferences. Organizations commonly support employee-driven T&D by allocating managers' time to work with employees on developing and implementing T&D plans, granting employees time to participate in T&D activities, and covering some or all of the cost of the T&D activities.

Employee-driven T&D plans are inherently individualized. The literature and our interviews with top organizations both identified individualized plans as the best approach to planning T&D activities.[29,30] Since staff have varying skills, knowledge levels, and career goals, the most appropriate activities to enhance skills, fill knowledge gaps, and propel careers in desired directions, will necessarily vary from individual to individual.

One data source stated that effective T&D plans often incorporate opportunities for employees to highlight their skills. As one top organization suggested, T&D activities can include staff taking a skills inventory to determine who might be best suited for particular assignments, and communicating with them about the assignment. They can also involve talking with employees about the tasks they believe will best utilize their skills and making assignments based on those discussions. Findings from our interviews and the literature review show that employees who are given the opportunity to use their skills have a greater sense of autonomy and competence, are more engaged and productive,[31] and perceive their jobs as more meaningful. These factors are major predictors of job satisfaction,[32] especially for Millennials,[33] and overall well-being.[34,35]

In addition, the Gallop meta-analysis found that employees are most engaged with their job, and more productive, when they can challenge themselves in their work.[36] T&D activities that create productive work challenges can include cross-training or stretch-assignments where staff tackle tasks somewhat beyond their current expertise or their comfort zone.

27 The Society for Human Resource Management. (https://www.shrm.org/resourcesandtools/tools-and-samples/toolkits/pages/developingemployees.aspx

28 HR Council. (2018).

29 Mooney, J. T. (2011).

30 U.S. Office of Personnel Management (2013).

31 Harter, J. K., et. al. (2013).

32 Harter, J. K., Schmidt, et. al. (2013).

33 Center for Generational Kinetics. (2015).

34 Meyer, J. P., & Gagne, M. (2008).

35 Gagné, M., & Deci, E. L. (2005).

36 Harter, J. K., et. al. (2013).

3.6. Consider Modalities When Selecting T&D Activities

T&D activities take many forms, including conferences, cross-training, temporary assignments, online webinars and classes, and classroom or team-based instruction. When considering career-development and other training opportunities, best practices call for considering the degree of fit between the training sought and the mode in which the training is delivered.[37] For example, research shows that basic training and mandatory, repeated training for staff are often well suited to online formats. The organizations we interviewed noted online training allow employees to schedule sessions at their own convenience and at their own pace. However, interviewees also noted some online formats, such as webinars, may not receive an employee's full attention due to multitasking.

The research also shows that in-person courses are more likely than online courses to lead to greater learning due to their interactive nature. Thus, for the acquiring complex skills required for day-to-day work, face-to-face, interactive classroom training is usually the best option.

According to the literature, conference attendance does not necessarily increase learning but does provide other benefits such as networking and business development opportunities, gaining a broader perspective on one's industry, and facilitating co-worker friendships. The literature indicates friendship among coworkers is a predictor of employee engagement [38, 39] and leads to better-performing staff.[40, 41]

3.7. Conduct Post-Participation Assessments of T&D Activities

Our research revealed that top organizations often maintain a database of the T&D activities their employees have attended. These databases contain training/course titles and the names of sponsoring organizations. Staff then have the database available as a resource when developing their T&D plans. The literature suggests employee feedback about training experiences is a useful component for training resources. The Kirkpatrick Model, illustrated in Figure 1, is a widely-respected tool used to assess the effectiveness of T&D activities.[42]

37 Individual learning styles will also play a role in determining the best modality for a specific training, though that topic is beyond the scope of this report.

38 Harter, J. K., et. al. (2013).

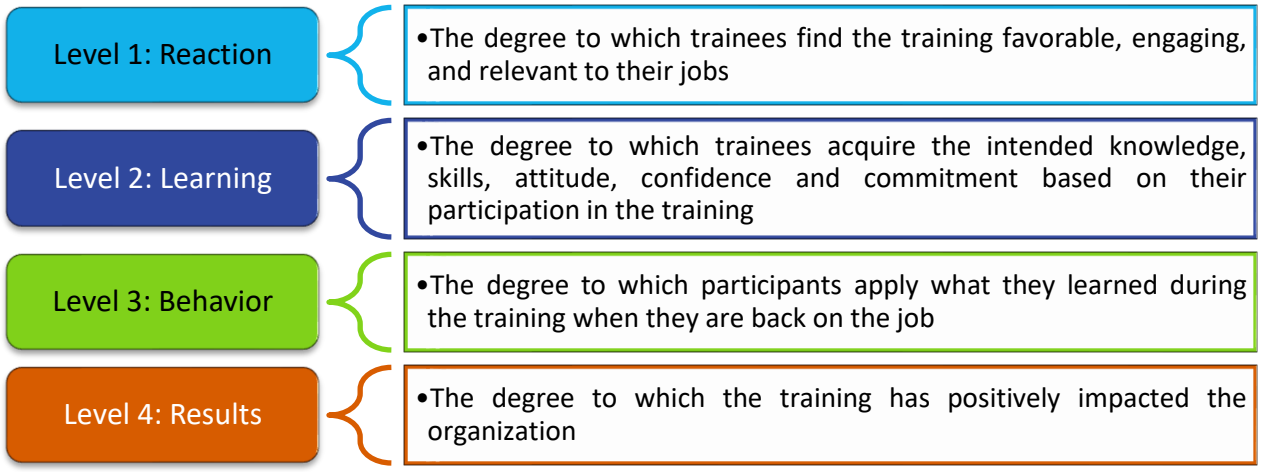
39 Friedman, R. (2014).

40 Jehn, K. A., & Shah, P. P. (1997).

41 Ozcelik, H., & Barsade, S. (2011).

42 Kirkpatrick Partners. (2018).

Figure 1. The Kirkpatrick Model



3.8. Train for Leadership

Becoming an effective communicator and leader is a learned skill that takes time to acquire. One source from the literature review also noted that, "the best leaders are great teachers."[43] Top organizations we spoke with, as well as the thrust of the T&D literature, concur that the best managers are trained to be leaders. Good leadership training is an effective way to ensure that managers are well equipped to advise staff on their T&D plans and, more broadly, on their career paths.

One organization we spoke with recommended Kouzes & Posner's "Five Best Practices of Exemplary Leadership" as a helpful resource for developing an organization's leadership.[44] Figure 2 illustrates the five most important and effective aspects of leaders in this model.

Figure 2. The Five Best Practices of Exemplary Leadership



[43] Finkelstein, S. (2018).

[44] Kouzes, J. M., & Posner, B. Z. (2006).

4. ENS's Current T&D Practices and Procedures

This chapter describes findings from our interviews with ENS staff. Through these discussions, staff provided their perceptions and insights about the:

1. ENS Working Environment and T&D
2. T&D Plan Development Process
3. Level of Follow-up on T&D Plans
4. Prioritization of T&D at ENS
5. Level of Post-T&D Knowledge Sharing and Assessment
6. Efficacy of Different T&D Formats

We describe ENS staff views on each of these topics below.

4.1. ENS Working Environment and T&D

Overall, interviewees described ENS as a forward-thinking, exciting, and collaborative organization that values its workforce. Most said they are eager to develop their skills and knowledge, that ENS supports T&D, and that they are able to pursue their career aspirations. One respondent explained:

> *"People can see ahead here. If they invest in people, they'll get better results. They'll continue to achieve and be successful."*

Most interviewees noted that they can generally pursue the T&D opportunities they are interested in. Two interviewees also mentioned the HR department aids their professional development by sending employees suggestions and examples of training opportunities to consider. Respondents also appreciated the variety and number of T&D opportunities afforded to them, with one respondent saying:

> *"There are a few mandatory training courses here and lots of opportunity for voluntary ones."*

Taken together, these staff perceptions are consistent with two T&D best practices discussed in Chapter 3 -- respect for all employees, and having ample T&D opportunities – especially for a "young" organization where many employees are still early in their careers.

4.2. T&D Plan Development Process

Respondents agree that identifying T&D opportunities to include in their plans is largely the responsibility of each staff member. This type of employee-driven approach is consistent with the best practice of developing individualized T&D plans discussed in Section 3.5.

Most respondents said they have a great deal of freedom in their T&D choices, which is consistent with the best practice of providing ample T&D opportunities (see Section 3.4). They appreciate and prefer this largely self-directed approach to having management dictate a list of T&D activities. As one said:

> *"I really like that you can determine what you want your own training to be. My manager asked me what I wanted to learn, which is very open minded as opposed to being told this is what you're going to be trained in. I like that you set your own T&D goals/plan."*

Still, several respondents suggested the ENS process could benefit from somewhat more structure and guidance. One, who had worked at another organization, explained:

> *"We have support, and can talk about training or opportunities, but there's no set out structure. Looking back on my previous team, it was nice to have structure. It was a goal with a plan."*

And two others said:

> *"I don't think we've done a good job at ensuring what the strategy is and everyone knows how to access it. It's kind of fly by the seat of your pants. It's really driven by the individual."*

> *"We might be able to do a better job of recommending what courses everybody should be taking, and why. Key courses for different roles."*

Some respondents also talked about how a more formalized process might reduce any potential T&D disparities among employees. One suggested that those early in their careers, or less experienced, may find it difficult to identify the most beneficial T&D opportunities on their own. Others mentioned that more proactive, confident employees, and those able to communicate well with their managers, are likely to benefit more from a largely self-directed approach. Finally, a few respondents wanted clearer guidance on whether or not they could attend specific training opportunities or conferences due to their expense or distance from Nova Scotia.

All ENS interviewees described the same three steps they take at the beginning of a calendar year to prepare their plans:

1. Compile a list of T&D opportunities they would like to pursue in the current year in an Excel spreadsheet.
2. Work with their manager to finalize the list and create a formal T&D plan.
3. Submit the completed plan to HR for final approval.

While all the staff we interviewed understood and complied with the same three steps, their specific experiences varied within Steps 1 and 2. This variation was related to how involved their managers were in guiding their T&D activities.

Respondents described how they develop their own lists of the training opportunities, conferences, and workshops they would like to attend. They also reported they use multiple sources of information to develop their lists, such as information from professional organizations, their ENS colleagues, Google searches, and their own prior knowledge about industry-specific training opportunities. However, the amount of input about T&D they received from their managers varied, with only a few saying their managers participated in Step 1. One respondent, who had worked with multiple managers at ENS, said it was his/her experience that some managers provide a great deal of T&D guidance while other provide very little.

While several interviewees noted their managers were amenable to the T&D ideas they presented, the extent and content of T&D planning discussions between staff and their managers (Step 2) also varied. Two interviewees said their managers talk with them about how their T&D plan reflects their longer term career goals. However, a majority of interviewees said they did not discuss their long-term career goals with their managers in creating their T&D plans (for instance, moving into leadership or learning how to tackle big data sets), and believed such discussions would help employees see their future at ENS. As one interviewee said:

> *"More involvement from the managers would be important. The managers should know what the career goals are of employees."*

Similarly, the interviewees reported that while some managers discuss how the T&D plan fits with ENS's mission, or "purpose statement," others do not. Notably, while the majority of interviewees felt their career goals are tied to the organization's overarching purpose, their depth of understanding of ENS's purpose statement varied. Some had a very pragmatic understanding – i.e., to save energy – while others described a more aspirational understanding that encompassed how energy is connected to a better lifestyle and future for all Nova Scotians. Although based on a small sample, those with a more limited view of ENS's purpose more often thought they would need to, at some point, pursue their career goals outside of ENS.

Overall, more than half of respondents said the T&D planning process could be more successful if staff received more guidance from their managers. Such guidance would help employees ensure that their training aligns with their career goals, as well as with ENS's purpose statement and strategic plan. Connecting T&D with career goals, and with ENS's organizational purpose and strategic plan, is also an important component of fostering big picture thinking as described in Section 3.2.

4.3. Level of Follow-up on T&D Plans

Findings from the interviews show that individual staff and managers take different approaches to following up on T&D plans throughout the year. While a few said they revisit their T&D plan with their managers throughout the year, the remainder said they revisit their T&D plan on their own, or do not revisit their plan until they begin to prepare the subsequent year's plan. More frequent communications between staff and managers about T&D activities would align ENS practices more consistently with the communications best practice discussed in Section 3.2.

Two interviewees whose managers did not follow up with them over the course of the year specifically mentioned they would benefit from receiving feedback and direction from their managers on their T&D plan more than once a year (when they develop a new plan). They felt that instituting a mid-year T&D check-in would improve ENS's T&D practices. One said simply:

> *"It would have been nice to have a mid-year or quarterly review to know where you're at."*

And another stated:

> *"We need to make time for talking about it, meeting about it, following up on goals. Now it's just setting goals and talking about them twelve months later. Pay increases are tied to the goals, so it doesn't feel like it's much in my control."*

4.4. Prioritization of T&D at ENS

While all respondents agreed ENS values T&D for employees, several indicated that T&D may be overlooked in day-to-day practice, as suggested in Sections 4.2 and 4.3 above. A few respondents thought this was simply due to a lack of time, either on their part or on the part of their manager. A few others indicated that their tightly-packed work schedules preclude them from attending some of the training opportunities included in their plans.

Still, a few respondents felt their managers did not place a high priority on T&D when they did not set aside time to discuss their annual plan or to follow up with them on their T&D progress throughout the year. Respondents stated:

> *"If it's something we hold high and value then it should be something we pay a little more attention to."*
>
> *"The issue is how you make it a priority."*

To ensure that T&D is successful, and that T&D opportunities are realized, respondents desired more time to seek out opportunities, and to discuss their career goals in the context of their T&D plans with their managers. These actions are consistent with ensuring the best practice that employees have a clear picture of the future of the organization.

4.5. Level of Post-T&D Knowledge Sharing and Assessment

All interviewees said that upon their return from T&D activities, they discussed their experiences in a variety of ways with their colleagues. Some said they had in-depth discussions, while others gave briefer feedback. Among those who gave brief feedback, a few respondents mentioned they did not have an opportunity to sufficiently discuss their take-aways from the training with their managers, and how the information they gleaned may have been useful to discuss, although they did not indicate why.

Most interviewees also reported that they share or offer to share the information they gained from T&D activities with other ENS staff. Knowledge sharing happens more formally within some teams than others. For example, several interviewees explained that staff on their team share conference or training learnings with the rest of the team at lunch-and-learn meetings. Another respondent explained he/she had become an in-house technical expert in a specific area due to a training opportunity and that other staff now come to him/her for technical guidance when needed.

A few respondents also offered that ENS does not formally track and assess how useful staff found specific T&D activities or whether they would recommend them to others. They suggested that a central resource that outlines training opportunities (e.g., courses, webinars), and provides feedback from other staff who have completed the training, would help them in developing their T&D plans.

> *"I don't want to spend too much time looking for those courses. So [it would be helpful] if we had a portal I could go in and see all the courses which other people have taken in a similar situation as me."*

Interviewees also suggested that managers could draw on this resource as they guide staff in developing T&D plans.

While these knowledge sharing and feedback activities do not formally assess the effectiveness of T&D activities, as suggested as a best practice in Section 3.7, they are consistent with it and with the high-performance, high engagement culture that ENS wishes to cultivate.

4.6. Efficacy of Different T&D Formats

All interviewees appreciated the T&D opportunities they have had through ENS and found them beneficial overall. At the same time, respondents said they had found some T&D formats to be more useful than others. As described in Section 3.6, actively considering the best modality for T&D activities is a best practice.

All of the respondents who attended conferences reported they were very helpful for networking, to get a better sense of current industry issues and the strategies used at other similar organizations, and for business development. Two respondents described the benefits of conferences this way:

> *"I think the other benefit is just networking. It's getting to know other people, whether they're in your industry or not. It's having the ability to leverage some of those relationships. You get to know people in your industry that you can trade information with or you can share best practices."*

> *"I get a lot out of going to conferences. It's a good way to quickly get an idea of where other organizations are on different issues, how many of them have adopted certain practices, and what the contentious issues are that academics and other organizations are still working out. That contextual understanding helps us make better strategic decisions about what to focus on and when."*

None of the respondents mentioned they boosted their technical knowledge through conference attendance.

With regard to other T&D activities, over half of interviewees found in-person, classroom-based training more helpful than online courses and webinars, explaining that in-person sessions led to greater engagement with the material. Interviewees also described an unexpected, additional benefit of in-person training: the ability to get to know co-workers and even develop better relationships with them. As one staff member explained:

> *"If you go on training with someone that you don't normally work with, especially an external training opportunity with only two people from the organization, it's an opportunity for bonding that may not otherwise happen. Depending on the content of the training there may be some exercises that exposes you to different aspects of a person or helps you understand the way they work more."*

This is an important training benefit, given that research indicates having a close friend at work is a predictor of high job engagement and better job performance.

5. Conclusions and Recommendations

Conclusion 1: ENS's T&D planning process enables employees to follow a T&D best practice of personalizing their plans based on their individual skills and goals.

> **Recommendation 1-1:** As ENS's T&D planning process evolves, ensure its focus continues to be on personalized plans that include opportunities tailored to each individual.

Conclusion 2: While having self-directed individualized T&D plans is consistent with best practice, the level of T&D guidance that managers provide varies widely. Respondents thought it was important that staff have in-depth discussions with their managers about their career goals and how those goals fit with ENS's overarching purpose and future, and then to ensure those factors are reflected in T&D plans. These steps will help ensure the T&D best practice of fostering big picture thinking.

> **Recommendation 2-1:** Provide greater support to managers charged with guiding staff in T&D by: clearly defining the manager role in T&D plan development; setting clear expectations for the T&D guidance managers provide throughout the year; and training managers to help staff articulate their career goals and to act as career counselors. Such training will enable managers to provide more insightful career guidance, better align T&D plans with ENS's purpose and strategic plan, recommend more relevant and useful T&D opportunities, and help reduce disparities in the T&D support individual staff receive.

Conclusion 3: ENS supports and values T&D, and staff appreciate the T&D opportunities ENS affords them. However, when time is tight, and staff are under pressure to complete other tasks, T&D can become a lower priority at ENS. This affects both T&D planning and attendance at scheduled training sessions. It also affects how well ENS can maintain the T&D best practice of demonstrating respect for all employees. In addition, staff would like more regular communication over the course of the year about progress toward their career goals and how they related to T&D activities; this type of clear and frequent communications is consistent with T&D best practices.

> **Recommendation 3-1:** Consistent with the T&D best practice of clear and frequent communications, encourage managers to demonstrate that T&D is an organizational priority by urging them to more frequently block off time to focus on T&D planning discussions with staff. Managers could schedule quarterly or semi-annual short check-in meetings to assess staff progress in implementing their T&D plans and to adjust the plans mid-year if needed.

> **Recommendation 3-2:** To the greatest extent possible, enable staff to stick to their scheduled T&D events. Encourage managers to help staff find assistance with day-to-day work when that work encroaches on scheduled T&D sessions.

Conclusion 4: Employees would benefit from a more systematized and reliable way to view T&D opportunities and to understand which are most suitable and beneficial to them.

> **Recommendation 4-1:** Develop an online repository/database of relevant training opportunities, preferably with an indication of the usefulness of the training for others at ENS (if available). Provide employees access to the list of training opportunities to help them prepare their T&D

plans, generate enthusiasm for learning opportunities, and envision a more expansive career or different paths.

Conclusion 5: Though employees share their experiences and learning from T&D activities with other staff through a variety of forums, their feedback is not formally tracked and used for subsequent T&D planning.

Recommendation 5-1: Develop a way to consistently communicate employee feedback about past training sessions. This feedback could be housed in an online repository that all employees and managers can access. Managers could refer to the repository in their conversations with employees to ensure that employees are aware of the feedback and make use of this valuable resource. Doing so will help other ENS employees—and the managers providing guidance – identify the T&D opportunities they think are worthwhile to pursue.

Recommendation 5-2: For in-house training opportunities that staff conduct, collect attendee feedback so the training opportunities can be improved.

Conclusion 6: Some staff have a deep understanding of the ENS purpose statement and strategic plan, are proactively "futuring," and are eager to pursue T&D activities that will help ENS meet industry changes and challenges, while other staff are less able to see ENS's future and envision their role in it.

Recommendation 6-1: Use additional methods to broadcast the future of ENS and the skills that staff need to succeed. Make any podcasts and presentation materials available so that staff who were unable to attend organization-wide meetings have access to the information, and so those who were able to attend have the information available for reference.

Recommendation 6-2: Provide inspiration to employees and help them keep the big picture in mind by periodically reminding them about ENS's purpose statement and strategic plan. This could be accomplished by reading the purpose statement at all-organization meetings, and by posting the statement and ENS's strategic plan in the lunch room or other high-traffic places.

Recommendation 6-3: Ensure leadership training and other skills required for leading ENS into the future (such as understanding and using big data) are identified and emphasized in T&D employee-manager discussions and in any T&D database that is developed (see Recommendation 4-1).

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Appendix B. Other Organization Interview Guide

B.1. Introduction

Thanks for taking the time to talk today. I work for Research Into Action in Portland, Oregon. On behalf of our client, Efficiency Nova Scotia (ENS), we are talking with organizations who are recognized as leaders in offering their employees cutting edge training and development (T&D) opportunities. Our goal is to provide ENS with insights about best practices for training and development.

Our talk will take about 30 minutes but it can be shorter if needed.

I'd like to audio record this interview so I can refer to it later to ensure the accuracy of my notes. We will use the recording internally at Research Into Action; we will not provide it to Efficiency Nova Scotia. Is it OK for me to record the interview?

Before we start, I want to mention we often use quotes from our interviews – without names attached -- in our reports. We use these quotes to illustrate key points and to make them more interesting and readable. At the end of our talk today I will ask if you:

1. Agree to being quoted anonymously
2. Agree to being quoted anonymously, subject to your review and approval of the quote(s)
3. Do not want to be quoted

B.2. Roles and Responsibilities

Q1. Let's start with a bit about you. Can you please tell me your title and briefly describe your role and responsibilities at (organization)? How long have you been in that role?

B.3. T&D Philosophy and Strategies

Q2. Now I have a few big picture questions. How would you describe your organization's philosophy and goals for training and career development activities for your employees? How does that philosophy work with your organizational mission? With your work culture?

Q3. Overall, what systems, policies, and processes do you have in place to guide and encourage your employees to make use of T&D opportunities? [*Probe: Who is involved? What processes are used? What resources are available?*] Are there any improvements you'd like to make to these systems, policies, and processes?

Q4. What are the key T&D strategies you use to help employees stay current in their jobs? [*Listen for/possibly probe for: mentoring, career planning services, employee skills inventory, paid internships, subsidies for professional accreditation*], Of these strategies, have you found any to be more important than others?

Q5. What are the key T&D strategies you use to help employees be prepared for future needs of the organization? [*Listen for/possibly probe for: mentoring, career planning services, employee skills inventory, paid internships, subsidies for professional accreditation*], Of these strategies, have you found any to be more important than others?

Q6. What are the key T&D strategies you use to help employees envision, plan, and reach their near- and long-term career goals? [*Listen for/possibly probe for: mentoring, career planning services, employee skills inventory, paid internships, subsidies for professional accreditation.*] Of these strategies, have you found any to be more important than others?)

Q7. We did a literature review to discover what others have identified as "best practices" for T&D within organizations. I'd like to briefly run these best practices by you to get your insights on how important each one is, and if important, what steps your organization takes to make that practice a reality. (*If needed: Some of them overlap with what you've already told me, so please bear with me.*) The first one is:

1. Giving employees the opportunity to see the bigger picture of the organization, including activities that address the organization's mission and the steps the organization is taking to achieve that mission.
2. Conducting organizational futuring with employees, such as discussions or activities that focus on future challenges and predicted changes for the organization.
3. Encouraging frequent communication and feedback among employees at all levels of the organization, including activities that increase employee feelings of inclusion, value, and engagement.
4. Providing clear guidelines about how to meet work goals, including activities that foster regular employer-employee communications and clearly articulated indicators of success.
5. Demonstrating respect for all employees, including activities that address work/life balance, create a constructive, safe workplace culture, and help employees thrive and grow in their jobs.
6. Developing individualized T&D plans for each employee or at least classes of employees, including activities that foster employee-driven approaches.
7. Giving employees tasks/projects that allow them to use their skills and abilities, and, when possible, allowing them to select the tasks/projects they work on, including tasks/projects (such as cross-training) that will challenge them.

B.4. Concluding Questions

To wrap-up I have a few general questions for you.

Q8. Overall, of all the factors we've discussed, what do you think are the most important ingredients of your T&D approach – the ones that make your organization a T&D leader?

Q9. What further improvements would you like to make to your T&D activities? Why?

Q10. Can you refer to me any underlying theory, literature, or resources that have helped your organization develop your T&D philosophy, goals and practices?

Q11. Finally, are there any other topics or insights about T&D at your organization that we haven't discussed that you'd like to mention now?

Q12. Those are all the questions I have for you. Before we close, I want to check with you about using your quotes – anonymously – in our report to illustrate key points and to make them more interesting and readable. We will do everything we can to protect your confidentiality. Please tell me if you:

1. Agree to being quoted anonymously
2. Agree to being quoted anonymously, subject to your review and approval of the quote(s)
3. Do not want to be quoted

Thanks for your time. Your insights have been very helpful.

Appendix C. ENS Staff Interview Guide

C.1. Introduction

Thanks for taking the time to talk today. I work for Research Into Action and we have been asked by Efficiency Nova Scotia (ENS) to evaluate your organization's training and development (T&D) practices and procedures. As part of that, we are interviewing staff like you so we can learn more about ENS's T&D at ENS.

Our talk will take about 45 to 60 minutes.

I'd like to audio record this interview so I can refer to it later to ensure the accuracy of my notes. We will use the recording internally at Research Into Action; we will not provide it to Efficiency Nova Scotia. Is it OK for me to record the interview?

Before we start, I want to mention we often use quotes from our interviews – without names attached -- in our reports. We use these quotes to illustrate key points and to make them more interesting and readable. At the end of our talk today I will ask if you:

1. Agree to being quoted anonymously
2. Agree to being quoted anonymously, subject to your review and approval of the quote(s)
3. Do not want to be quoted

If you want to refer me to specific documents to answer any of my questions, that's great – I'm happy to look things up if I know where to get the information.

Do you have any questions before we get started?

C.2. Roles and Responsibilities

Q1. Let's start with a bit about you. Can you please tell me your title and briefly describe your role and responsibilities at ENS?

Q2. Have your job title or responsibilities changed in the last year? If so, how?

Q3. How would you define your career goals at ENS for the next few years? [*Probes: additional responsibilities, specific job title, learning new skills, learning more about specific topics*.]

C.3. T&D Planning

Now, I'd like you to think back over the past year or so about various experiences you've had with Training and Development (T&D) activities, both in how you planned for T&D and the activities you undertook.

Q4. First, how do you learn about the types of training and development opportunities that might be useful in your work and career at ENS?

Q5. For your most recent T&D plan, what process did you go through to develop the plan? Who did you work with – or get input from – to develop your plan? [*If anyone*] How helpful was input and guidance from those you worked with?

Q6. For your most recent T&D plan, what goals or objectives did you have in mind, if any? [*If any*] Do you feel your T&D plan reflected those goals and objectives?

Q7. How, if at all, will the T&D activities help you in your current job? Why do you say that?

Q8. How, if at all, will the T&D activities help you achieve the career goals we discussed a few minutes ago? Why do you say that?

Q9. Were there any activities, topics, or opportunities you would have liked to include in your most recent T&D plan but didn't? [*Probe: What new skills or additional knowledge, if any, would you like to gain over the next two years?*] [*If so*] What were they? Why weren't they included in your T&D plan?

Q10. How do you ensure you follow your T&D plan over the course of a year? How does your manager, or an ENS HR staff member, track your progress in meeting your T&D goals throughout the year?

C.4. Recent and Desired T&D Activities

Q11. Thinking back over the conferences you've attended in the past couple of years, how helpful have they been in terms of your career development? Why do you say that?

1. Did you attend any pre- or post-conference workshops? [*If so*] How helpful were those?
2. Have you used any of the information from the conference, including any workshops, in your job? Please explain.
3. How, if at all, did you share your experience at the conference with other ENS staff?

Q12. Thinking about the job-related classes, workshops, or webinars you attended in 2017, how helpful were they overall to your career development? Why do you say that? [*Probes: Online or in person? Format (e.g., large lecture, small classroom, etc)? Designed for individuals, a team, or other?*]

1. Have you used any of the information from these activities in your job? Please explain.
2. How, if at all, did you share any of the information from these activities with other ENS staff?

Q13. [*If sharing information mentioned in Q11.3 or Q12.2*] You mentioned that you shared information from the conference, class, workshop, or webinar with your colleagues. Do staff who attend such events typically share that information with other staff? How?

Q14. Again, over the past couple of years, have you participated in any other types of training and development activities, such as having an interim or temporary assignment or being cross-trained for another function? If so, please describe that activity and how useful it was to you.

Q15. Overall, looking back over the past couple of years and the training and development opportunities you've participated in, were there any additional or unexpected benefits that you received from these activities? [*Probes, if needed: networking and professional connections*.]

Q16. Over the past couple of years, were there any job-related training or career development activities you would have liked to pursue, but didn't? What were they? Why were you unable to pursue them?

C.5. ENS as a High Performance, High Engagement Workplace

Q17. How would you describe the overall working environment at ENS? [*Probes: What do you perceive as ENS' workplace values? What types of activities demonstrate those values?*]

Q18. How well does that working environment contribute to your career development and goals?

Q19. How would you describe ENS's mission? How do you see your career goals being tied ENS's overall mission? Why do you say that?

Q20. What changes do you think the energy efficiency industry will experience over the next couple of years? How do see your T&D activities relating to these industry changes?

C.6. Concluding Questions

To wrap-up I have a few general questions for you.

Q21. What do you think is most effective about ENS's current approach to T&D for its employees?

Q22. What suggestions do you have for improving ENS's current approach to T&D, both for employees and for supervisors?

Q23. Is there anything about ENS's T&D practices and procedures at ENS that we have not discussed that you would like to mention?

Q24. Those are all the questions I have for you. Before we close, I want to check with you about using your quotes – anonymously – in our report to illustrate key points and to make them more interesting and readable. We will do everything we can to protect your confidentiality. Please tell me if you:

1. Agree to being quoted anonymously
2. Agree to being quoted anonymously, subject to your review and approval of the quote(s)
3. Do not want to be quoted

Thanks for your time.

EFFICIENCYONE

PROCUREMENT POLICY

Board Approved: 26 November 2014

Revised and Board Approved: 25 June 2015

Revised and Board Approved: 27 September 2018

I. PURPOSE

The purpose of this Procurement Policy (the policy) is to set out requirements for procuring goods and services at EfficiencyOne. The policy includes the minimum required standards that must be followed by all employees to ensure that:

- Procurement decisions are aligned with Board approved policies and objectives;
- Procurement risks are identified;
- Procurement processes are consistent and coordinated across the organization;
- Appropriate approvals and internal controls are followed.

II. DEFINITIONS

- *Director*
  A member of EfficiencyOne's Board of Directors.

- *Employee*
  A person who is an employee of EfficiencyOne. Upon Board decision, an individual who is not an employee of EfficiencyOne may be considered an employee for the purpose of this policy (i.e. contracted professional).

- *Best Value Procurement*
  Best value procurement is when other factors, in addition to price, are considered in the procurement decision.

- *Sustainable Procurement*
  Sustainable procurement integrates social and environmental factors with financial considerations. Buying sustainably preferred alternatives means purchasing products and services that have a reduced negative effect on human health and environment, while enhancing social and environmental conditions.

- *Life Cycle Costing*
  Includes consideration of the costs of items such as shipping and packaging, disposal of packaging, energy use, maintenance, warranty, parts and repairs, consumable supplies, disposal, training, etc. over the life of the product or service.

- *Designated Authority*
  An Executive Leadership Team (ELT) member assigns procurement authority of less than $20,000 to a member of their staff, for procurement purposes. This authority must be granted in writing by the ELT member and provided to the Supply Chain Specialist.

III. SCOPE

This policy applies to all Directors and Employees, for the procurement of all goods, services, and construction.

IV. POLICY GUIDELINES

- *Best Value Procurement*

  EfficiencyOne procurement decisions are to be based on overall best value. A holistic approach to determining best value is to be used, which includes the consideration of a combination of:

  - Expertise of the vendor or contractor;
  - Vendor or contractor's workplace safety;
  - Price:
  - Quality:

- Reliability;
- Timeliness;
- Customer service;
- Life cycle costing;
- Added value proposition; and
- Other relevant considerations.

► *Sustainable Procurement*

To guide the adoption of sustainable procurement, EfficiencyOne will include criteria to evaluate the positive economic and environmental impact in all of its procurement decisions. Criteria will specifically include support for the local economy and energy efficiency industry as outlined below.

➢ *Support for the Local Economy*

To help establish Nova Scotia as a leading jurisdiction in energy efficiency, EfficiencyOne will to the best of its ability consider local economic benefit and the potential to build local capabilities in all procurement decisions.

This means:

- Procuring goods produced from or services provided by companies owned and/or managed in Nova Scotia whenever possible and/or feasible;

AND

- Encouraging non-Nova Scotia-based suppliers to increase Nova Scotia content. Examples of effective means for non-Nova Scotian suppliers to increase Nova Scotian content include:
  - Establishing a branch or office for their organization within Nova Scotia;
  - Subcontracting work when qualified local organizations exist;
  - Training local partners in key areas; and
  - Developing a staged approach to partnering in which subsequent contracts involve local partners to a greater extent than earlier contracts.

➢ *Support for Energy Efficiency*

To help establish Nova Scotia as a leading jurisdiction in energy efficiency, EfficiencyOne will to the best of its ability, consider the potential to further support energy efficiency behaviors and industries in all procurement decisions.

This means:

- Procuring goods produced from or services provided by companies that have embedded energy efficiency business practices, behaviors, and initiatives into their organizational structure, whenever it is possible and/or feasible.

In addition to the criteria above, other sustainable criteria may be considered in procurement decisions where appropriate. These may include the following where applicable:

- Other environmental criteria, e.g. Green House Gas Reduction, Waste Reduction, Toxic Use Reduction;
- Other economic criteria, e.g. Life Cycle Costing, Fiscal Responsibility;
- Social criteria, e.g. Employee Health and Safety, Inclusiveness and Fair Wage, Health Promotion, Gender Equality; and
- Other relevant sustainability considerations as determined by EfficiencyOne.

► *Minimum Procurement Process Requirements Based on Total Value of Procurement*

Minimum procurement process requirements are set out below based on the total value of each procurement. These minimum process requirements have been established to make sure that appropriate processes are consistently used across the organization, to ensure appropriate levels of diligence are exercised with respect to procurement risks, and that approvals and internal control requirements are followed. Regardless of whether the procurement is for a one-time purchase, a repetitive purchase from a single supplier, or a long term multi-year contract, the following process requirement minimums will apply, based on the total value of the procurement:

➢ Goods, services or construction valued below $10,000 excluding taxes

For goods, services or construction valued below $10,000 excluding taxes quotes are not required. EfficiencyOne shall ensure that it undertakes appropriate due diligence and selection processes to ensure value is received.

➢ Goods, services or construction valued equal to and above $10,000 excluding taxes

For goods, services and construction valued equal to and above $10,000 excluding taxes, EfficiencyOne will seek competitive quotes on an invitational / targeted basis. The exception to this would be when Directors and Employees are using the Alternative Procurement Process.

➢ Goods, services or construction valued equal to and above $100,000 excluding taxes

For goods, services and construction valued equal to and above $100,000 excluding taxes, EfficiencyOne will seek competitive proposals, quotes, etc. through an RFP/ RFx Process which includes public notification. The exception to this would be when Employees are using the Alternative Procurement Process.

► *Alternative Procurement*

For the Procurement Policy to balance the need to be open and competitive with the demands of urgent, specialized or exceptional circumstances, EfficiencyOne Employees may use Alternative Procurement. Alternative procurement shall be used only for the purposes intended and not to avoid competition or to discriminate against specific suppliers.

Alternative Procurement may be used in exceptional cases only where at least one of the following conditions has been met:

- The extension of an existing contract awarded in accordance with procedures acceptable to EfficiencyOne for additional goods or services of a similar nature would clearly be economic and efficient and minimal advantage would be obtained by further competition;
- There has been an unsatisfactory response to open or selective procurement request carried out in accordance with EfficiencyOne's procurement policy and procedures;

- A product/service can only be provided by a single supplier because of exclusive capabilities or rights (sole sourcing);
- Standardization with existing equipment is determined to be important and justified, the number of new items are generally less than the existing number and compatible goods cannot be provided by other suppliers;
- It is a case of extreme urgency brought about by unforeseeable events not attributable to EfficiencyOne;
- There is a need to procure goods or consulting services involving matters of a confidential or privileged nature and the disclosure of those matters through an open procurement could reasonably be expected to compromise confidentiality or cause economic disruption to the organization's ongoing operations; or
- It is a strategic alliance/partnership, typically with a local organization to promote innovation or achievement of mutually desired outcomes, that support EfficiencyOne's strategic priorities. A strategic alliance should result in achieving benefits that are greater than those from individual efforts and provide the parties with resources such as:
    - Project funding;
    - Capital equipment;
    - Knowledge;
    - Expertise; or
    - Intellectual property.

In these cases, an Employee may, with the approval from the applicable Approval Authority, invite a single firm to present its proposal, quote, etc. without prior public notification.

► *Unsolicited Proposals*

EfficiencyOne may consider Unsolicited Proposals on a case by case basis at its sole discretion.

► *Supplier Debriefing*

EfficiencyOne, upon the request of the proponent, will provide feedback regarding their proposal submission, including information on how future submissions may be improved. Information on other proponents' submissions is confidential and will not be provided.

V. APPROVALS AND RESPONSIBILITIES

► *Approval Authorities*

The acquisition of any goods or services requires prior approval based on the thresholds set out in the table below.

Approval Authorities by Procurement Value	
Dollar Value	**Approval Authority**
Less than $500	Employee making the purchase
$500 - $19,999	Employee as designated by an ELT member
$20,000 - $99,999	ELT Member
$100,000 - $2,000,000	CEO
Greater than $2,000,000	Board of Directors

- *Responsibilities*

  All Directors and Employees have the responsibility for procuring goods, services, or construction in accordance with the requirements of this Policy. Specifically, they must:
  - Read and be familiar with the Policy; and
  - Be responsible for the safe-guarding of funds or credit cards provided.

  The Director of Finance provides to the Finance Committee an annual report on procurement activities over $100,000. The report highlights the vendor name, total paid to vendor, whether vendor is Nova Scotia based, scope of work and procurement method for the goods or services.

- *Conflict of Interest*

  All Directors and Employees, in accordance with the Code of Business Conduct and Ethics Policy, have an obligation to act in the best interests of EfficiencyOne. Accordingly, they should not be involved in any procurement activity that creates or gives the appearance of a conflict of interest between their personal interests and the interests of EfficiencyOne. All Directors and Employees have the responsibility for procuring goods and services in a manner that is free from any conflict of interest in accordance with the requirements of this Policy and those specifically indicated in the "Code of Business Conduct and Ethics Policy, Section 6 Conflict of Interest".

VI. POLICY REVIEW

The Director of Finance is responsible for ensuring the Procurement Policy is reviewed on a bi-annual basis, including recommendations for changes so that the policy continues to be sufficient and appropriate. Findings and recommended changes that result from the bi-annual review will be reported to the Finance Committee of the Board.

NON-CONFIDENTIAL

Request IR-16:

Reference: Appendix A, 2020-2022 DSM Plan, pages 6-8.

EfficiencyOne states that one of the sources it relied on to inform the key considerations in the Preferred Plan was stakeholder comments:

(a) Please provide the date on which EfficiencyOne engaged Navigant Consulting to provide its ProCESS short-term DSM planning tool.

(b) Please provide the timeline for development and finalization of the Preferred Plan and the Alternate scenario accounting for all stages of the modelling process.

(c) Please identify the specific stakeholder comments relied upon by EfficiencyOne.

(d) Please identify and describe (including when received) any input EfficiencyOne obtained from regulatory stakeholders regarding the development of the Preferred Plan or the Alternate scenario prior to engaging Navigant Consulting or commencement of the modeling process.

(e) Please identify and describe any updates or revisions EfficiencyOne made to either the Preferred Plan or the Alternate scenario as a result of input received from regulatory stakeholders, and please describe all input received from regulatory and other stakeholders.

Response IR-16:

a) EfficiencyOne's engagement with Navigant Consulting for modelling services of the 2020-2022 DSM Resource Plan began July 6, 2018.

b) The development and finalization of the Preferred Plan and Alternate scenario, inclusive of all stages of the modelling process took place from July 6, 2018 to February 28, 2019. Key milestones in the process and the dates they occurred include:

1. Measure characterization and model configuration

July 2018 – October 2018

2. Initial model runs

October 2018 – December 2018

3. Internal Review

December 2018 – January 2019

4. Integrating feedback & Final model runs & QA

January 2019 – February 2019

c) Please refer to EfficiencyOne's response to NS Power IR-05.

d) Navigant and EfficiencyOne prepared inputs and performed testing of the model through the summer and into the fall of 2018. Prior to Navigant finalizing the model, EfficiencyOne sought stakeholder comments on the energy savings and investment level for the Preferred Plan and Alternate Scenario. EfficiencyOne also shared the guiding principles (key considerations) for the development of the plan and the intention to file one Alternate Scenario.

e) Please refer to EfficiencyOne's response to NS Power IR-05.

NON-CONFIDENTIAL

Request IR-17:

Reference: Appendix A, 2020-2022 DSM Plan, page 9, section 2.4.

The UARB confirmed that the test for cost effectiveness test screening is the Total Resource Cost (TRC) test. EfficiencyOne has used the TRC test and the Program Administrator Cost (PAC) test in its DSM Plan. EfficiencyOne states that it has presented "PAC test results on an information-only basis".

(a) Please confirm there has been no consensus reached among members of the DSMAG to use the PAC test or any other cost effectiveness methodology other than the TRC test.

(b) Please confirm the only methodology to be applied by the UARB and stakeholders in assessing cost-effectiveness of the 2020-2022 DSM Plan is the TRC test. If not, is EfficiencyOne proposing to change the cost-effectiveness test from the TRC?

Response IR-17:

a) Confirmed.

b) Confirmed.

NON-CONFIDENTIAL

Request IR-18:

Reference: Appendix A, 2020-2022 DSM Plan, page 13, lines 15-17.

Please provide the calculations and any supporting working papers by measure for the estimates of annual incremental C02 reductions of 86 MT and cumulative net lifetime Co2 reductions of 3,180 MT.

Response IR-18:

Please refer to Exhibit E-2, E1 Errata & attached corrections to Application & Evidence for the corrected units for these estimates. Please refer to Attachment 1 of this IR (filed electronically) for the calculations.

NON-CONFIDENTIAL

Request IR-19:

Reference: Appendix A, 2020-2022 DSM Plan, page 17, lines 12-13.

Please provide EfficiencyOne's evidentiary support for the statement, "In Nova Scotia, household perception of the importance of reducing energy use is at an all-time high".

Response IR-19:

Please refer to EfficiencyOne's response to NS Power IR-20.

NON-CONFIDENTIAL

Request IR-20:

Reference: Appendix A, 2020-2022 DSM Plan, page 18, Figure 2.

Please identify the source data for Figure 2 and provide copies of the data and working papers used to create Figure 2.

Response IR-20:

Figure 2 was prepared for EfficiencyOne by Corporate Research Associates. The data is collected from a general population survey of Nova Scotia adults, conducted each quarter. All raw data remains the property of Corporate Research Associates.

NON-CONFIDENTIAL

Request IR-21:

Reference: Appendix A, 2020-2022 DSM Plan, section 4.1.

(a) Please provide a detailed breakdown of the annual cost estimated for the "Appliance Retirement" component of the Residential Efficient Product Rebates Program for each of 2020, 2021 and 2022. As part of that breakdown, please indicate what portion of those costs are budgeted for participants in the HomeWarming Program.

(b) Please provide a detailed breakdown of the annual cost estimated for the "Instant Savings" component of the Residential Efficient Product Rebates Program for each of 2020, 2021 and 2022.

(c) Please provide a breakdown of the forecast spend for the "Appliance Retirement" Component by geographical area.

(d) Please provide a breakdown of the forecast spend for the "Instant Savings" Component by geographical area.

(e) Please provide a breakdown of the rebates to be provided through the Instant Savings component by energy efficiency product type for 2020, 2021 and 2022.

(f) For each year from 2016 to 2018 inclusive, please provide a breakdown of the annual costs of incentives provided by energy efficiency product type.

(g) Are the enhancements to the Residential Efficient Product Rebates Program accounted for in the Alternate Scenario?

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Response IR-21:

a) Please refer to EfficiencyOne's Appendix A – 2020-2022 DSM Resource Plan, Attachment 1 – The Measure Level Technical Tables, columns AL, AX, and BJ for measure-level and total costs in Appliance Retirement for 2020, 2021, and 2022. The measures, Dehumidifier replacement (Low-Income only), Freezer replacement (Low-Income only), and Refrigerator replacement (Low-Income only) are replacements occurring through the HomeWarming program. Over the 2020-2022 period, 11 percent of Appliance Retirement costs are budgeted for participants in the HomeWarming program

b) Please refer to EfficiencyOne's, Appendix A – 2020-2022 DSM Resource Plan, Attachment 1 – The Measure Level Technical Tables, columns AL, AX, and BJ for measure-level and total costs in Instant Savings for 2020, 2021, and 2022.

c) Participation in both the Appliance Retirement and Instant Savings program components is voluntary. EfficiencyOne would not have this data for the 2020-2022 period.

d) Please refer to c).

e) Please refer to EfficiencyOne's response to NS Power IR-31 Attachment 2, Columns X, Y, and Z for unitary incentives for all measures for 2020, 2021, and 2022.

f) Please refer to Table 1 on the next page for a summary of incentive costs in the Instant Savings and Appliance Retirement program components for 2016-2018 by product type.

NON-CONFIDENTIAL

Table 1: Annual Cost of Incentives Provided by Energy Efficiency Product Type

Program Component	Product type	2016	2017	2018
Instant Savings	LED lamps	$ 2,225,203	$ 829,308	$ 596,523
Instant Savings	LED fixtures	$ 290,214	$ 279,831	$ 421,978
Instant Savings	Appliances	$ 148,497	$ 181,500	$ 416,325
Instant Savings	Controls	$ 92,015	$ 81,866	$ 108,560
Appliance Retirement[1]	Appliances	$ 988,947	$ 988,414	$ 899,497
	Total	$ 3,744,877	$ 2,360,919	$ 2,442,884

[1]. Costs include both direct incentives (cheques to participants) and the cost to remove and replace appliances

g) Yes, enhancements have been included in the Alternate Scenario.

NON-CONFIDENTIAL

Request IR-22:

Reference: Appendix A, 2020-2022 DSM Plan, page 23, lines 14-17.

EfficiencyOne states:

[p. 23] Barriers to participating in the Efficient Product Rebates program includes:

- **Affordability: The cost difference between efficient products and less efficient products can create a participation barrier.**

[p. 37] Barriers to participating in the Existing Residential program include:

- **Affordability – lack of financial resources to cover upfront costs (product/equipment, installation, energy assessments).**

[p. 47] Barriers to participation in the New Residential program include:

- **Upfront costs: for both modelling and energy efficient upgrades.**

[p. 62] Barriers to participation in the Custom Incentives program include:

- **Financial constraints resulting from internal competition for capital.**
- **Upfront cost requirement for feasibility studies and audits before energy savings potential is known can be challenging 1 for businesses to justify.**
- **Payback periods: businesses often require short paybacks on investments making it challenging for custom energy efficiency projects to compete against other capital investments.**

[p. 70] Barriers to participation in the Direct Installation program include:

- **Affordability: the cost of equipment/upgrades and lack of access to affordable capital can be a barrier to program participation.**

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(a) Please provide statistics for the most recent historical year available for each of EfficiencyOne's residential programs, which provides the number of participants and savings levels broken out by income level categories.

(b) Does EfficiencyOne verify household income levels prior to awarding subsidies? If not, why not?

(c) Has EfficiencyOne considered income testing for awarding subsidies? If not, why not?

Response IR-22:

a) Aside from the Low-Income Homeowner Service offered by Efficiency Nova Scotia Corporation prior to 2015, EfficiencyOne does not require households participating in its DSM programs to report on income level.

b) No. Independent evaluation of free ridership quantifies the effectiveness of incentives, rebates and other program support in overcoming all participation barriers, including financial. Because free ridership is independently evaluated for all DSM programs administered by EfficiencyOne, knowledge of participants' income levels is not required in order to confirm cost effectiveness and impact.

c) No. Please refer to part b).

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Request IR-23:

Reference: Appendix A, 2020-2022 DSM Plan, page 28, lines 6-28.

Please provide:

(a) the annual amounts spent on advertising by type (i.e. television, print, social media, etc.) in each of 2016 to 2018, inclusive and the budgeted amounts for 2019 to 2022, inclusive; and,

(b) any studies/analysis in support of the rationale for the above spends by media type and an explanation of how they individually contribute to EfficiencyOne goals.

Response IR-23:

a) Please refer to the table below for 2016 to 2018 advertising spend and the 2019 advertising budget. The budget for 2020-2022, including an advertising budget, will be developed after receiving the Nova Scotia Utility and Review Board's Decision on the 2020-2022 DSM Resource Plan.

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Advertising Spend - DSM Portion ($000s)				
	2016 Actual	**2017 Actual**	**2018 Actual**	**2019 Budget**
TV	$ 142	$ 147	$ 148	$ 113
Print	13	13	19	15
Online	122	217	281	216
Radio	57	93	88	68
Out of Home	29	31	72	55
Promotional Materials	308	179	162	133
Total	**$ 671**	**$ 680**	**$ 770**	**$ 600**

Note: Advertising Spend does not include production costs or agency fees

b) EfficiencyOne's annual media plans are developed to effectively reach the most relevant target audiences with minimum expenditure. EfficiencyOne and its media buy partner use a variety of research and insights to determine the profile of the target audience for each media campaign and to understand media consumption habits, which form the basis of the rationale for the annual amounts spent on advertising by media type, including:

- Existing knowledge of the energy efficiency economy and historical campaign results;
- Various industry research studies and tools, including Numeris, RTS, LENS, comScore, nLogic, ThinkTV, IAB and eMarketer; and,
- Consumer insights from Google and Facebook.

In addition, EfficiencyOne uses the following strategies to maximize the impact of the overall media buy budget:

- Conduct regular conversations with media vendors, Google, and Facebook to ensure awareness of the most current opportunities and innovation;
- Negotiate competitive rates with media providers;
- Perform ongoing monitoring of media campaigns to ensure they are delivered as required; and

- Review post-campaign consumption statistics to gauge the effectiveness of individual activities in meeting campaign and business objectives.

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Request IR-24:

Reference: Appendix A, 2020-2022 DSM Plan, page 60.

Please provide a list of custom incentive projects for 2020 to 2022, inclusive with the following detail:

(a) Customer Name or Customer Identifier (Name, EfficiencyOne identification code for individual customer or other like identification)

(b) Customer rate class;

(c) Program (or sub-component, if applicable);

(d) Measures

(e) Energy saving estimate/evaluated

(f) Demand saving estimate/evaluated

(g) Total project cost estimate/actual

(h) Incentive estimate/actual

(i) Project start date

(j) Agreement date

(k) In-service date

(l) Customer's payback period without incentives

Response IR-24:

a) Customer engagement is a continuous process. While certain Custom projects known at the date of preparing the 2020-2022 DSM Resource Plan may close in the 2020-2022 period, EfficiencyOne does not have a full listing of all anticipated Custom projects for the 2020-2022 period. The 2020-2022 DSM Resource Plan individual program targets are designed based on EfficiencyOne's experience as DSM administrator in Nova Scotia, and not based on specific projects.

With regard to those known Custom projects, EfficiencyOne asserts this IR, which is requesting individual, customer-specific information, engages issues of relevance and confidentiality.

The individualized information sought by NS Power in this IR is not relevant to determination of the matter before the Nova Scotia Utility and Review Board (NSUARB), which, has as its primary purpose, the conclusion and approval of a DSM supply agreement between EfficiencyOne and NSPI, involving the establishment of a DSM Resource Plan for the 2020-2022 period.

EfficiencyOne is under an ongoing legal requirement to ensure protection of customers' personal information. While NS Power's request allows for use of an identifying number, the combination of remaining requests would allow for the identification of individual customers which may, in certain circumstances, violate EfficiencyOne's privacy policy.

b) Please refer to part a).

c) Please refer to part a).

d) Please refer to part a).

e) Please refer to part a).

f) Please refer to part a).

g) Please refer to part a).

h) Please refer to part a).

i) Please refer to part a).

j) Please refer to part a).

k) Please refer to part a).

l) Please refer to part a).

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Request IR-25:

Reference: Appendix A, 2020-2022 DSM Plan, pages 68-74 (5.3 Direct Installation: Program Description).

Please provide an estimate and supporting details of the direct installation savings for 2020-2022 including the number of customers served, energy and demand savings and cost.

Response IR-25:

Please Refer to Appendix A, 2020-2022 DSM Resource Plan, Attachment 1: 2020-2022 Preferred Plan Measure Level Technical Tables for this information.

Estimates of measure-level first year energy savings for 2020, 2021, and 2022 can be found in columns AD, AP, and BB respectively; estimates of measure-level demand savings for 2020, 2021, and 2022 can be found in columns AC, AO, and BA respectively; estimates of measure-level costs for 2020, 2021, and 2022 can be found in columns AL, AX, BJ respectively. The Direct Installation program was characterized at the measure-level rather than a project or participant-level. As such, the number of customers served or participant counts are not available from this data. However, more granular measure quantity information for 2020, 2021, and 2022 can be found in columns AB, AN, and AZ respectively. Estimates of participant counts were required for the Rate and Bill Impact Analysis, and those values and their derivation are provided in EfficiencyOne's response to NS Power IR-64

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Request IR-26:

Reference: Appendix A, 2020-2022 DSM Plan, pages 77-85.

For each of the categories of "Enabling Strategies" identified, please provide:

(a) the level of expenditure by year (2016, 2017, 2018);

(b) the level of energy and demand savings attributable to that strategy in each year; and

(c) any other quantifiable benefit specifically attributable to that strategy in each year.

Please provide items (a) through (c) separately for each of the following enabling strategies:

- **Education and Outreach;**
- **Development and Research; and**
- **Other Enabling Strategies:**
  - **Efficiency Trade Network;**
  - **Codes & Standards; and**
  - **Regulatory Affairs.**

Response IR-26:

a) Table 1 below provides level of expenditure by year (2016, 2017, 2018) for each category of Enabling Strategies.

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Table 1: Level of expenditure by year (2016, 2017, 2018) for Enabling Strategy Categories

Enabling Strategies ($000's)			
	2016	2017	2018
Development and Research	383	247	494
Education and Outreach	1,716	1,608	1,691
Other			
Regulatory Affairs	851	839	1,005
Codes and Standards	99	71	82
Total Other	950	910	1,087
Total Enabling Strategies	3,049	2,765	3,272

b) Although there are no energy and demand savings attributable to the Enabling Strategies during the 2016-2018 period that count towards the achievement of EfficiencyOne's Performance Targets, Enabling Strategies are an essential component of a DSM Plan and are required for EfficiencyOne to meet energy and system-peak demand savings targets now and in the future.

c) **Education and Outreach**

Education and Outreach strategies create awareness of and provide information about energy efficiency to Nova Scotians. During the 2016-2018 period, education and outreach strategies helped maintain high public awareness of Efficiency Nova Scotia (83 percent) and influence on reducing household energy use (30 percent). Overall public opinion of Efficiency Nova Scotia increased by 13 percent, with seven out of 10 Nova Scotians expressing a favourable opinion of Efficiency Nova Scotia at the end of 2018. The results in Table 2 below demonstrate the reach of key Education and Outreach activities during the 2016-2018 DSM Plan period.

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Table 2:

	2016	**2017**	**2018**
Media Mentions	135	150	160
Social Media Reach	Facebook 4% ↑ Twitter 10% ↑ LinkedIn 15% ↑	Facebook 2% ↑ Twitter 10% ↑ LinkedIn 9% ↑ Instagram 75% ↑	Facebook 2% ↑ Twitter 23% ↑ LinkedIn 10% ↑ Instagram 200% ↑
Green Schools participating schools and engagements	203 schools 419 engagements	252 schools 565 engagements	291 schools 1,030 engagements
Student Participation in Dal and SMU courses	16	20	32
Bright Business Conference attendees	260	250	270
Workshops, home shows, trade shows, and other presentations	89	108	86
Summer Tour stops	20	21	26
e-newsletter subscribers	27,407	28,915	19,597
Website visits	168,833 visitors 690,152 pageviews	221,484 visitors 923,061 pageviews	288,509 visitors 1,134,729 pageviews
Other education and outreach activities	• Hosted 50 grade 7 students for 'Discovery Days' at the Discovery Centre • Hosted Passive House display at Energize Bridgewater Centre for summer	• Hosted 'Energy Efficiency Days' at the Halifax Central Library (free public event) • Hosted Passive House display at the Hants County Exhibition	• Outreach to 80 landlords and building owners

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	• 36 workshops and energy management plans delivered to non-profit organizations	• 37 workshops and energy management plans delivered to non-profit organizations	

Efficiency Trade Network

EfficiencyOne supports growth and capacity-building in Nova Scotia's energy efficiency industry through the Efficiency Trade Network. The ETN helps increase awareness of and participation in Efficiency Nova Scotia programs by making it easier for Nova Scotians to find skilled professionals to assist with their energy efficiency project(s). Membership in the ETN more than tripled between 2016 and 2018. At the end of 2018, the ETN had 239 active members across Nova Scotia. In 2016, EfficiencyOne offered its first training event to ETN members. The number of training or networking events increased to 3 in 2017 and 20 in 2018, with nearly 400 people attending ETN training or networking events in 2018. In a survey of ETN members in 2018 (filed with the NSUARB as part of the 2018 Program Evaluations), ETN members reported gaining new customers through their ETN membership. Respondents also listed networking opportunities and staying abreast of developments in the industry as additional benefits to joining the ETN.

Development and Research

During the 2016-2018 DSM Plan period, development and research activities included:

- Incentive Setting Methodology Study and implementation;
- Small Business Energy Study;
- Residential Socket Study;
- DSM data tracking system implementation;
- electronic Technical Reference Manual (eTRM) development;
- tracking quality assurance and participant satisfaction;
- tracking other attitudinal metrics among the general population of Nova Scotian households to help EfficiencyOne respond to changing market conditions;

- a review of the economic impact of the energy efficiency industry in Nova Scotia; and
- receipt, analysis and utilization of NS Power customer usage data to aid in program-specific marketing campaigns and promotions.

Codes and Standards

EfficiencyOne works with governments to advance the introduction of energy-efficient products and technologies, through assisting in the creation of effective regulations designed to save Nova Scotians money, and decrease the environmental effects of energy use.

During the 2016-2018 DSM Plan period, EfficiencyOne supported the ongoing development of Canadian energy efficiency standards by:

- participating in the Canadian Standards Association's Steering Committee on Performance Energy Efficiency and Renewables (SCOPEER) and the Strategic Resource Task Force (SRTF) committee;
- assisting in the development of proposed changes to the National Energy Code for Buildings (NECB) developed by NRCan;
- participating in the Atlantic Heat Pump Working Group organized by the Atlantic Canada Opportunities Agency (ACOA);
- continuing to facilitate the evaluation of impacts relating to code and regulation changes on an annual basis;
- continuing to provide feedback on market transformation initiatives for key technologies relating to Canada's Pan-Canadian Framework on Clean Growth and Climate Change; and
- providing provincial and federal governments with general technical support and market insights in an effort to support the continued development of energy efficiency-related standards, products, and codes and regulations.

Regulatory Affairs

Regulatory Affairs activities enable EfficiencyOne to meet its regulatory requirements and provide a fair and transparent process for stakeholders and Nova Scotians to offer input into DSM Resource Plans, programs, and investments.

During the 2016-2018 DSM Plan period, Regulatory Affairs activities included:

- engaging with regulatory stakeholders, the DSM Advisory Group and consultants, as appropriate through DSM Advisory Group meetings and technical sessions;
- gaining NSUARB approval of the following:
  - EfficiencyOne's Affiliate Code of Conduct;
  - the provision of customer electricity data from NS Power; and
  - the 2019 DSM Resource Plan.
- EfficiencyOne's 2016, 2017, and 2018 historical Rate and Bill Impact Analysis and working to refine the methodology of the same;
- development of a standardized filing framework for future DSM Resource Plan applications;
- implementing the Incentive Setting Methodology Study;
- developing a Locational DSM report, in collaboration with NS Power;
- filing of an Application for Approval of the Use of Non-Energy Benefits within the Context of Cost-Effectiveness Testing, and responding to Information Requests for the same; please refer to section 3 for further information;
- Participating in the regulatory process in relation to NS Power's Advanced Metering Infrastructure (AMI) Application;
- development and filing of ENS's 2016, 2017, and 2018 Evaluation Reports;
- developing and filing Quarterly and Annual NSUARB reports;
- filing EfficiencyOne's 2016, 2017, and 2018 Audited Financial Statements and Internal Audits reports and response to the NSUARB's Information Requests in relation to these matters; addressing evaluation and verification recommendations;
- coordinating the Evaluation Consultant's and Verification Consultant's site visits and facilitating the evaluation and verification processes.

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Request IR-27:

Reference: Appendix A, 2020-2022 DSM Plan, page 77, Enabling Strategies. 13

Please describe the controls and policies EfficiencyOne has in place to protect against and verify that EfficiencyOne is not subsidizing its affiliate unregulated activities through EfficiencyOne's Enabling Strategies.

Response IR-27:

The EfficiencyOne Inter-Affiliate Code of Conduct (the "Code") was approved by the Nova Scotia Utility and Review Board (NSUARB) on September 6, 2017[1]. The Code applies to EfficiencyOne's electricity efficiency and conservation activities as regulated by the NSUARB and referred to and operated as the Efficiency Nova Scotia (ENS) franchise. The purpose of the Code is to set out standards and parameters for the interaction between the Utility and its Affiliates to prohibit conduct that may adversely affect the Utility. Specifically, the Code is intended to "ensure Efficiency Nova Scotia does not cross-subsidize competitive or non-regulated activities"[2]

EfficiencyOne is required to file an annual Compliance Report with the NSUARB detailing all inter-affiliate activities on an annual basis. Section 8.3 of the Code identifies the requirements for annual reporting on Code compliance. In addition, the Code requires retention of all records that may be required to allow for a third-party audit of the state of compliance with the Code[3].

EfficiencyOne is required to file its initial Compliance Report by May 31, 2019.

[1] M07390, Inter-Affiliate Code of Conduct, Nova Scotia Utility and Review Board Amended Order, September 6, 2017.

[2] Inter- Affiliate Code of Conduct 1.1(a)

[3] Inter-Affiliate Code of Conduct 8.4

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Request IR-28:

Reference: Appendix A, 2020-2022 DSM Plan, 6.3.2 Codes & Standards, page 84, lines 6-18.

Are you aware of or anticipate any potential changes to codes and standards (such as building codes) that will result in DSM benefits that are being considered for adoption between now and the end of 2030? If yes, please provide the information related to such changes and the associated savings.

Response IR-28:

EfficiencyOne is aware of two sources of codes and product regulation that are anticipated to change between now and 2030.

The first is the production of incrementally more stringent model building codes as a collaborative effort between provincial, territorial and federal governments. The federal government has announced the following key goals:

- Federal, provincial, and territorial governments will work to develop and adopt increasingly stringent model building codes, starting in 2020, with the goal that provinces and territories adopt a "net-zero energy ready" model building code by 2030.[1]
- Federal, provincial, and territorial governments will work to develop a model code for existing buildings by 2022, with the goal that provinces and territories adopt the code.[2]

[1] Build Smart: Canada's Buildings Strategy - A Key Driver of the Pan-Canadian Framework on Clean Growth and Climate Change, Energy and Mines Ministers' Conference, St. Andrews by-the-Sea, NB, August 2017, ISBN 978-0-660-08766-5, at page 8.
[2] *Ibid,* at page 10

The second is the continued advancement of Canada's *Energy Efficiency Regulations*, which provide minimum standards for certain energy-consuming products offered for sale in Canada. These advancements typically arrive in the form of Amendments to *the Regulations.*

Amendment 14 was published[3] on October 31, 2018 in the Canada Gazette, Part II, and will largely come into force on April 30, 2019. Details on Amendment 14 are provided as Attachment 1 to this response.

Amendment 15 was pre-published in the Canada Gazette, Part I on October 20, 2018, and opened for a 70-day comment period, which closed December 29, 2018. EfficiencyOne is not aware of a specific date for final publication of Amendment 15. Details on Amendment 15 are provided as Attachment 2 to this response.

Amendment 16 was pre-published in the Canada Gazette, Part I on December 8, 2018, and opened for a 45-day comment period, which closed January 22, 2018. EfficiencyOne is not aware of a specific date for final publication of Amendment 16. Details on Amendment 16 are provided as Attachment 3 to this response.

Beyond Amendment 16, Natural Resources Canada (NRCan) has announced its intention to update regulations for the following products, as presented in Table 1, Table 2, Table 3 below.

[3] NRCan "pre-publishes" a Regulatory Amendment for the purposes of stakeholder engagement and comment, as opposed to "publication" which serves the purpose of announcing a new or amended regulation becoming effective (pending any enforcement delay as indicated by NRCan).

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Table 1: Residential Regulation Categories

Residential	
Existing Product Categories	**New Product Categories**
battery chargers (uninterruptible power supplies)	clothes dryers (gas)
central air conditioners and heat pumps	pool pumps
electric ranges	windows
gas ranges	light duty vehicle replacement tires
heat recovery ventilators (MEPS)	
electric water heaters (including Heat Pump water heaters)	
portable air conditioners (MEPS)	
gas-fired storage water heaters	

Note: MEPS refers to "Minimum Efficiency Performance Standard"

Table 2: Commercial and Industrial Regulation Categories

Commercial and Industrial	
Existing Product Categories	**New Product Categories**
internal water loop heat pumps	air compressors
	commercial warm air furnaces
	computer room air conditioners
	double duct air cooled air conditioners
	liquid filled transformers
	variable refrigerant flow multi-split air conditioners and heat pumps

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Table 3: Lighting Regulation Categories

Lighting	
Existing Product Categories	**New Product Categories**
general service lamps modified spectrum incandescent lamps	

EfficiencyOne's 2020-2022 DSM Resource Plan was developed with an understanding of future regulatory amendments in mind and is not anticipated to be further affected by these changes, beyond those already taken into account (e.g. LED lighting anticipated regulations). EfficiencyOne engages its independent evaluator to evaluate impacts related to changes in codes and standards on a year-to-year basis and intends to continue to do so as part of the 2020-2022 DSM Resource Plan.

Regulations Amending the Energy Efficiency Regulations, 2016: SOR/2018-201

Canada Gazette, Part II, Volume 152, Number 22

Registration

October 10, 2018

ENERGY EFFICIENCY ACT

P.C. 2018-1248 October 4, 2018

Her Excellency the Governor General in Council, on the recommendation of the Minister of Natural Resources, pursuant to sections 20 [a] and 25 of the *Energy Efficiency Act* [b], makes the annexed *Regulations Amending the Energy Efficiency Regulations, 2016*.

Regulations Amending the Energy Efficiency Regulations, 2016

Amendments

1 The *Energy Efficiency Regulations, 2016* [1] are amended by adding the following after section 1:

Standards and procedures of other jurisdiction incorporated by reference

1.1 Despite these Regulations, if an energy efficiency standard or test procedure that is incorporated by reference in these Regulations as amended from time to time is a reference to a standard or test procedure set out in the laws of another jurisdiction and that standard or procedure is subsequently repealed or revoked in that other jurisdiction, the reference to the standard or procedure in these Regulations is deemed to be a reference to that standard or procedure as it read on the day before the day on which it was repealed or revoked and it continues to apply for the purposes of these Regulations.

2 (1) Subsection 4(2) of the Regulations is replaced by the following:

Location and visibility

(2) The verification mark must be readily visible on the surface of the energy-using product. However, in respect of the following energy-using products, the verification mark may be on the exterior of the product's package:

- **(a)** a CFL;
- **(b)** a general service lamp;
- **(c)** a modified spectrum incandescent lamp;
- **(d)** a general service fluorescent lamp;
- **(e)** a general service incandescent reflector lamp;
- **(f)** a battery charger; and
- **(g)** an external power supply.

(2) Paragraph 4(3)(a) of the Regulations is replaced by the following:

(a) a laboratory that is accredited to test the energy performance of lighting products by either the Standards Council of

Canada or the National Voluntary Laboratory Accreditation Program has verified the values for nominal power, luminous flux and correlated colour temperature provided to the Minister under subsection 432(1); and

(3) Subparagraph 4(3)(b)(i) of the Regulations is replaced by the following:

(i) if the life testing of the CFL is completed, verified the value for life provided to the Minister under subsection 432(1), or

3 (1) Subsection 5(1) of the Regulations is amended by striking out "and" at the end of paragraph (e), by adding "and" at the end of paragraph (f) and by adding the following after paragraph (f):

(g) information that indicates whether a mathematical model described in subsection (3) was used to generate any of the information provided under paragraph (f).

(2) Section 5 of the Regulations is amended by adding the following after subsection (2):

Mathematical model

(3) Despite any provision in these Regulations requiring that the information referred to in this section be collected in accordance with an identified standard, a dealer may instead provide the information as generated by a mathematical model that, by means of an engineering or statistical analysis or a computer simulation or model, emulates the manner in which the information is collected under the identified standard.

4 Section 7 of the Regulations is amended by adding the following after subsection (1):

Exception

(1.1) However, the following energy-using products are not energy-using products for the purpose of subsection (1) if, at the time of their importation, they are incorporated into another product:

(a) a battery charger;
(b) an external power supply;
(c) a fluorescent lamp ballast;
(d) an electric motor; and
(e) a small electric motor.

5 (1) The definition *CSA C361-12* in section 12 of the Regulations is repealed.

(2) Section 12 of the Regulations is amended by adding the following in alphabetical order:

CSA C361-16 means the CSA standard CAN/CSA-C361-16 entitled *Energy performance and drum volume of household electric clothes dryers*. (*CSA C361-16*)

6 The portion of item 2 of the table to section 19 of the Regulations in columns 1 and 2 is replaced by the following:

	Column 1	Column 2
Item	**Standard**	**Energy Efficiency Standard**
2	CSA C361-16 or 10 C.F.R. Appendix D2	CSA C361-16, Table 1

7 The portion of item 2 of the table to section 20 of the Regulations in column 2 is replaced by the following:

	Column 2
Item	**Standard**
2	CSA C361-16 or 10 C.F.R. Appendix D2

8 The portion of items 4 and 5 of the table to section 24 of the Regulations in column 3 is replaced by the following:

	Column 3
Item	**Energy Efficiency Standard**
4	Modified energy factor ≥ 38.23 L/kWh/cycle Integrated water consumption factor ≤ 1.18 L/cycle/L
5	Modified energy factor ≥ 56.63 L/kWh/cycle Integrated water consumption factor ≤ 0.55 L/cycle/L

9 The portion of items 3 and 4 of the table to section 30 of the Regulations in columns 1 and 2 are replaced by the following:

	Column 1	Column 2
Item	**Standard**	**Energy Efficiency Standard**
3	CSA C360-13 for clothes washer function CSA C361-16 or 10 C.F.R. Appendix D2 for clothes dryer function	CSA C360-13, Table 9, for clothes washer function CSA C361-16, Table 1, for clothes dryer function
4	CSA C360-13 for clothes washer function CSA C361-16 or 10 C.F.R. Appendix D2 for clothes dryer function	CSA C360-13, Table 10, for clothes washer function CSA C361-16, Table 1, for clothes dryer function

10 The portion of item 2 of the table to section 31 of the Regulations in column 2 is replaced by the following:

	Column 2
Item	**Standard**
2	CSA C360-13 for clothes washer function CSA C361-16 or 10 C.F.R. Appendix D2 for clothes dryer function

11 (1) Item 3 of the table to section 37 of the Regulations is repealed.

(2) Item 5 of the table to section 37 of the Regulations is replaced by the following:

	Column 1	Column 2	Column 3	Column 4
Item	**Energy-using Product**	**Standard**	**Energy Efficiency Standard**	**Period of Manufacture**
5	Dishwashers	CSA C373-14	CSA C373-14, Table 2	On or after May 30, 2013

12 (1) The portion of item 3 of the table to section 38 of the Regulations in column 2 is replaced by the following:

	Column 2
Item	**Standard**
3	CSA C373-14, for information set out in paragraphs (b) to (d) and (f)

(2) The portion of item 3 of the table to section 38 of the Regulations in column 3 is amended by striking out "and" at the end of paragraph (d), by adding "and" at the end of paragraph (e) and by adding the following after paragraph (e):

Item	Column 3 Information
3	**(f)** water consumption factor in L/cycle.

13 (1) The definition *dehumidifier* in section 61 of the Regulations is replaced by the following:

dehumidifier means a household appliance that is primarily designed to remove moisture from the air and is

(a) self-contained and encased;
(b) electrically operated; and
(c) mechanically refrigerated. (*déshumidificateur*)

(2) Section 61 of the Regulations is amended by adding the following in alphabetical order:

portable dehumidifier means a dehumidifier that is not a whole-home dehumidifier. (*déshumidificateur portatif*)

10 C.F.R. Appendix X1 means Appendix X1 to Subpart B of Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Dehumidifiers*, as amended from time to time. (*appendice X1 10 C.F.R.*)

10 C.F.R. §430.32(v)(2) means the table to paragraph 430.32(v)(2) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.32(v)(2)*)

whole-home dehumidifier means a dehumidifier that is designed to be installed in an air duct. (*déshumidificateur à conduit*)

14 Subsection 62(2) of the Regulations is replaced by the following:

Limit

(2) However, for the purposes of sections 4, 5 and 63, a dehumidifier is not considered to be an energy-using product unless

(a) it is manufactured on or after December 31, 1998; and
(b) in the case of a whole-home dehumidifier, it is manufactured on or after June 13, 2019.

15 The table to section 63 of the Regulations is replaced by the following:

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Dehumidifiers	CSA C749-94	CSA C749-94, clause 4.2	On or after December 31, 1998 and before October 1, 2007
2	Dehumidifiers	CSA C749-07	CSA C749-07, Table 1	On or after October 1, 2007 and before October 1, 2012
3	Dehumidifiers	CSA C749-07	CSA C749-07, Table 1B	On or after October 1, 2012 and before June 13, 2019
4	Portable dehumidifiers	10 C.F.R. Appendix X1	Minimum integrated energy factor applicable, based on product's capacity, as set out in 10 C.F.R. §430.32(v)(2)	On or after June 13, 2019
5	Whole-home dehumidifiers	10 C.F.R. Appendix X1	Minimum integrated energy factor applicable, based on product's case volume, as set out in 10 C.F.R. §430.32(v)(2)	On or after June 13, 2019

16 (1) The portion of item 2 of the table to section 64 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	**Energy-using Product**
2	Dehumidifiers manufactured on or after October 1, 2007 and before June 13, 2019

(2) The table to section 64 of the Regulations is amended by adding the following in numerical order:

	Column 1	Column 2	Column 3
Item	**Energy-using Product**	**Standard**	**Information**
3	Dehumidifiers manufactured on or after June 13, 2019	10 C.F.R. Appendix X1	**(a)** if product is a portable dehumidifier, water removal capacity, in L/day; **(b)** if product is a whole-home dehumidifier, case volume in litres (cubic feet); **(c)** integrated energy factor, in L/kWh; and **(d)** standby power, in watts.

	Colonne 1	Colonne 2	Colonne 3
Article	**Matériel consommateur d'énergie**	**Norme**	**Renseignements**
3	Déshumidificateurs fabriqués le 13 juin 2019 ou après cette date	Appendice X1 10 C.F.R.	**a)** s'agissant d'un déshumidificateur portatif, capacité d'assèchement, en L/j; **b)** s'agissant d'un déshumidificateur à conduit, volume du boîtier, en litres (pieds cubes); **c)** facteur énergétique intégré, en L/kWh; **d)** puissance en mode veille, en W.

17 The Regulations are amended by adding the following after section 64:

SUBDIVISION J

Microwave Ovens

Definitions

65 The following definitions apply in this Subdivision.

CSA C388-15 means the CSA standard CAN/CSA-C388-15 entitled *Energy performance and capacity measurement of household microwave ovens*. (*CSA C388-15*)

microwave oven means a household cooking appliance that is designed to cook or heat food in a compartment by means of microwave energy and includes one that has a thermal element that is designed for the surface browning of food. (*four à micro-ondes*)

10 C.F.R. Appendix I means Appendix I to Subpart B of Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Cooking Products*, as amended from time to time. (*appendice I 10 C.F.R.*)

10 C.F.R. §430.32(j)(3) means paragraph 430.32(j)(3) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.32(j)(3)*)

Type

66 For the purposes of these Regulations, a microwave oven is one of the following types:

(a) microwave-only oven;
(b) countertop convection microwave oven;
(c) built-in convection microwave oven; or
(d) over-the-range convection microwave oven.

Energy-using product

67 (1) A microwave oven is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 68, a microwave oven is not considered to be an energy-using product unless it is manufactured on or after March 31, 2019.

Energy efficiency standard

68 (1) The energy efficiency standard for a microwave oven is the standard set out for that type of microwave oven in 10 C.F.R. §430.32(j)(3).

Testing standard

(2) A microwave oven complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by CSA C388-15 or 10 C.F.R. Appendix I that are applicable to a *microwave oven* as defined in section 65.

Information

69 For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a microwave oven:

(a) its type;
(b) its volume, expressed in litres (cubic feet); and
(c) its standby power, expressed in watts, as collected in accordance with CSA C388-15 or 10 C.F.R. Appendix I.

18 (1) The definitions *off mode*, *on mode* and *standby mode* in section 108 of the Regulations are repealed.

(2) Section 108 of the Regulations is amended by adding the following in alphabetical order:

CSA C368.1-14 means the CSA standard CAN/CSA-C368.1-14 entitled *Energy performance of room air conditioners*. (*CSA C368.1-14*)

19 Section 112 of the Regulations is replaced by the following:

Energy efficiency standards

112 (1) The energy efficiency standards set out in column 2 of the table to this section apply to room air conditioners that are manufactured during the periods set out in column 3.

Testing standard

(2) A room air conditioner complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 1 that are applicable to a *room air conditioner* as defined in section 108.

TABLE

	Column 1	Column 2	Column 3
Item	Standard	Energy Efficiency Standard	Period of Manufacture
1	CSA C368.1	CSA C368.1, Table 2, second column	On or after February 3, 1995 and before June 1, 2014

2	CSA C368.1-14	CSA C368.1-14, Table 2, second column	On or after June 1, 2014

20 The portion of item 2 of the table to section 113 of the Regulations in column 2 is replaced by the following:

	Column 2
Item	**Standard**
2	CSA 368.1-14, for information set out in paragraphs (b) and (c)

21 Section 116 of the Regulations is amended by adding the following in alphabetical order:

CSA C746-17 means the CSA standard CAN/CSA-C746-17 entitled *Energy performance rating for large and single packaged vertical air conditioners and heat pumps*. (*CSA C746-17*)

22 (1) Subsection 118(2) of the Regulations is replaced by the following:

Energy efficiency standards — cooled by water

(2) The energy efficiency standards set out in column 3 of Table 2 to this section apply to large air conditioners that are cooled by water and described in column 1 and that are manufactured during the period set out in column 4.

Energy efficiency standards — cooled by evaporation

(2.1) The energy efficiency standards set out in column 3 of Table 3 to this section apply to large air conditioners that are cooled by evaporation and described in column 1 and that are manufactured during the period set out in column 4.

(2) Tables 1 and 2 to section 118 of the Regulations are replaced by the following:

TABLE 1

	Column 1	Column 2	Column 3	Column 4
Item	Energy-using Product	Standard	Energy Efficiency Standard	Period of Manufacture
1	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 10.3	On or after December 31, 1998 and before January 1, 2010
2	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 11.2	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.4	
3	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 11.2	On or after January 1, 2018
			IEER ≥ 12.9	
4	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 9.7	On or after December 31, 1998 and before January 1, 2010
5	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 11.0	On or after January 1, 2010 and before January 1, 2018

		AHRI 340/360 for IEER	IEER ≥ 11.2	
6	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 11.0 IEER ≥ 12.4	On or after January 1, 2018
7	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 10.0	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 10.1	
8	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and either without a heating section or with an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 10.0 IEER ≥ 11.6	On or after January 1, 2018
9	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 10.1	On or after December 31, 1998 and before January 1, 2010
10	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 11.0	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.2	
11	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 11.0 IEER ≥ 12.7	On or after January 1, 2018
12	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 9.5	On or after December 31, 1998 and before January 1, 2010
13	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 10.8	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.0	
14	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 10.8 IEER ≥ 12.2	On or after January 1, 2018
15	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 9.8	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 9.9	
16	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 9.8	On or after January 1, 2018

IEER ≥ 11.4

TABLE 2

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 11.5	On or after December 31, 1998 and before January 1, 2010
2	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 11.5	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.7	
3	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 12.1	On or after January 1, 2018
			IEER ≥ 11.7	
4	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 11.0	On or after December 31, 1998 and before January 1, 2010
5	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 11.0	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.2	
6	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 12.5	On or after January 1, 2018
			IEER ≥ 11.2	
7	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 11.3	On or after December 31, 1998 and before January 1, 2010
8	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 11.3	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.5	
9	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 11.9	On or after January 1, 2018
			IEER ≥ 11.5	

10	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 10.8	On or after December 31, 1998 and before January 1, 2010
11	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 10.8	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.0	
12	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 12.3	On or after January 1, 2018
			IEER ≥ 11.0	
13	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 11.0	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.1	
14	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and either without a heating section or with an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 12.4	On or after January 1, 2018
			IEER ≥ 11.1	
15	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 10.8	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 10.9	
16	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 12.2	On or after January 1, 2018
			IEER ≥ 10.9	

TABLE 3

	Column 1	Column 2	Column 3	Column 4
Item	Energy-using Product	Standard	Energy Efficiency Standard	Period of Manufacture
1	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 11.5	On or after December 31, 1998 and before January 1, 2010
2	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio	Energy efficiency ratio ≥ 11.5	On or after January 1, 2010 and before January 1, 2018
		AHRI 340/360 for IEER	IEER ≥ 11.7	
3		CSA C746-17		On or after January 1, 2018

	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and either without a heating section or with an electric heating section		Energy efficiency ratio ≥ 12.1 IEER ≥ 11.7	
4	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 11.0	On or after December 31, 1998 and before January 1, 2010
5	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio AHRI 340/360 for IEER	Energy efficiency ratio ≥ 11.0 IEER ≥ 11.2	On or after January 1, 2010 and before January 1, 2018
6	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and either without a heating section or with an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 12.0 IEER ≥ 11.2	On or after January 1, 2018
7	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 11.3	On or after December 31, 1998 and before January 1, 2010
8	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio AHRI 340/360 for IEER	Energy efficiency ratio ≥ 11.3 IEER ≥ 11.5	On or after January 1, 2010 and before January 1, 2018
9	Large air conditioners that have a cooling capacity of ≥ 19 kW and < 40 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 11.9 IEER ≥ 11.5	On or after January 1, 2018
10	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-98	Energy efficiency ratio ≥ 10.8	On or after December 31, 1998 and before January 1, 2010
11	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio AHRI 340/360 for IEER	Energy efficiency ratio ≥ 10.8 IEER ≥ 11.0	On or after January 1, 2010 and before January 1, 2018
12	Large air conditioners that have a cooling capacity of ≥ 40 kW and < 70 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 11.8 IEER ≥ 11.0	On or after January 1, 2018
13	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and either without a heating section or with an electric heating section	CSA C746-06 for energy efficiency ratio AHRI 340/360 for IEER	Energy efficiency ratio ≥ 11.0 IEER ≥ 11.1	On or after January 1, 2010 and before January 1, 2018
14		CSA C746-17		On or after January 1, 2018

	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and either without a heating section or with an electric heating section		Energy efficiency ratio ≥ 11.9 IEER ≥ 11.1	
15	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and a heating section other than an electric heating section	CSA C746-06 for energy efficiency ratio AHRI 340/360 for IEER	Energy efficiency ratio ≥ 10.8 IEER ≥ 10.9	On or after January 1, 2010 and before January 1, 2018
16	Large air conditioners that have a cooling capacity of ≥ 70 kW and < 223 kW and a heating section other than an electric heating section	CSA C746-17	Energy efficiency ratio ≥ 11.7 IEER ≥ 10.9	On or after January 1, 2018

23 (1) The portion of item 1 of the table to section 119 of the Regulations in column 3 is amended by striking out "and" at the end of paragraph (b), by adding "and" at the end of paragraph (c) and by adding the following after paragraph (c):

	Column 3
Item	**Information**
1	**(d)** information that indicates whether the product has a heating section and, if so, whether it is electric or other than electric.

(2) The portion of item 2 of the table to section 119 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	**Energy-using Product**
2	Large air conditioners manufactured on or after January 1, 2010 and before January 1, 2018

(3) The portion of item 2 of the table to section 119 of the Regulations in column 3 is amended by striking out "and" at the end of paragraph (c), by adding "and" at the end of paragraph (d) and by adding the following after paragraph (d):

	Column 3
Item	**Information**
2	**(e)** information that indicates whether the product has a heating section and, if so, whether it is electric or other than electric.

(4) The table to section 119 of the Regulations is amended by adding the following in numerical order:

	Column 1	Column 2	Column 3
Item	**Energy-using Product**	**Standard**	**Information**
3	Large air conditioners manufactured on or after January 1, 2018	CSA C746-17	**(a)** product classification set out in Column II of Table 1 of CSA C746-17; **(b)** cooling capacity, in kW (Btu/h); **(c)** energy efficiency ratio; **(d)** IEER; and

(e) information that indicates whether the product has a heating section and, if so, whether it is electric or other than electric.

24 Section 120 of the Regulations is amended by adding the following in alphabetical order:

CSA C744-17 means the joint CSA and AHRI standard ANSI/AHRI 310/380-2017/CAN/CSA-C744-17 entitled *Packaged terminal air-conditioners and heat pumps*. (*CSA C744-17*)

25 (1) The portion of item 2 of the table to section 122 of the Regulations in column 3 is replaced by the following:

	Column 3
Item	**Period of Manufacture**
2	On or after September 30, 2012 and before January 1, 2017

(2) The table to section 122 of the Regulations is amended by adding the following in numerical order:

	Column 1	Column 2	Column 3
Item	**Standard**	**Energy Efficiency Standard**	**Period of Manufacture**
3	CSA C744-17	CSA C744-17, Table 2	On or after January 1, 2017

	Colonne 1	Colonne 2	Colonne 3
Article	**Norme**	**Norme d’efficacité énergétique**	**Période de fabrication**
3	CSA C744-17	CSA C744-17, tableau 2	Le 1er janvier 2017 ou après cette date

26 Subsection 123(2) of the Regulations is amended by striking out “or” at the end of paragraph (a) and by replacing paragraph (b) with the following:

(b) CSA C744-14, if the product was manufactured on or after September 30, 2012 and before January 1, 2017; or
(c) CSA C744-17, if the product is manufactured on or after January 1, 2017.

27 Section 136 of the Regulations is replaced by the following:

Definition of *large condensing unit*

136 In this Subdivision, ***large condensing unit*** means a commercial or industrial condensing unit that is intended for air conditioning applications and that has a cooling capacity of at least 40 kW (135,000 Btu/h) but not more than 70 kW (240,000 Btu/h).

28 Subsection 141(2) of the Regulations is replaced by the following:

Limit

(2) However, for the purposes of sections 4, 5 and 142, a chiller is not considered to be an energy-using product unless it has an integral refrigerant condenser and is manufactured on or after October 28, 2004.

29 Section 191 of the English version of the Regulations is replaced by the following:

Definition of *internal water loop heat pump*

191 In this Subdivision, ***internal water loop heat pump*** means a water-source single package or split-system heat pump that is factory-built, is intended for installation in an internal water loop system and has a cooling or heating capacity of not more than 40 kW (135,000 Btu/h).

30 Section 195 of the Regulations is amended by adding the following in alphabetical order:

CSA C746-17 means the CSA standard CAN/CSA-C746-17 entitled *Energy performance rating for large and single packaged vertical air conditioners and heat pumps*. (*CSA C746-17*)

31 Tables 1 and 2 to section 197 of the Regulations are replaced by the following:

TABLE 1

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Large heat pumps that have a cooling capacity of ≥ 19 kW and < 40 kW	CSA C746-98	Energy efficiency ratio ≥ 10.1 Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.2 with −8.3°C inlet air	On or after December 31, 1998 and before January 1, 2010
2	Large heat pumps that have a cooling capacity of ≥ 19 kW and < 40 kW	CSA C746-06 for energy efficiency ratio and heating coefficient of performance AHRI 340/360 for IEER	Energy efficiency ratio ≥ 11.0 Heating coefficient of performance ≥ 3.3 with 8.3°C inlet air and ≥ 2.25 with −8.3°C inlet air IEER ≥ 11.2	On or after January 1, 2010 and before January 1, 2018
3	Large heat pumps that have a cooling capacity of ≥ 19 kW and < 40 kW	CSA C746-17	Energy efficiency ratio ≥ 11.0 Heating coefficient of performance ≥ 3.3 with 8.3°C inlet air and ≥ 2.25 with −8.3°C inlet air IEER ≥ 12.2	On or after January 1, 2018
4	Large heat pumps that have a cooling capacity of ≥ 40 kW and < 70 kW	CSA C746-98	Energy efficiency ratio ≥ 9.3 Heating coefficient of performance ≥ 3.1 with 8.3°C inlet air and ≥ 2.0 with −8.3°C inlet air	On or after December 31, 1998 and before January 1, 2010
5	Large heat pumps that have a cooling capacity of ≥ 40 kW and < 70 kW	CSA C746-06 for energy efficiency ratio and heating coefficient of performance AHRI 340/360 for IEER	Energy efficiency ratio ≥ 10.6 Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.05 with −8.3°C inlet air IEER ≥ 10.7	On or after January 1, 2010 and before January 1, 2018
6	Large heat pumps that have a cooling capacity of ≥ 40 kW and < 70 kW	CSA C746-17	Energy efficiency ratio ≥ 10.6 Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.05 with −8.3°C inlet air IEER ≥ 11.6	On or after January 1, 2018
7	Large heat pumps that have a cooling capacity of ≥ 70 kW and < 223 kW	CSA C746-06 for energy efficiency ratio and heating coefficient of performance AHRI 340/360 for IEER	Energy efficiency ratio ≥ 9.5 Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.05 with −8.3°C inlet air IEER ≥ 9.6	On or after January 1, 2010 and before January 1, 2018
8		CSA C746-17	Energy efficiency ratio ≥ 9.5	On or after January 1, 2018

	Large heat pumps that have a cooling capacity of ≥ 70 kW and < 223 kW		Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.05 with −8.3°C inlet air IEER ≥ 10.6

TABLE 2

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Large heat pumps that have a cooling capacity of ≥ 19 kW and < 40 kW	CSA C746-98	Energy efficiency ratio ≥ 9.9 Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.2 with −8.3°C inlet air	On or after December 31, 1998 and before January 1, 2010
2	Large heat pumps that have a cooling capacity of ≥ 19 kW and < 40 kW	CSA C746-06 for energy efficiency ratio and heating coefficient of performance AHRI 340/360 for IEER	Energy efficiency ratio ≥ 10.8 Heating coefficient of performance ≥ 3.3 with 8.3°C inlet air and ≥ 2.25 with −8.3°C inlet air IEER ≥ 11.0	On or after January 1, 2010 and before January 1, 2018
3	Large heat pumps that have a cooling capacity of ≥ 19 kW and < 40 kW	CSA C746-17	Energy efficiency ratio ≥ 10.8 Heating coefficient of performance ≥ 3.3 with 8.3°C inlet air and ≥ 2.25 with −8.3°C inlet air IEER ≥ 12.0	On or after January 1, 2018
4	Large heat pumps that have a cooling capacity of ≥ 40 kW and < 70 kW	CSA C746-98	Energy efficiency ratio ≥ 9.1 Heating coefficient of performance ≥ 3.1 with 8.3°C inlet air and ≥ 2.0 with −8.3°C inlet air	On or after December 31, 1998 and before January 1, 2010
5	Large heat pumps that have a cooling capacity of ≥ 40 kW and < 70 kW	CSA C746-06 for energy efficiency ratio and heating coefficient of performance AHRI 340/360 for IEER	Energy efficiency ratio ≥ 10.4 Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.05 with −8.3°C inlet air IEER ≥ 10.5	On or after January 1, 2010 and before January 1, 2018
6	Large heat pumps that have a cooling capacity of ≥ 40 kW and < 70 kW	CSA C746-17	Energy efficiency ratio ≥ 10.4 Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.05 with −8.3°C inlet air IEER ≥ 11.4	On or after January 1, 2018
7	Large heat pumps that have a cooling capacity of ≥ 70 kW and < 223 kW	CSA C746-06 for energy efficiency ratio and heating coefficient of performance AHRI 340/360 for IEER	Energy efficiency ratio ≥ 9.3 Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.05 with −8.3°C inlet air IEER ≥ 9.4	On or after January 1, 2010 and before January 1, 2018
8		CSA C746-17	Energy efficiency ratio ≥ 9.3	

	Large heat pumps that have a cooling capacity of ≥ 70 kW and < 223 kW	Heating coefficient of performance ≥ 3.2 with 8.3°C inlet air and ≥ 2.05 with −8.3°C inlet air IEER ≥ 10.4	On or after January 1, 2018

32 (1) Paragraph 1(g) of the table to section 198 of the Regulations is replaced by the following:

	Column 3
Item	**Information**
1	**(g)** information that indicates whether the product has a heating section and, if so, whether it is electric or other than electric.

(2) The portion of item 2 of the table to section 198 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	**Energy-using Product**
2	Large heat pumps manufactured on or after January 1, 2010 and before January 1, 2018

(3) Paragraph 2(g) of the table to section 198 of the Regulations is replaced by the following:

	Column 3
Item	**Information**
2	**(g)** information that indicates whether the product has a heating section and, if so, whether it is electric or other than electric; and

(4) The table to section 198 of the Regulations is amended by adding the following in numerical order:

	Column 1	Column 2	Column 3
Item	**Energy-using Product**	**Standard**	**Information**
3	Large heat pumps manufactured on or after January 1, 2018	CSA C746-17	**(a)** product classification set out in columns II and III of Table 2 of CSA C746-17; **(b)** cooling capacity, in kW (Btu/h); **(c)** energy efficiency ratio; **(d)** heating capacity, in kW (Btu/h); **(e)** heating coefficient of performance at 8.3°C; **(f)** heating coefficient of performance at −8.3°C; **(g)** information that indicates whether the product has a heating section and, if so, whether it is electric or other than electric; and **(h)** IEER.

33 The Regulations are amended by adding the following after the heading “Furnaces, Fireplaces and Unit Heaters” of Division 4 of Part 2:

Interpretation

Definitions

256.1 The following definitions apply in this Division.

CSA P.2 means the CSA standard CAN/CSA-P.2-13 entitled *Testing method for measuring the annual fuel utilization efficiency of residential gas-fired or oil-fired furnaces and boilers*. (*CSA P.2*)

FER means, in respect of a gas furnace or an oil-fired furnace, the fan energy rating, which is the annual electrical energy consumption of the furnace fan normalized by annual fan operating hours and the product's maximum airflow (Q_{max}). (*FER*)

10 C.F.R. Appendix AA means Appendix AA to Subpart B of Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Furnace Fans*, as amended from time to time. (*appendice AA 10 C.F.R.*)

10 C.F.R. §430.32(y) means Table 1 to paragraph 430.32(y) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.32(y)*)

34 The definition *CSA P.2* in section 257 of the Regulations is repealed.

35 (1) Items 2 and 3 of the table to section 259 of the Regulations are replaced by the following:

	Column 1	Column 2	Column 3	Column 4
Item	**Energy-using Product**	**Standard**	**Energy Efficiency Standard**	**Period of Manufacture**
2	Gas furnaces that have an input rate of ≤ 65.92 kW (225,000 Btu/h), use single-phase electric current and do not have an integrated cooling component	CSA P.2	Annual fuel utilization efficiency ≥ 90%	On or after December 31, 2009 and before July 3, 2019
2.1	Gas furnaces that have an input rate of ≤ 65.92 kW (225,000 Btu/h), use single-phase electric current and do not have an integrated cooling component	CSA P.2, for annual fuel utilization efficiency 10 C.F.R. Appendix AA, for FER	Annual fuel utilization efficiency ≥ 90% FER ≤ FER for product class "Non-Weatherized, Condensing Gas Furnace Fan (NWG-C)", set out in 10 C.F.R. §430.32(y)	On or after July 3, 2019
3	Gas furnaces that are outdoor furnaces, have an input rate of ≤ 65.92 kW (225,000 Btu/h), use single-phase electric current and have an integrated cooling component	CSA P.2	Annual fuel utilization efficiency ≥ 78%	On or after December 31, 2009 and before July 3, 2019
3.1	Gas furnaces that are outdoor furnaces, have an input rate of ≤ 65.92 kW (225,000 Btu/h), use single-phase electric current and have an integrated cooling component	CSA P.2, for annual fuel utilization efficiency 10 C.F.R. Appendix AA, for FER	Annual fuel utilization efficiency ≥ 78% FER ≤ FER for product class "Weatherized Non-Condensing Gas Furnace Fan (WG-NC)", set out in 10 C.F.R. §430.32(y)	On or after July 3, 2019

(2) Item 5 of the table to section 259 of the Regulations is replaced by the following:

	Column 1	Column 2	Column 3	Column 4
Item	**Energy-using Product**	**Standard**	**Energy Efficiency Standard**	**Period of Manufacture**

5	Gas furnaces that are through-the-wall, have an input rate of ≤ 65.92 kW (225,000 Btu/h), use single-phase electric current and have an integrated cooling component	CSA P.2	Annual fuel utilization efficiency ≥ 90%	On or after December 31, 2012 and before July 3, 2019
5.1	Gas furnaces that are through-the-wall, have an input rate of ≤ 65.92 kW (225,000 Btu/h), use single-phase electric current and have an integrated cooling component	CSA P.2, for annual fuel utilization efficiency 10 C.F.R. Appendix AA, for FER	Annual fuel utilization efficiency ≥ 90% FER ≤ FER for product class "Non-Weatherized, Condensing Gas Furnace Fan (NWG-C)", set out in 10 C.F.R. §430.32(y)	On or after July 3, 2019

36 (1) The portion of item 2 of the table to section 260 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	**Energy-using Product**
2	Gas furnaces that have an input rate of ≤ 65.92 kW (225,000 Btu/h), that use single-phase electric current and that are manufactured on or after December 31, 2009 and before July 3, 2019

(2) Paragraph 2(a) of the table to section 260 of the Regulations is replaced by the following:

	Column 3
Item	**Information**
2	**(a)** maximum heat input and output nominal capacities, in kW (Btu/h);

(3) The table to section 260 of the Regulations is amended by adding the following in numerical order :

	Column 1	Column 2	Column 3
Item	**Energy-using Product**	**Standard**	**Information**
2.1	Gas furnaces that have an input rate of ≤ 65.92 kW (225,000 Btu/h), that use single-phase electric current and that are manufactured on or after July 3, 2019	CSA P.2, for information set out in paragraphs (a) to (e) 10 C.F.R. Appendix AA, for information set out in paragraphs (f) and (g)	**(a)** maximum heat input and output nominal capacities, in kW (Btu/h); **(b)** annual fuel utilization efficiency; **(c)** information that indicates whether product has an integrated cooling component; **(d)** if product has an integrated cooling component, information that indicates whether the product is outdoor or through-the-wall; **(e)** type of fuel used; **(f)** FER, expressed in W/472 L/s (W/1,000 ft³/min); and **(g)** product's maximum airflow (Q_{max}), expressed in L/s (ft³/min).

37 Sections 263 and 264 of the Regulations are replaced by the following:

Energy efficiency standards

263 (1) The energy efficiency standards set out in column 2 of the table to this section apply to oil-fired furnaces that are manufactured during the periods set out in column 3.

Testing standard

(2) An oil-fired furnace complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 1 that are applicable to an *oil-fired furnace* as defined in section 261.

TABLE

Item	Column 1 Standard	Column 2 Energy Efficiency Standard	Column 3 Period of Manufacture
1	CSA B212	Seasonal energy utilization efficiency ≥ 78%	On or after December 31, 1998 and before January 1, 2017
2	CSA P.2	Annual fuel utilization efficiency ≥ 83%	On or after January 1, 2017 and before July 3, 2019
3	CSA P.2, for annual fuel utilization efficiency 10 C.F.R. Appendix AA, for FER	Annual fuel utilization efficiency ≥ 83% FER ≤ FER for product class "Non-Weatherized, Non-Condensing Oil Furnace Fan (NWO-NC)", set out in 10 C.F.R. §430.32(y)	On or after July 3, 2019

Information

264 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected in accordance with the standard set out in column 2 and provided to the Minister in respect of an oil-fired furnace described in column 1.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
1	Oil-fired furnaces that are manufactured on or after December 31, 1998 and before January 1, 2017	CSA B212	**(a)** input rate, in kW (Btu/h); and **(b)** seasonal energy utilization efficiency.
2	Oil-fired furnaces that are manufactured on or after January 1, 2017 and before July 3, 2019	CSA P.2	**(a)** input rate, in kW (Btu/h); and **(b)** annual fuel utilization efficiency.
3	Oil-fired furnaces that are manufactured on or after July 3, 2019	CSA P.2, for information set out in paragraphs (a) and (b) 10 C.F.R. Appendix AA, for information set out in paragraphs (c) and (d)	**(a)** input rate, in kW (Btu/h); **(b)** annual fuel utilization efficiency; **(c)** FER, expressed in W/472 L/s (W/1,000 ft³/min); and **(d)** maximum airflow (Q_{max}), expressed in L/s (ft³/min).

38 Section 369 of the Regulations is replaced by the following:

Definitions

369 The following definitions apply in this Division.

CSA P.3-15 means the CSA standard CAN/CSA-P.3-15 entitled *Testing method for measuring energy consumption and determining efficiencies of gas-fired and fuel oil-fired water heaters*. (*CSA P.3-15*)

first-hour rating means, in respect of a gas-fired storage water heater or an oil-fired water heater, the measure of the maximum volume of hot water that the water heater can supply within an hour that begins when the water in the water heater is fully heated. (*capacité de première heure*)

V_r means the nominal volume, expressed in litres, of a water heater's storage tank. (V_r)

V_s means the measured storage volume, expressed in litres, of a water heater's storage tank. (V_s)

39 The definition *electric water heater* in section 370 of the Regulations is replaced by the following:

electric water heater means a stationary electric storage tank water heater that is intended for use on a pressurized water system and that has an input rate of less than 12 kW (40,982 Btu/h) and a V_r of at least 50 L (13.21 US gallons) but not more than 454 L (120 US gallons). (*chauffe-eau électrique*)

40 Sections 376 and 377 of the Regulations are replaced by the following:

Energy efficiency standards

376 (1) The energy efficiency standards set out in column 3 of the table to this section apply to gas-fired storage water heaters described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) A gas-fired storage water heater complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *gas-fired storage water heater* as defined in section 374.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Gas-fired storage water heaters	CSA P.3-04	Energy factor of ≥ 0.67 – 0.0005 V_r	On or after February 3, 1995 and before December 31, 2016
2	Gas-fired storage water heaters	CSA P.3-04	Energy factor of ≥ 0.675 – 0.00039 V_r	On or after December 31, 2016 and before January 1, 2018
3	Gas-fired storage water heaters that have a first-hour rating of < 68 L (18 US gallons)	CSA P.3-04 for energy factor CSA P.3-15 for uniform energy factor	Must have at least one of the following: **(a)** energy factor of ≥ 0.675 – 0.00039 V_r; or **(b)** uniform energy factor of ≥ 0.3456 – 0.00053 V_s	On or after January 1, 2018
4	Gas-fired storage water heaters that have a first-hour rating of ≥ 68 L (18 US gallons) but < 193 L (51 US gallons)	CSA P.3-04 for energy factor	Must have at least one of the following:	On or after January 1, 2018

		CSA P.3-15 for uniform energy factor	**(a)** energy factor of ≥ 0.675 – 0.00039 V_r; or **(b)** uniform energy factor of ≥ 0.5982 – 0.00050 V_s.	
5	Gas-fired storage water heaters that have a first-hour rating of ≥ 193 L (51 US gallons) but < 284 L (75 US gallons)	CSA P.3-04 for energy factor CSA P.3-15 for uniform energy factor	Must have at least one of the following: **(a)** energy factor of ≥ 0.675 – 0.00039 V_r; or **(b)** uniform energy factor of ≥ 0.6483 – 0.00045 V_s.	On or after January 1, 2018
6	Gas-fired storage water heaters that have a first-hour rating of > 284 L (75 US gallons)	CSA P.3-04 for energy factor CSA P.3-15 for uniform energy factor	Must have at least one of the following: **(a)** energy factor of ≥ 0.675 – 0.00039 V_r; or **(b)** uniform energy factor of ≥ 0.692 – 0.00034 V_s.	On or after January 1, 2018

Information

377 (1) For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a gas-fired storage water heater:

(a) its input rate, expressed in kilowatts;

(b) its recovery efficiency;

(c) the fuel it uses;

(d) its annual energy consumption, expressed in kilojoules;

(e) its first-hour rating, expressed in litres;

(f) its V_r;

(g) its energy factor, if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(a), 4(a), 5(a) and 6(a) of the table to section 376; and

(h) its uniform energy factor and V_s, if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(b), 4(b), 5(b) and 6(b) of the table to section 376.

Standard

(2) The information must be collected in accordance with one of the following standards:

(a) CSA P.3-04, if the product

(i) was manufactured on or after February 3, 1995 and before January 1, 2018, or

(ii) is manufactured on or after January 1, 2018 and a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(a), 4(a), 5(a) and 6(a) of the table to section 376; or

(b) CSA P.3-15, if the product is manufactured on or after January 1, 2018 and if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(b), 4(b), 5(b) and 6(b) of the table to section 376.

41 Sections 380 and 381 of the Regulations are replaced by the following:

Energy efficiency standards

380 (1) The energy efficiency standards set out in column 3 of the table to this section apply to oil-fired water heaters described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) An oil-fired water heater complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to an *oil-fired water heater* as defined in section 378.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Oil-fired water heaters	CSA B211-00	Energy factor of ≥ 0.59 – 0.0005 V_r	On or after February 3, 1995 and before December 31, 2016
2	Oil-fired water heaters	CSA B211-00	Energy factor of ≥ 0.68 – 0.0005 V_r	On or after December 31, 2016 and before January 1, 2018
3	Oil-fired water heaters that have a first-hour rating of < 68 L (18 US gallons)	CSA B211-00 for energy factor CSA P.3-15 for uniform energy factor	Must have at least one of the following: **(a)** energy factor of ≥ 0.68 – 0.0005 V_r; or **(b)** uniform energy factor of ≥ 0.2509 – 0.00032 V_s.	On or after January 1, 2018
4	Oil-fired water heaters that have a first-hour rating of ≥ 68 L (18 US gallons) but < 193 L (51 US gallons)	CSA B211-00 for energy factor CSA P.3-15 for uniform energy factor	Must have at least one of the following: **(a)** energy factor of ≥ 0.68 – 0.0005 V_r; or **(b)** uniform energy factor of ≥ 0.5330 – 0.00042 V_s.	On or after January 1, 2018
5	Oil-fired water heaters that have a first-hour rating of ≥ 193 L (51 US gallons) but < 284 L (75 US gallons)	CSA B211-00 for energy factor CSA P.3-15 for uniform energy factor	Must have at least one of the following: **(a)** energy factor of ≥ 0.68 – 0.0005 V_r; or **(b)** uniform energy factor of ≥ 0.6078 – 0.00042 V_s.	On or after January 1, 2018

6	Oil-fired water heaters that have a first-hour rating of > 284 L (75 US gallons)	CSA B211-00 for energy factor CSA P.3-15 for uniform energy factor	Must have at least one of the following: **(a)** energy factor of ≥ 0.68 – 0.0005 V_r; or **(b)** uniform energy factor of ≥ 0.6815 – 0.00037 V_s.	On or after January 1, 2018

Information

381 (1) For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of an oil-fired water heater:

(a) its input rate, expressed in kilowatts;

(b) its recovery efficiency;

(c) its annual energy consumption, expressed in kilojoules;

(d) its first-hour rating, expressed in litres;

(e) its V_r;

(f) its energy factor, if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(a), 4(a), 5(a) and 6(a) of the table to section 380; and

(g) its uniform energy factor and V_s, if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(b), 4(b), 5(b) and 6(b) of the table to section 380.

Standard

(2) The information must be collected in accordance with one of the following standards:

(a) CSA B211-00, if the product

(i) was manufactured on or after February 3, 1995 and before January 1, 2018, or

(ii) is manufactured on or after January 1, 2018 and a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(a), 4(a), 5(a) and 6(a) of the table to section 380; or

(b) CSA P.3-15, if the product is manufactured on or after January 1, 2018 and a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(b), 4(b), 5(b) and 6(b) of the table to section 380.

42 (1) The definition *ANSI C79.1* in section 424 of the Regulations is repealed.

(2) The definition *lampe pour appareils électroménagers* in section 424 of the French version of the Regulations is repealed.

(3) The definitions *ANSI C81.61, IES LM45, IES LM49* and *IES LM65* in section 424 of the Regulations are replaced by the following:

ANSI C81.61 means the ANSI standard ANSI C81.61-2016 entitled *American National Standard for Electrical Lamp Bases — Specifications for Bases (Caps) for Electric Lamps*. (*ANSI C81.61*)

IES LM45 means the IES standard IES LM-45-15 entitled *IES Approved Method for the Electrical and Photometric Measurement of General Service Incandescent Filament Lamps*. (*IES LM45*)

IES LM49 means the IES standard IES LM-49-12 entitled *IES Approved Method For Life Testing of Incandescent Filament Lamps*. (*IES LM49*)

IES LM65 means the IES standard IES LM-65-14 entitled *IES Approved Method for the Life Testing of Single-Based Fluorescent Lamps*. (*IES LM65*)

(4) Section 424 of the Regulations is amended by adding the following in alphabetical order:

ANSI C78.79 means the ANSI standard ANSI C78.79-2014 entitled *American National Standard for Electric Lamps — Nomenclature for Envelope Shapes Intended for Use with Electric Lamps*. (*ANSI C78.79*)

(5) Section 424 of the French version of the Regulations is amended by adding the following in alphabetical order:

lampe pour appareils domestiques Lampe qui est commercialisée comme lampe pour appareils domestiques, qui a une puissance nominale maximale de 40 W et qui est conçue pour être utilisée à une température ambiante pouvant aller jusqu'à 315 °C. (*appliance lamp*)

43 (1) The definition *general service incandescent reflector lamp* in section 441 of the Regulations is replaced by the following:

general service incandescent reflector lamp means an incandescent reflector lamp that has a bulb shape described in ANSI C78.79 or a bulb shape similar to that shape, and that has an E26/24 single contact or E26/50×39 skirted medium screw base, a nominal voltage of at least 100 V but not more than 130 V or a nominal voltage range that lies at least partially between those voltages, a diameter of more than 57 mm and a nominal power of at least 40 W but not more than 205 W. It does not include any of the following:

(a) a coloured lamp;

(b) a rough service lamp;

(c) a vibration service lamp;

(d) a BR30 or BR40 lamp that has a nominal power of 50 W or less or of 65 W;

(e) an R20 lamp that

(i) has a nominal power of 45 W or less, or

(ii) has a nominal power of 100 W and a nominal overall length of not more than 92 mm (3.625 inches) and is designed and marketed for pool and spa applications; or

(f) a modified spectrum lamp that

(i) is an ER30 or ER40 lamp, that has a nominal power of 50 W or less,

(ii) is an ER40 lamp that has a nominal power of 65 W, or

(iii) was manufactured before July 15, 2012. (*lampe-réflecteur à incandescence standard*)

(2) The definition *CSA C862-12* in section 441 of the English version of the Regulations is replaced by the following:

CSA C862-12 means the CSA standard CAN/CSA-C862-12 entitled *Performance of incandescent reflector lamps*. (*CSA C862-12*)

44 (1) The definition *CSA C819-95* in section 445 of the Regulations is repealed.

(2) The definition *CSA C819-11* in section 445 of the English version of the Regulations is replaced by the following:

CSA C819-11 means the CSA standard CAN/CSA-C819-11 entitled *Performance of general service fluorescent lamps*. (*CSA C819-11*)

(3) Paragraph (b) of the definition *coloured fluorescent lamp* in section 445 of the Regulations is replaced by the following:

(b) a correlated colour temperature of less than 2 500 K or more than 7 000 K, as determined in accordance with the IES standard IES LM-9-09 entitled *IES Approved Method for the Electrical and Photometric Measurement of Fluorescent Lamps*. (*lampe fluorescente colorée*)

(4) Paragraphs (d) to (f) of the definition *general service fluorescent lamp* in section 445 of the Regulations are replaced by the following:

(d) is instant-start and straight-shaped and has a nominal overall length of 2 400 mm (96 inches), a single-pin base and a nominal power of at least 49 W;

(e) is straight-shaped and standard output and has a nominal overall length of at least 1 125 mm (45 inches) but not more than 1 200 mm (48 inches), a miniature bi-pin base and a nominal power of at least 25 W;

(f) is straight-shaped and high output with a nominal overall length of at least 1 125 mm (45 inches) but not more than 1 200 mm (48 inches), a miniature bi-pin base and a nominal power of at least 44 W; or

(5) Paragraph (o) of the definition *general service fluorescent lamp* in section 445 of the English version of the Regulations is replaced by the following:

(o) a fluorescent lamp that has a colour rendering index of at least 87. (*lampe fluorescente standard*)

45 Section 447 of the Regulations is replaced by the following:

Energy efficiency standards

447 (1) The energy efficiency standards set out in column 2 of the table to this section apply to general service fluorescent lamps that are manufactured during the periods set out in column 3.

Testing standard

(2) A general service fluorescent lamp complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 1 that are applicable to a *general service fluorescent lamp* as defined in section 445.

TABLE

	Column 1	Column 2	Column 3
Item	Standard	Energy Efficiency Standard	Period of Manufacture
1	CSA C819-11	CSA C819-11, Table 1	On or after December 31, 1996 and before January 26, 2018
2	CSA C819-16 or 10 C.F.R. Appendix R	CSA C819-16, Table 1 or average lamp efficacy × 1.011 > minimum average lamp efficacy for the product in 10 C.F.R. §430.32(n)(4)	On or after January 26, 2018

46 (1) Paragraph 448(1)(h) of the English version of the Regulations is replaced by the following:

(h) its average colour rendering index; and

(2) Subsection 448(2) of the Regulations is replaced by the following:

Standard

(2) The information must be collected in accordance with one of the following standards:

(a) CSA C819-11, if the product was manufactured on or after December 31, 1996 and before January 26, 2018; or

(b) CSA C819-16 or 10 C.F.R. Appendix R, if the product is manufactured on or after January 26, 2018.

47 Section 449 of the Regulations is replaced by the following:

Definitions

449 (1) The following definitions apply in this Subdivision.

CSA C654-10 means the CSA standard CAN/CSA-C654-10 entitled *Fluorescent lamp ballast efficacy measurements*. (*CSA C654-10*)

CSA C654-14 means the CSA standard CAN/CSA-C654-14 entitled *Fluorescent lamp ballast efficacy measurements*. (*CSA C654-14*)

fluorescent lamp ballast means a ballast that is

(a) designed to start and operate fluorescent lamps by

(i) providing the necessary voltage and current,

(ii) limiting the current during normal operation, and

(iii) if necessary to facilitate lamp operation, providing cathode heating;

(b) designed for a nominal voltage of at least 120 V but not more than 347 V; and

(c) described in Table 1A of CSA C654-14.

It does not include any of the following:

(d) a ballast — other than a T12 dimming ballast — that, by means of an integrated dimming capability, is designed to reduce the output of a fluorescent lamp by 50% or more;

(e) a low-frequency T8 ballast that is designed and marketed only for use in an electromagneticinterference-sensitive environment and that is sold in a package of 10 or fewer; or

(f) a program-start ballast that is designed to operate one or more T8 fluorescent lamps with a nominal overall length of 1 200 mm and a medium bi-pin base, and that delivers an average current of less than 140 mA to each lamp. (*ballast pour lampes fluorescentes*)

high-frequency means, in respect of a fluorescent lamp ballast, that the ballast operates the lamp at a frequency of 10 kHz or more. (*à haute fréquence*)

low-frequency means, in respect of a fluorescent lamp ballast, that the ballast operates at a supply frequency of 50 to 60 Hz and operates the lamp at the same frequency as the supply. (*à basse fréquence*)

10 C.F.R. §430.32(m)(2)(ii)(B) means paragraph 430.32(m)(2)(ii)(B) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F. R. §430.32(m)(2)(ii)(B)*)

T12 dimming ballast means a fluorescent lamp ballast that

(a) is designed for a nominal voltage of at least 120 V but not more than 277 V;

(b) by means of an integrated dimming capability, is designed to reduce the output of a T12 fluorescent lamp by 50% or more; and

(c) is designed to operate one F34T12 fluorescent lamp or two F34T12, F96T12ES or F96T12HO ES fluorescent lamps. (*ballast de gradation T12*)

Table 1A of CSA C654-14

(2) Despite subsection 1(3), a reference in this Subdivision to Table 1A of CSA C654-14 is a reference to that table as it read on the day on which the standard was published.

48 Subsection 450(2) of the Regulations is replaced by the following:

Limit

(2) However, for the purposes of sections 4, 5 and 451, a fluorescent lamp ballast is not considered to be an energy-using product if

(a) it was manufactured before February 3, 1995; or

(b) it was manufactured on or after February 3, 1995 and before November 14, 2014 and

(i) is a T12 dimming ballast,

(ii) is designed to operate a fluorescent lamp other than an F32T8, F34T12, F40T10 or F40T12 rapid-start fluorescent lamp or an F96T12ES, F96T12IS, F96T12HO or F96T12HO ES fluorescent lamp, or

(iii) is designed to be used in an outdoor sign and to operate two F96T12HO fluorescent lamps in ambient temperatures at or below –28.9°C.

49 Section 451 of the Regulations is replaced by the following:

Energy efficiency standards

451 (1) The energy efficiency standards set out in column 3 of the table to this section apply to fluorescent lamp ballasts described in column 1 that are manufactured during the periods described in column 4.

Testing standard

(2) A fluorescent lamp ballast complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *fluorescent lamp ballast* as defined in section 449.

TABLE

	Column 1	Column 2	Column 3	Column 4
Item	Energy-using Product	Standard	Energy Efficiency Standard	Period of Manufacture
1	Fluorescent lamp ballasts	CSA C654-10	CSA C654-10, clause 4 for power factor CSA C654-10, Table 2 for ballast efficacy factor	On or after February 3, 1995 and before November 14, 2014
2	Fluorescent lamp ballasts, other than T12 dimming ballasts	CSA C654-14	CSA C654-14, clause 4 for power factor CSA C654-14, clause 5.2 for ballast luminous efficiency	On or after November 14, 2014
3	T12 dimming ballasts that are low-frequency and designed to operate one F34T12 lamp	CSA C654-14	CSA C654-14, clause 4 for power factor Must have ballast luminous efficiency that is ≥ that specified for ballast in table to 10 C.F.R. §430.32(m)(2)(ii)(B)	On or after November 14, 2014
4	T12 dimming ballasts that are high-frequency and designed to operate one F34T12 lamp	CSA C654-14	CSA C654-14, clause 4 for power factor Must have ballast luminous efficiency that is ≥ that specified for ballast in table to 10 C.F.R. §430.32(m)(2)(ii)(B)	On or after November 14, 2014
5	T12 dimming ballasts that are low-frequency and designed to operate two F34T12 lamps	CSA C654-14	CSA C654-14, clause 4 for power factor Must have ballast luminous efficiency that is ≥ that specified for ballast in table to 10 C.F.R. §430.32(m)(2)(ii)(B)	On or after November 14, 2014
6	T12 dimming ballasts that are high-frequency and designed to operate two F34T12 lamps	CSA C654-14	CSA C654-14, clause 4 for power factor Must have ballast luminous efficiency that is ≥ that specified for ballast in table to 10 C.F.R. §430.32(m)(2)(ii)(B)	On or after November 14, 2014
7	T12 dimming ballasts that are low-frequency and designed to operate two F96T12/ES lamps	CSA C654-14	CSA C654-14, clause 4 for power factor Must have ballast luminous efficiency that is ≥ that specified for ballast in table to 10 C.F.R. §430.32(m)(2)(ii)(B)	On or after November 14, 2014
8	T12 dimming ballasts that are high-frequency and designed to operate two F96T12/ES lamps	CSA C654-14	CSA C654-14, clause 4 for power factor	On or after November 14, 2014

			Must have ballast luminous efficiency that is ≥ that specified for ballast in table to 10 C.F.R. §430.32(m)(2)(ii)(B)	
9	T12 dimming ballasts that are low-frequency and designed to operate two F96T12HO/ES lamps	CSA C654-14	CSA C654-14, clause 4 for power factor Must have ballast luminous efficiency that is ≥ that specified for ballast in table to 10 C.F.R. §430.32(m)(2)(ii)(B)	On or after November 14, 2014
10	T12 dimming ballasts that are high-frequency and designed to operate two F96T12HO/ES lamps	CSA C654-14	CSA C654-14, clause 4 for power factor Must have ballast luminous efficiency that is ≥ that specified for ballast in table to 10 C.F.R. §430.32(m)(2)(ii)(B)	On or after November 14, 2014

50 (1) Paragraph 1(c) of the table to section 452 of the Regulations is replaced by the following:

	Column 3
Item	**Information**
1	**(c)** nominal voltage.

(2) The portion of item 2 of the table to section 452 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	**Energy-using Product**
2	Fluorescent lamp ballasts manufactured on or after November 14, 2014, other than T12 dimming ballasts

(3) Paragraph 2(c) of the table to section 452 of the Regulations is replaced by the following:

	Column 3
Item	**Information**
2	**(c)** nominal voltage;

(4) The table to section 452 of the Regulations is amended by adding the following in numerical order:

	Column 1	Column 2	Column 3
Item	**Energy-using Product**	**Standard**	**Information**
3	T12 dimming ballasts manufactured on or after November 14, 2014	CSA C654-14	**(a)** the type and number of fluorescent lamps it is designed to operate; **(b)** ballast luminous efficiency; **(c)** nominal voltage; **(d)** ballast input power, in watts; **(e)** total lamp arc power, in watts; **(f)** power factor; and **(g)** whether it is high-frequency or low-frequency.

51 The Regulations are amended by adding the following after section 452:

SUBDIVISION G

Metal Halide Lamp Ballasts

Definitions

453 The following definitions apply in this Subdivision.

CSA C863-16 means the CSA standard CAN/CSA C863-16 entitled *Energy efficiency of high-intensity discharge (HID) and low-pressure sodium (LPS) lamp ballasts*. (*CSA C863-16*)

electronic ballast means a ballast that is controlled by a transistor, thyristor or other active electronic component and in which impedance is provided by capacitive or inductive reactance. (*ballast électronique*)

magnetic-regulated lamp ballast means a ballast that operates at a lagging high power factor and that has

(a) three coils;

(b) isolated secondary windings; and

(c) a constant-voltage regulator that, in conjunction with capacitive reactance, provides power factor correction and lamp wattage regulation. (*ballast à régulation magnétique*)

metal halide lamp ballast means a device that is used to obtain the voltage, current and waveform necessary for starting and operating a metal halide lamp that has a nominal power of at least 50 W but not more than 1 000 W. It does not include any of the following:

(a) a magnetic-regulated lamp ballast;

(b) a replacement metal halide lamp ballast; or

(c) an electronic ballast that is designed for a nominal voltage of 480 V or to operate a lamp at an output frequency of 1000 Hz or more. (*ballast pour lampes aux halogénures métalliques*)

replacement metal halide lamp ballast means a ballast that is marketed for use as replacement ballast for a metal halide luminaire installation and that is sold in a package of 10 or fewer. (*ballast pour lampes aux halogénures métalliques de remplacement*)

Energy-using product

454 (1) A metal halide lamp ballast is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 455, a metal halide lamp ballast is not considered to be an energy-using product if

(a) it was manufactured before February 10, 2017; or

(b) it is manufactured before December 31, 2019 and is capable of using a nominal voltage of 347 V.

Energy efficiency standards

455 (1) The energy efficiency standards set out in Table 3 of CSA C863-16 apply to metal halide lamp ballasts.

Testing standard

(2) A metal halide lamp ballast complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by CSA C863-16 that are applicable to a *metal halide lamp ballast* as defined in section 453.

Information

456 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with CSA C863-16 and provided to the Minister in respect of a metal halide lamp ballast:

(a) its type;

(b) the efficiency of the lamp and ballast combination, expressed as a percentage;

(c) its nominal voltage;

(d) its input power, in watts;

(e) the power, in watts, of the lamps that the ballast is designed to operate; and

(f) its power factor.

52 The definition *ITE VTCSH* in section 506 of the Regulations is repealed.

53 Subdivision B of Division 8 of Part 2 of the Regulations is repealed.

54 Section 515 of the Regulations is replaced by the following:

Definitions

515 The following definitions apply in this Subdivision.

ceiling fan light kit means equipment that is designed to provide light from a ceiling fan and that is

(a) integral to the fan before its retail sale; or

(b) attachable to the fan after its retail sale. (*ensemble d'éclairage pour ventilateurs de plafond*)

integrated solid-state lighting circuitry means the circuitry in a ceiling fan light kit that is not replaceable by a consumer and that is used to connect the light kit's solid-state lighting components. (*circuits intégrés d'éclairage à semi-conducteurs*)

10 C.F.R. §430.23(x)(2) means paragraph 430.23(x)(2) of Subpart B, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.23(x)(2)*)

10 C.F.R. §430.32(s)(6) means the table to paragraph 430.32(s)(6) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.32(s)(6)*)

55 Paragraphs 516(2)(a) and (b) of the Regulations are replaced by the following:

(a) for the purposes of sections 4 and 5, if it was manufactured before January 1, 2010; and

(b) for the purpose of section 517,

(i) if it was manufactured before January 1, 2010,

(ii) if it is manufactured on or after January 1, 2010 and before January 7, 2019, it has a total power less than or equal to 10 W or only pin-based sockets, or

(iii) if it is manufactured on or after January 7, 2019, it has at least one socket, has maximum wattage markings on each socket that together indicate that the combined total power for the lighting is less than or equal to 70 W and does not have integrated solid state lighting circuitry.

56 Sections 517 and 518 of the Regulations are replaced by the following:

Energy efficiency standards

517 (1) The energy efficiency standards set out in column 3 of the table to this section apply to ceiling fan light kits described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) A ceiling fan light kit complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *ceiling fan light kit* as defined in section 515.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Ceiling fan light kits	CSA C22.2 No. 250.0	Total power for lighting ≤ 190 W	On or after January 1, 2010 and before January 7, 2019
2	Ceiling fan light kits that have at least one socket, that are not packaged with a lamp for each socket and that do not have integrated solid-state lighting circuitry	CSA C22.2 No. 250.0	Total power for lighting ≤ 70 W	On or after January 7, 2019
3	Ceiling fan light kits that have at least one socket, that are packaged with a lamp for each socket, but that do not have integrated solid-state lighting circuitry	10 C.F.R. §430.23(x)(2)	Lighting efficacy ≥ minimum required efficacy in 10 C.F.R. §430.32(s)(6)	On or after January 7, 2019
4	Ceiling fans light kits that have integrated solid-state lighting circuitry	10 C.F.R. §430.23(x)(2)	Lighting efficacy ≥ minimum required efficacy in 10 C.F.R. §430.32(s)(6)	On or after January 7, 2019

Information

518 (1) For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a ceiling fan light kit:

(a) if it has at least one socket, the type of socket and the number of each type of socket;

(b) if it has integrated solid-state lighting circuitry, the lighting efficacy, expressed in lumens per watt;

(c) if it has a pin-based socket, the ballast type;

(d) if it is packaged with lamps, their type, brand name and model number; and

(e) the total power for the lighting, expressed in watts.

Standard

(2) The information must be collected in accordance with CSA C22.2 No. 250.0 or 10 C.F.R. §430.23(x)(2).

57 Paragraph (a) of the definition *legend* in section 519 of the Regulations is replaced by the following:

(a) a representation of a running person, as described in Annex B.1 of the CSA standard CSA C22.2 No. 141 entitled *Emergency lighting equipment*; and

58 Paragraph (b) of the definition *traffic signal module* in section 523 of the Regulations is replaced by the following:

(b) provide drivers with movement information by means of a red or green traffic signal indicator that has a nominal diameter of 200 mm (8 inches) or 300 mm (12 inches). (*module de signalisation routière*)

59 The portions of items 1 to 4 of the table to section 525 of the Regulations in column 1 are replaced by the following:

Item	Column 1 Energy-using Product
1	Traffic signal modules that have a red traffic signal indicator that has a nominal diameter of 200 mm (8 inches)
2	Traffic signal modules that have a red traffic signal indicator that has a nominal diameter of 300 mm (12 inches)
3	Traffic signal modules that have a green traffic signal indicator that has a nominal diameter of 200 mm (8 inches)
4	Traffic signal modules that have a green traffic signal indicator that has a nominal diameter of 300 mm (12 inches)

60 (1) The definition *CSA C62301* in section 573 of the English version of the Regulations is replaced by the following:

CSA C62301 means the CSA standard CAN/CSA-C62301:11 entitled *Household electrical appliances – Measurement of standby power*. (*CSA C62301*)

(2) Section 573 of the Regulations is amended by adding the following in alphabetical order:

medical device has the same meaning as in section 1 of the *Medical Devices Regulations*. (*instrument médical*)

61 The definition *standby mode* in section 574 of the Regulations is replaced by the following:

standby mode means the mode in which the product, while connected to mains power,

(a) is not producing sound, providing mechanical function or exchanging data with, or receiving it from, an external source; and

(b) can be switched into another mode with a remote control unit, an internal signal or an internal timer. (*mode veille*)

62 The definition *standby mode* in section 578 of the Regulations is replaced by the following:

standby mode means the mode in which the product, while connected to mains power,

(a) is not producing video or audio output signals, providing any mechanical function or exchanging data with, or receiving it from, an external source; and

(b) can be switched into another mode with a remote control unit, an internal signal or an internal timer. (*mode veille*)

63 The definition *standby mode* in section 582 of the Regulations is replaced by the following:

standby mode means the mode in which the product, while connected to mains power,

(a) is not producing sound or picture, providing any mechanical function or exchanging data with, or receiving it from, an external source; and

(b) can be switched into another mode with a remote control unit, an internal signal or an internal timer. (*mode veille*)

64 (1) The definitions *external power supply* and *replacement external power supply* in subsection 586(1) of the Regulations are replaced by the following:

external power supply means a single-voltage external power supply or a multiple-voltage external power supply that is designed to be used with a household or office end-use product that constitutes the primary load. It does not include

(a) a direct operation external power supply that has a nominal output voltage of less than 3 V and a nominal output current of 1 000 mA or more and that charges the battery of an end-use product that is fully or primarily motor-operated;

(b) an indirect operation external power supply that has a nominal output power of greater than 250 W;

(c) a device that powers the charger of a detachable battery pack of an end-use product;

(d) a device that is an accessory to a medical device; or

(e) a device that is solely designed to power solid-state lighting or a ceiling fan that has a direct current motor. (*bloc d'alimentation externe*)

replacement external power supply means an external power supply that is marked as a replacement to be used with a specific end-use product that was manufactured before July 1, 2017. (*bloc d'alimentation externe de remplacement*)

(2) Subsection 586(1) of the Regulations is amended by adding the following in alphabetical order:

adaptive external power supply means an external power supply that, without user intervention and while it is connected to mains power and each output is connected to a load, can alter the output voltage using a digital communication protocol with the end-use product. (*bloc d'alimentation externe adaptatif*)

CSA C381.1-17 means the CSA standard CAN/CSA C381.1-17 entitled *Energy performance of external ac-dc and ac-ac power supplies*. (*CSA C381.1-17*)

direct operation external power supply means a power supply device that is capable of operating an end-use product, other than a battery charger, without the assistance of a battery. (*bloc d'alimentation externe à fonctionnement direct*)

indirect operation external power supply means a power supply device that can only operate an end-use product with the assistance of a battery. (*bloc d'alimentation externe à fonctionnement indirect*)

multiple-voltage external power supply means a device that is designed to convert line voltage AC input into more than one simultaneous lower voltage AC or DC outputs. (*bloc d'alimentation externe à tensions multiples*)

single-voltage external power supply means a device that is designed to convert line voltage AC input into only one lower AC or DC voltage output at a time. (*bloc d'alimentation externe à simple tension*)

10 C.F.R. §430.32(w)(1)(i) means the table to paragraph 430.32(w)(1)(i) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.32(w)(1)(i)*)

verification mark has the same meaning as in section 2. (*marque de vérification*)

(3) Subsection 586(2) of the Regulations is repealed.

65 Subsection 587(2) of the Regulations is replaced by the following:

Limit

(2) However, an external power supply is not considered to be an energy-using product

(a) for the purposes of sections 4 and 5 if

(i) it was manufactured before July 1, 2010, or

(ii) it was manufactured on or after July 1, 2010 and before July 1, 2017 and

(A) it is a multiple-voltage external power supply or an adaptive external power supply,

(B) it is a direct operation external power supply that has a nominal output power of greater than 250 W, or

(C) it is an indirect operation external power supply that has a nominal output voltage of greater than 3 V and a nominal output current of less than 1 000 mA and that charges the battery of an end-use product that is fully or primarily motor-operated; and

(b) for the purpose of section 588 if

(i) it was manufactured before July 1, 2010,

(ii) it was manufactured on or after July 1, 2010 and before July 1, 2017 and

(A) it is a multiple-voltage external power supply or an adaptive external power supply,

(B) it is a direct operation external power supply that has a nominal output power of greater than 250 W, or

(C) it is an indirect operation external power supply that has a nominal output voltage of greater than 3 V and a nominal output current of less than 1 000 mA and that charges the battery of an end-use product that is fully or primarily motor-operated, or

(iii) it was manufactured before July 1, 2013 and is a replacement external power supply.

66 Sections 588 and 589 of the Regulations are replaced by the following:

Energy efficiency standards

588 (1) The energy efficiency standards set out in column 3 of the table to this section apply to external power supplies described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) An external power supply complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to an *external power supply* as defined in subsection 586(1).

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	External power supplies, other than replacement external power supplies	CSA C381.1 or 10 C.F.R. Appendix Z	10 C.F.R. §430.32(w)(1)(i) for efficiency in active mode and, if product is not a security external power supply, power in no-load mode ≤ 0.5 W	On or after July 1, 2010 and before July 1, 2017
2	Direct operation external power supplies other than replacement external power supplies	CSA C381.1-17 or 10 C.F.R. Appendix Z	CSA C381.1-17, Table D.1, for efficiency in active mode and power in no-load mode	On or after July 1, 2017
3	Indirect operation external power supplies other than replacement external power supplies	CSA C381.1 or 10 C.F.R. Appendix Z	10 C.F.R. §430.32(w)(1)(i) for efficiency in active mode and, if product is not a security external power supply, power in no-load mode ≤ 0.5 W	On or after July 1, 2017
4	Replacement external power supplies	CSA C381.1 or 10 C.F.R. Appendix Z	10 C.F.R. §430.32(w)(1)(i) for efficiency in active mode and, if product is not a security external power supply, power in no-load mode ≤ 0.5 W	On or after July 1, 2013 and before February 10, 2020
5	Replacement external power supplies	CSA C381.1-17 or 10 C.F.R. Appendix Z	CSA C381.1-17, Table D.1, for efficiency in active mode and power in no-load mode	On or after February 10, 2020

Information

589 (1) For the purpose of subsection 5(1) of the Act, the following information must provided to the Minister in respect of an external power supply:

(a) information that indicates whether the product is a single-voltage external power supply or a multiple-voltage external power supply;

(b) for each voltage output, its nominal output voltage at the highest and lowest settings and information that indicates whether that voltage is AC or DC;

(c) its nominal output power, expressed in watts, at the highest and lowest power settings, if applicable;

(d) its average efficiency at the highest and lowest power settings, if applicable;

(e) its power in no-load mode, expressed in watts;

(f) the Roman numeral mark, if applicable;

(g) information that indicates whether the product bears a verification mark; and

(h) information that indicates whether the product is a replacement external power supply or a security external power supply and, if it is one of those power supplies, the end-use product or equipment, as applicable, and the model number and brand of that end-use product or equipment.

Standard

(2) The information must be collected in accordance with a standard set out in column 2 of the table to this section in respect of an external power supply described in column 1.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard
1	External power supplies, other than replacement external power supplies, that are manufactured on or after July 1, 2010 and before July 1, 2017	CSA C381.1 or 10 C.F.R. Appendix Z

2	Direct operation external power supplies, other than replacement external power supplies, that are manufactured on or after July 1, 2017	CSA C381.1-17 or 10 C.F.R. Appendix Z
3	Indirect operation external power supplies, other than replacement external power supplies, that are manufactured on or after July 1, 2017	CSA C381.1 or 10 C.F.R. Appendix Z
4	Replacement external power supplies that are manufactured on or after July 1, 2013 and before February 10, 2020	CSA C381.1 or 10 C.F.R. Appendix Z
5	Replacement external power supplies that are manufactured on or after February 10, 2020	CSA C381.1-17 or 10 C.F.R. Appendix Z

SUBDIVISION E

Battery Chargers

Definitions

590 The following definitions apply in this Subdivision.

backup battery charger means a device that

(a) is incorporated into an end-use product, including a device that is incorporated into an uninterruptible power supply or that uses an external power supply, that is designed to operate continuously using mains power; and

(b) recharges a battery that is used to maintain the continuity of electrical power to the end-use product such that the product can continue its full or partial operation in the event of a failure of mains power. (*chargeur de batterie de secours*)

battery charger means a device that charges the battery of a wheelchair, golf cart, low-speed vehicle or any other end-use product. It does not include any of the following:

(a) a device that charges the battery of a vehicle other than a wheelchair, golf cart or low-speed vehicle;

(b) a device that charges the battery of a medical device;

(c) a wireless battery charger, other than a wireless battery charger that is inductive and designed for wet environments; or

(d) a backup battery charger. (*chargeur de batterie*)

CSA C381.2-17 means the CSA standard CSA C381.2-17 entitled *Energy performance of battery-charging systems and uninterruptible power supplies*. (*CSA C381.2-17*)

low-speed vehicle means a vehicle that

(a) does not use fuel as an on-board source of energy;

(b) travels on two or more wheels;

(c) is powered by an electric power train that is designed to allow the vehicle to attain a speed of no greater than 40 km/h over a distance of 1.6 km on a paved level surface; and

(d) has a loaded weight, as specified by its manufacturer, of less than 1 361 kg. (*véhicule à basse vitesse*)

10 C.F.R. Appendix Y means Appendix Y to Subpart B, Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Battery Chargers*, as amended from time to time. (*appendice Y 10 C.F.R.*)

Energy-using product

591 (1) A battery charger is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 592, a battery charger is not considered to be an energy-using product unless it is manufactured on or after June 13, 2019.

Energy efficiency standard

592 (1) A battery charger must have a unit energy consumption that is less than or equal to that set out for the battery charger's product class in Table C.1 of CSA C381.2-17.

Testing standards

(2) A battery charger complies with the energy efficiency standard if it meets that standard when tested in accordance with the testing procedures established by CSA C381.2-17 or 10 C.F.R. Appendix Y that are applicable to a *battery charger* as defined in section 590.

Information

593 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with CSA C381.2-17 or 10 C.F.R. Appendix Y and provided to the Minister in respect of a battery charger:

(a) its product class;
(b) its rated battery energy (E_{batt}), expressed in watt-hours;
(c) its unit energy consumption, expressed in kilowatt-hours per year;
(d) its power, expressed in watts, when it is in active mode, maintenance mode and standby mode, respectively; and
(e) if an external power supply was used to test the battery charger, the power supply's model number and the name of its manufacturer.

67 (1) The definitions *commercial freezer*, *commercial refrigerator* and *commercial refrigerator-freezer* in section 636 of the Regulations are replaced by the following:

commercial freezer means a freezer that is selfcontained or remote-condensing, that uses or is designed to be used with a vapour-compression refrigeration system and whose compartments are all designed for the freezing and display or storage of food, beverages or ice at temperatures below 0°C. It does not include a household freezer or walk-in freezer. (*congélateur commercial*)

commercial refrigerator means a refrigerator that is self-contained or remote-condensing, that uses or is designed to be used with a vapour-compression refrigeration system and whose compartments are all designed for the display or storage of food, beverages or flowers at temperatures at or above 0°C. It does not include a household refrigerator, refrigerated buffet table, refrigerated preparation table or walk-in cooler. (*réfrigérateur commercial*)

commercial refrigerator-freezer means a refrigerator-freezer that is self-contained or remote-condensing, that uses or is designed to be used with a vapour-compression refrigeration system and that has two or more compartments, at least one of which is designed for the display or storage of food and beverages at temperatures at or above 0°C and at least one of which is designed for the freezing and display or storage of food and beverages at temperatures below 0°C. It does not include a household refrigerator-freezer, walk-in freezer or walk-in cooler. (*réfrigérateur-congélateur commercial*)

(2) Section 636 of the Regulations is amended by adding the following in alphabetical order:

ice cream freezer means a commercial freezer that is designed to operate at temperatures at or below −21°C ± 1.1°C and that is designed or marketed for the storage, display or dispensing of ice cream. (*congélateur de crème glacée*)

68 (1) Paragraph 637(2)(a) of the Regulations is replaced by the following:

(a) for the purposes of sections 4 and 5, unless
(i) it is self-contained and manufactured on or after April 1, 2007, or
(ii) it is remote-condensing and manufactured on or after January 1, 2012; and

(2) Subparagraph 637(2)(b)(i) of the Regulations is replaced by the following:

(i) it is self-contained, closed and was manufactured on or after April 1, 2007 and before January 1, 2012, or

69 Section 638 of the Regulations is replaced by the following:

Energy efficiency standards

638 (1) The energy efficiency standards set out in column 3 of the table to this section apply to commercial refrigerators described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) A commercial refrigerator complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *commercial refrigerator* as defined in section 636.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Commercial refrigerators that are self-contained, closed and not transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.00441 V + 4.22$	On or after April 1, 2007 and before January 1, 2008
2	Commercial refrigerators that are self-contained, closed and not transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.00441 V + 2.76$	On or after January 1, 2008 and before January 1, 2010
3	Commercial refrigerators that are self-contained, closed and not transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.00353 V + 2.04$	On or after January 1, 2010 and before March 27, 2017
4	Commercial refrigerators that are self-contained and transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.00607 V + 5.78$	On or after April 1, 2007 and before January 1, 2008
5	Commercial refrigerators that are self-contained and transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.00607 V + 4.77$	On or after January 1, 2008 and before January 1, 2010
6	Commercial refrigerators that are self-contained and transparent and that do not have pull-down temperature reduction capability	CSA C657, Test Procedure A	$E_{daily} \leq 0.00424 V + 3.34$	On or after January 1, 2010 and before March 27, 2017
7	Commercial refrigerators that are self-contained and transparent and that have pull-down temperature reduction capability	CSA C657, Test Procedure A	$E_{daily} \leq 0.00445 V + 3.51$	On or after January 1, 2010 and before March 27, 2017
8	Commercial refrigerators that are self-contained and open	CSA C657, Test Procedure A	CSA C657, Table 5	On or after January 1, 2012 and before March 27, 2017
9	Commercial refrigerators that are remote-condensing	CSA C657, Test Procedure A	CSA C657, Table 5	On or after January 1, 2012 and before March 27, 2017
10	Commercial refrigerators	CSA C657, Test Procedure B	CSA C657, Table 6	On or after March 27, 2017

70 (1) Section 639 of the Regulations is renumbered as subsection 639(1) and the portion of that subsection before paragraph (a) is replaced by the following:

Information

639 (1) For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a commercial refrigerator:

(2) Section 639 of the Regulations is amended by adding the following after subsection (1):

Standards

(2) The information must be collected in accordance with one of the following standards:

(a) CSA C657, Test Procedure A, if the product was manufactured before March 27, 2017; or
(b) CSA C657, Test Procedure B, if the product is manufactured on or after March 27, 2017.

71 (1) Subparagraphs 640(2)(a)(i) and (ii) of the Regulations are replaced by the following:

(i) it is self-contained, is closed and is manufactured on or after April 1, 2007,
(ii) it is self-contained, is open and is manufactured on or after January 1, 2012, or
(iii) it is remote-condensing and is manufactured on or after January 1, 2012; and

(2) Subparagraphs 640(2)(b)(i) and (ii) of the Regulations are replaced by the following:

(i) it is self-contained, is closed, is not transparent and is manufactured on or after April 1, 2007,
(ii) it is self-contained, is open or transparent and is manufactured on or after January 1, 2012, or
(iii) it is remote-condensing and is manufactured on or after January 1, 2012.

72 Sections 641 and 642 of the Regulations are replaced by the following:

Energy efficiency standards

641 (1) The energy efficiency standards set out in column 3 of the table to this section apply to commercial refrigerator-freezers described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) A commercial refrigerator-freezer complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *commercial refrigerator-freezer* as defined in section 636.

TABLE

	Column 1	Column 2	Column 3	Column 4
Item	Energy-using Product	Standard	Energy Efficiency Standard	Period of Manufacture
1	Commercial refrigerator-freezers that are self-contained, closed and not transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.00964$ AV + 2.63	On or after April 1, 2007 and before January 1, 2008
2	Commercial refrigerator-freezers that are self-contained, closed and not transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.00964$ AV + 1.65	On or after January 1, 2008 and before January 1, 2010
3	Commercial refrigerator-freezers that are self-contained, closed and not transparent	CSA C657, Test Procedure A	$E_{daily} \leq$ the greater of (0.00953 AV − 0.71) and 0.70	On or after January 1, 2010 and before March 27, 2017
4	Commercial refrigerator-freezers that are self-contained and open or transparent	CSA C657, Test Procedure A	CSA C657, Table 5	On or after January 1, 2012 and before March 27, 2017
5	Commercial refrigerator-freezers that are remote-condensing	CSA C657, Test Procedure A	CSA C657, Table 5	On or after January 1, 2012 and before March 27, 2017
6	Commercial refrigerator-freezers			On or after March 27, 2017

	CSA C657, Test Procedure B	CSA C657, Table 6

Information

642 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected in accordance with the standard set out in column 2 and provided to the Minister in respect of a commercial refrigerator-freezer described in column 1.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
1	Commercial refrigerator-freezers that are self-contained, closed, not transparent and manufactured on or after April 1, 2007 and before March 27, 2017	CSA C657, Test Procedure A	**(a)** E_{daily}; **(b)** AV; and **(c)** for each compartment tested at the lowest temperature setting, the integrated average temperature, expressed in degrees Celsius, at the lowest temperature setting.
2	Commercial refrigerator-freezers that are self-contained, transparent and manufactured on or after April 1, 2007 and before January 1, 2012	CSA C657, Test Procedure A	**(a)** E_{daily}; **(b)** AV; and **(c)** for each compartment tested at the lowest temperature setting, the integrated average temperature, expressed in degrees Celsius, at the lowest temperature setting.
3	Commercial refrigerator-freezers that are self-contained, open or transparent and manufactured on or after January 1, 2012 and before March 27, 2017	CSA C657, Test Procedure A	**(a)** E_{daily}; **(b)** for each compartment tested at the lowest temperature setting, the integrated average temperature, expressed in degrees Celsius, at the lowest temperature setting; and **(c)** for each compartment, its equipment class designation and TDA.
4	Commercial refrigerator-freezers that are remote-condensing and manufactured on or after January 1, 2012 and before March 27, 2017	CSA C657, Test Procedure A	**(a)** E_{daily}; **(b)** for each compartment tested at the lowest temperature setting, the integrated average temperature, expressed in degrees Celsius, at the lowest temperature setting; and **(c)** for each compartment, its equipment class designation and TDA.
5	Commercial refrigerator-freezers that are manufactured on or after March 27, 2017	CSA C657, Test Procedure B	**(a)** E_{daily}; **(b)** for each compartment tested at the lowest temperature setting, the integrated average temperature, expressed in degrees Celsius, at the lowest temperature setting; and **(c)** for each compartment, its equipment class designation and its TDA or V, as applicable.

73 (1) Paragraph 643(2)(a) of the Regulations is replaced by the following:

(a) for the purposes of sections 4 and 5, unless
- **(i)** it is self-contained and manufactured on or after April 1, 2007, or
- **(ii)** it is remote-condensing and is manufactured on or after January 1, 2012; and

(2) Subparagraph 643(2)(b)(i) of the Regulations is replaced by the following:

(i) it is self-contained, closed and was manufactured on or after April 1, 2007 and before January 1, 2012, or

74 Section 644 of the Regulations is replaced by the following:

Energy efficiency standards

644 (1) The energy efficiency standards set out in column 3 of the table to this section apply to commercial freezers described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) A commercial freezer complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *commercial freezer* as defined in section 636.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Commercial freezers that are self-contained and open, other than ice cream freezers	CSA C657, Test Procedure A	CSA C657, Table 5	On or after January 1, 2012 and before March 27, 2017
2	Commercial freezers that are self-contained, closed and not transparent and have a volume of < 340 L	CSA C657, Test Procedure A	$E_{daily} \leq 7.62$	On or after April 1, 2007 and before January 1, 2008
3	Commercial freezers that are self-contained, closed and not transparent and have a volume of < 340 L	CSA C657, Test Procedure A	$E_{daily} \leq 7.07$	On or after January 1, 2008 and before January 1, 2010
4	Commercial freezers that are self-contained, closed and not transparent and have a volume of ≥ 340 L	CSA C657, Test Procedure A	$E_{daily} \leq 0.0141\ V + 2.83$	On or after April 1, 2007 and before January 1, 2008
5	Commercial freezers that are self-contained, closed and not transparent and have a volume of ≥ 340 L	CSA C657, Test Procedure A	$E_{daily} \leq 0.0141\ V + 2.28$	On or after January 1, 2008 and before January 1, 2010
6	Commercial freezers that are self-contained, closed and not transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.01413\ V + 1.38$	On or after January 1, 2010 and before January 1, 2012
7	Commercial freezers that are self-contained, closed and not transparent, other than ice cream freezers	CSA C657, Test Procedure A	$E_{daily} \leq 0.01413\ V + 1.38$	On or after January 1, 2012 and before March 27, 2017
8	Commercial freezers that are self-contained and transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.0332\ V + 5.10$	On or after April 1, 2007 and before January 1, 2010
9	Commercial freezers that are self-contained and transparent	CSA C657, Test Procedure A	$E_{daily} \leq 0.02649\ V + 4.10$	On or after January 1, 2010 and before January 1, 2012
10	Commercial freezers that are self-contained and transparent, other than ice cream freezers	CSA C657, Test Procedure A	$E_{daily} \leq 0.02649\ V + 4.10$	

				On or after January 1, 2012 and before March 27, 2017
11	Commercial freezers that are remote-condensing, other than ice cream freezers	CSA C657, Test Procedure A	CSA C657, Table 5	On or after January 1, 2012 and before March 27, 2017
12	Ice cream freezers	CSA C657, Test Procedure A	CSA C657, Table 5	On or after January 1, 2012 and before March 27, 2017
13	Commercial freezers	CSA C657, Test Procedure B	CSA C657, Table 6	On or after March 27, 2017

75 (1) Section 645 of the Regulations is renumbered as subsection 645(1) and the portion of that subsection before paragraph (a) is replaced by the following:

Information

645 (1) For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a commercial freezer:

(2) Section 645 of the Regulations is amended by adding the following after subsection (1):

Standards

(2) The information must be collected in accordance with one of the following standards:

(a) CSA C657, Test Procedure A, if the product was manufactured before March 27, 2017; or
(b) CSA C657, Test Procedure B, if the product is manufactured on or after March 27, 2017.

76 The Regulations are amended by adding the following after section 656:

SUBDIVISION D

Walk-in Freezer and Walk-in Cooler Components

Interpretation

Definitions

657 The following definitions apply in this Subdivision.

annual walk-in energy factor means the ratio of total heat removed from an enclosed space, excluding heat generated by the operation of the walk-in refrigeration system, to the total energy input of the walk-in refrigeration system during a one-year period, expressed in watt-hours per watt-hours. (*facteur énergétique annuel de la chambre froide*)

dedicated condensing unit means a positive displacement condensing unit that

(a) is part of a refrigeration system, including a matched refrigeration system;
(b) has one or more compressors, one condenser and one refrigeration circuit; and
(c) is designed to serve one refrigerated load. (*unité de condensation dédiée*)

display door assembly means a walk-in door assembly that is designed for product display and that has 75% or more of its surface area composed of glass or other transparent material. (*assemblage de porte de présentation*)

floor panel means a walk-in panel that is installed, or designed to be installed, as the floor of a walk-in freezer. (*panneau de plancher*)

freight door assembly means a walk-in door assembly, other than a display door assembly, that is 1.22 m (4 feet) or more in width and 2.44 m (8 feet) or more in height. (*assemblage de porte de quai de chargement*)

passage door assembly means a walk-in door assembly that is not a display door assembly or a freight door assembly. (*assemblage de porte de passage*)

R-value means, in respect of a walk-in panel and a walk-in door assembly, its thermal resistance, expressed in square metre kelvins per watt. (*valeur-R*)

single-package dedicated system means a singlepackage refrigeration system that has

(a) one or more compressors, one condenser and a means of forced circulation of refrigerated air; and
(b) components by which heat is transferred from air to refrigerant without any components that are external to the system imposing resistance to the flow of the refrigerated air. (*système dédié monobloc*)

structural panel means a walk-in panel that is installed, or is designed to be installed, as the ceiling or a wall of a walk-in cooler or walk-in freezer. (*panneau de structure*)

10 C.F.R. Appendix A means Appendix A to Subpart R, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for the Measurement of Energy Consumption of the Components of Envelopes of Walk-In Coolers and Walk-In Freezers*, as amended from time to time. (*appendice A 10 C.F.R.*)

10 C.F.R. Appendix B means Appendix B to Subpart R, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for the Measurement of R-Value for Envelope Components of Walk-In Coolers and Walk-In Freezers*, as amended from time to time. (*appendice B 10 C.F.R.*)

10 C.F.R. Appendix C means Appendix C to Subpart R, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for the Measurement of Net Capacity and AWEF of Walk-In Cooler and Walk-In Freezer Refrigeration Systems*, as amended from time to time. (*appendice C 10 C.F.R.*)

10 C.F.R. §431.304 means section 431.304 of Subpart R, Part 431 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §431.304*)

walk-in cooler means an enclosed storage space that has an area of less than 278.71 m^2 (3,000 square feet) and is designed to be cooled to temperatures at or above 0° C and to allow a person to enter. (*réfrigérateur-chambre*)

walk-in door assembly means an assembly that

(a) is installed, or is designed to be installed, in an opening of an interior or exterior wall of a walk-in cooler or walk-in freezer in order to allow access through the opening or to close it off; and
(b) consists of the framing material necessary for its attachment and a moveable door panel, including any glass, door plugs or mullions. (*assemblage de porte de chambre froide*)

walk-in freezer means an enclosed storage space that has an area of less than 278.71 m^2 (3000 square feet) and is designed to be cooled to temperatures below 0° C and to allow a person to enter. (*congélateur-chambre*)

walk-in panel means a panel that is installed, or is designed to be installed, as part of the envelope of a walk-in cooler or walk-in freezer. It does not include a walk-in door assembly. (*panneau de chambre froide*)

walk-in process cooling refrigeration system means a refrigeration system that

(a) is sold as a set with an insulated enclosure and, when assembled with the enclosure, has a cooling capacity of at least 1.035 kW/m^3 (100 $Btu/h/ft^3$) of enclosed internal volume;
(b) is sold as a set that has a dedicated condensing unit and an assembly that has a means of forced air circulation and an evaporator coil that has a height that is
(i) at least 1.37 m (4.5 feet), as measured perpendicular to the tubes, and
(ii) at least one-and-a half times the width, as measured parallel to the tubes; or
(c) is sold as a set that has a dedicated condensing unit and an evaporator coil. (*système de réfrigération de type chambre pour refroidissement industriel*)

walk-in refrigeration system means a refrigeration system that is installed, or is designed to be installed, in a walk-in cooler for the purpose of cooling its refrigerated compartment and has a dedicated condensing unit or a single-package dedicated system. It includes all controls and other components that are integral to its operation but does not include a walk-in process cooling refrigeration system. (*système de réfrigération de chambre froide*)

Nameplate

Nameplate required

658 Every walk-in door assembly and walk-in panel that is manufactured on or after June 26, 2017 must be labelled with a nameplate that is attached to the outside of the product in a location that is readily visible prior to assembly of the walk-in cooler or walk-in freezer and that sets out the following information in English and French:

(a) the brand name or manufacturer of the product; and
(b) a statement indicating whether the product is intended for use in a walk-in cooler, walk-in freezer or both.

Walk-in Door Assemblies

Energy-using product

659 (1) A walk-in door assembly is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 660, a walk-in door assembly is not considered to be an energy-using product unless it is manufactured on or after June 5, 2017.

Energy efficiency standards

660 (1) The energy efficiency standards set out in column 3 of the table to this section apply to walk-in door assemblies described in column 1 that are manufactured on or after June 5, 2017.

Testing standard

(2) A walk-in door assembly complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *walk-in door assembly* as defined in section 657.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard
1	Display door assemblies for walk-in coolers	10 C.F.R. Appendix A	$E_{daily} \leq 0.4306 \times A_{dd} + 0.41$ ($0.04 \times A_{dd} + 0.41$)
2	Display door assemblies for walk-in freezers	10 C.F.R. Appendix A	$E_{daily} \leq 1.6146 \times A_{dd} + 0.29$ ($0.15 \times A_{dd} + 0.29$)
3	Freight door assemblies for walk-in coolers	10 C.F.R. Appendix A for E_{daily} 10 C.F.R. Appendix B for R-value	$E_{daily} \leq 0.4306 \times A_{nd} + 1.9$ ($0.04 \times A_{nd} + 1.9$) R-value ≥ 4.40 K · m^2/W (25 $ft^2 \cdot °F \cdot h$/Btu)
4	Freight door assemblies for walk-in freezers	10 C.F.R. Appendix A for E_{daily} 10 C.F.R. Appendix B for R-value	$E_{daily} \leq 1.2917 \times A_{nd} + 5.6$ ($0.12 \times A_{nd} + 5.6$) R-value ≥ 5.64 K · m^2/W (32 $ft^2 \cdot °F \cdot h$/Btu)
5	Passage door assemblies for walk-in coolers	10 C.F.R. Appendix A for E_{daily} 10 C.F.R. Appendix B for R-value	$E_{daily} \leq 0.5382 \times A_{nd} + 1.7$ ($0.05 \times A_{nd} + 1.7$) R-value ≥ 4.40 K · m^2/W (25 $ft^2 \cdot °F \cdot h$/Btu)
6	Passage door assemblies for walk-in freezers	10 C.F.R. Appendix A for E_{daily} 10 C.F.R. Appendix B for R-value	$E_{daily} \leq 1.5069 \times A_{nd} + 4.8$ ($0.14 \times A_{nd} + 4.8$) R-value ≥ 5.64 K · m^2/W (32 $ft^2 \cdot °F \cdot h$/Btu)

Information

661 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with 10 C.F.R. §431.304 and provided to the Minister in respect of a walk-in door assembly:

(a) its E_{daily};
(b) information that indicates whether it is a display door assembly, freight door assembly or passage door assembly;
(c) information that indicates whether it is for use with a walk-in cooler or walk-in freezer; and
(d) if the product is a freight door assembly or passage door assembly, its R-value.

Walk-in Panels

Energy-using product

662 (1) A walk-in panel is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 663, a walk-in panel is not considered to be an energy-using product unless it is manufactured on or after June 5, 2017.

Energy efficiency standards

663 (1) The energy efficiency standards set out in column 2 of the table to this section apply to walk-in panels described in column 1 that are manufactured on or after June 5, 2017.

Testing standard

(2) A walk-in panel complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix B that are applicable to a *walk-in panel* as defined in section 657.

TABLE

	Column 1	Column 2
Item	Energy-using Product	Energy Efficiency Standard
1	Structural panels for walk-in coolers	R-value ≥ 4.40 K · m^2/W (25 ft^2·°F·h/Btu)
2	Structural panels for walk-in freezers	R-value ≥ 5.64 K · m^2/W (32 ft^2·°F·h/Btu)
3	Floor panels	R-value ≥ 4.93 K · m^2/W (28 ft^2·°F·h/Btu)

Information

664 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with 10 C.F.R. Appendix B and provided to the Minister in respect of a walk-in panel:

(a) its R-value;
(b) information that indicates whether it is a structural panel or floor panel; and
(c) if it is a structural panel, information that indicates whether it is for use with a walk-in cooler or walk-in freezer.

Walk-in Refrigeration Systems

Energy-using product

665 (1) A walk-in refrigeration system is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 666, a walk-in refrigeration system is not considered to be an energy-using product unless it is manufactured on or after January 1, 2020.

Energy efficiency standards

666 (1) The following energy efficiency standards apply to a walk-in refrigeration system that is manufactured on or after January 1, 2020:

(a) if its condenser is designed and marketed only for use indoors, the product must have an annual walk-in energy factor of 1.644 or more;
(b) if its condenser is designed and marketed only for use outdoors, the product must have an annual walk-in energy factor of 2.227 or more; and
(c) if its condenser is designed and marketed for use both indoors and outdoors, the product must meet the energy efficiency standards set out in paragraphs (a) and (b).

Testing standard

(2) A walk-in refrigeration system complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix C that are applicable to a *walk-in refrigeration system* as defined in section 657.

Information

667 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with 10 C.F.R. Appendix C and provided to the Minister in respect of a walk-in refrigeration system:

(a) its annual walk-in energy factor; and
(b) information that indicates whether it is designed and marketed for use indoors, outdoors or both.

77 (1) The definition *CSA C802.2-12* in section 703 of the English version of the Regulations is replaced by the following:

CSA C802.2-12 means the CSA standard CAN/CSA-C802.2-12 entitled *Minimum efficiency values for dry-type transformers*. (*CSA C802.2-12*)

(2) Section 703 of the Regulations is amended by adding the following in alphabetical order:

10 C.F.R. Appendix A means Appendix A to Subpart K, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Distribution Transformers*, as amended from time to time. (*appendice A 10 C.F.R.*)

78 (1) Subsection 705(1) of the Regulations is replaced by the following:

Energy efficiency standards — manufactured before January 1, 2016

705 (1) In respect of dry-type transformers that were manufactured on or after January 1, 2005 and before January 1, 2016, the energy efficiency standards set out in column 2 of the table to this section apply to dry-type transformers that were manufactured during the periods set out in column 3.

(2) The portion of item 2 of the table to section 705 of the Regulations in column 3 is replaced by the following:

	Column 3
Item	**Period of Manufacture**
2	On or after January 1, 2010 and before January 1, 2016

79 Section 706 of the Regulations is replaced by the following:

Energy efficiency standard — single-phase and 1.2 kV voltage class

705.1 (1) In respect of dry-type transformers that are single-phase, in the 1.2 kV voltage class and manufactured on or after January 1, 2016, the energy efficiency standards set out in column 2 of Table 1 to this section apply to dry-type transformers that have a kVA rating described in column 1.

Energy efficiency standards — single-phase and voltage class greater than 1.2 kV

(2) In respect of dry-type transformers that are single-phase, in a voltage class greater than 1.2 kV and manufactured on or after January 1, 2016, the energy efficiency standards that are set out in relation to the product's BIL rating set out in column 2 of Table 2 to this section apply to dry-type transformers that have a kVA rating set out in column 1.

Interpolation

(3) For the purposes of subsections (1) and (2), if the kVA rating of the product falls between the kVA ratings set out in two consecutive items in column 1 of the applicable table to this section, the energy efficiency standard for the product is an interpolation of the corresponding energy efficiency standards set out in column 2.

Testing standard

(4) A dry-type transformer complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix A that are applicable to a *dry-type transformer* as defined in section 703.

TABLE 1

	Column 1	Column 2
Item	kVA Rating	% Efficiency When Tested at 35% of Nominal Load
1	15.0	97.70
2	25.0	98.00
3	37.5	98.20
4	50.0	98.30
5	75.0	98.50
6	100.0	98.60
7	167.0	98.70
8	250.0	98.80
9	333.0	98.90

TABLE 2

	Column 1	Column 2		
		% Efficiency When Tested at 50% of Nominal Load		
Item	kVA Rating	20-45 kV BIL	> 45-95 kV BIL	> 95-199 kV BIL
1	15.0	98.10	97.86	97.60
2	25.0	98.33	98.12	97.90
3	37.5	98.49	98.30	98.10
4	50.0	98.60	98.42	98.20
5	75.0	98.73	98.57	98.53

6	100.0	98.82	98.67	98.63
7	167.0	98.96	98.83	98.80
8	250.0	99.07	98.95	98.91
9	333.0	99.14	99.03	98.99
10	500.0	99.22	99.12	99.09
11	667.0	99.27	99.18	99.15
12	833.0	99.31	99.23	99.20

Energy efficiency standards — three-phase and 1.2 kV voltage class

705.2 (1) In respect of dry-type transformers that are three-phase, in the 1.2 kV voltage class and manufactured on or after January 1, 2016, the energy efficiency standards set out column 2 of Table 1 to this section apply to dry-type transformers that have a kVA rating set out in column 1.

Energy efficiency standards — three-phase and voltage class greater than 1.2 kV

(2) In respect of dry-type transformers that are three-phase, in a voltage class greater than 1.2 kV and manufactured on or after January 1, 2016, the energy efficiency standards that are set out in relation to the product's BIL rating set out in column 2 of Table 2 to this section apply to dry-type transformers that have a kVA rating set out in column 1.

Interpolation

(3) For the purposes of subsections (1) and (2), if the kVA rating of the product falls between the kVA ratings set out in two consecutive items in column 1 of the applicable table to this section, the energy efficiency standard for the product is an interpolation of the corresponding energy efficiency standards set out in column 2.

Reduced energy efficiency standard

(4) The energy efficiency standard that is applicable to a dry-type transformer under this section is reduced by 0.11 if the transformer has multiple high-voltage windings and a voltage ratio other than 2:1.

Testing standard

(5) A dry-type transformer complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix A that are applicable to a *dry-type transformer* as defined in section 703.

TABLE 1

	Column 1	Column 2
Item	kVA Rating	% Efficiency When Tested at 35% of Nominal Load
1	15.0	97.89
2	30.0	98.23
3	45.0	98.40
4	75.0	98.60
5	112.5	98.74
6	150.0	98.83
7	225.0	98.94

8	300.0	99.02
9	500.0	99.14
10	750.0	99.23
11	1 000.0	99.28

TABLE 2

	Column 1	Column 2		
		% Efficiency When Tested at 50% of Nominal Load		
Item	kVA Rating	20-45 kV BIL	> 45-95 kV BIL	> 95-199 kV BIL
1	15.0	97.50	97.18	96.80
2	30.0	97.90	97.63	97.30
3	45.0	98.10	97.86	97.60
4	75.0	98.33	98.13	97.90
5	112.5	98.52	98.36	98.10
6	150.0	98.65	98.51	98.20
7	225.0	98.82	98.69	98.57
8	300.0	98.93	98.81	98.69
9	500.0	99.09	98.99	98.89
10	750.0	99.21	99.12	99.02
11	1 000.0	99.28	99.20	99.11
12	1 500.0	99.37	99.30	99.21
13	2 000.0	99.43	99.36	99.28
14	2 500.0	99.47	99.41	99.33
15	3 000.0	99.47	99.41	99.33
16	3 750.0	99.47	99.41	99.33
17	5 000.0	99.47	99.41	99.33
18	7 500.0	99.48	99.41	99.39

Information

706 (1) For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a dry-type transformer:

(a) if applicable, information that indicates whether the transformer is in the 1.2 kV voltage class;
(b) its BIL rating;
(c) if applicable, information that indicates whether the transformer is a three-phase transformer that has multiple high-voltage windings and a voltage ratio other than 2:1;

(d) its kVA rating;
(e) its phase — namely, single-phase or three-phase;
(f) the tested efficiency, expressed as a percentage;
(g) the loss, expressed in watts, when it is under load and when it is not under load; and
(h) if it is manufactured on or after January 1, 2010, the impedance, expressed as a percentage.

Standard

(2) The information must be collected in accordance with one of the following standards:

(a) CSA C802.2-12, if the product was manufactured on or after January 1, 2005 and before January 1, 2016; or
(b) 10 C.F.R. Appendix A, if the product is manufactured on or after January 1, 2016.

80 Sections 749 to 797 of the Regulations are replaced by the following:

SUBDIVISION A

Electric Motors

Definitions

749 The following definitions apply in this Subdivision.

CSA C390-10 means the CSA standard CSA C390-10 entitled *Test methods, marking requirements, and energy efficiency levels for three-phase induction motors*. (*CSA C390-10*)

electric motor means a machine that converts electrical power into rotational mechanical power and that

(a) is an electric three-phase induction design;
(b) is one of the following designs:
(i) a NEMA design A, B or C with a three- or four-digit NEMA frame number,
(ii) an enclosed NEMA design A, B or C with a NEMA frame number of 56, or
(iii) an IEC design N or H with an IEC frame number of 80 or above;
(c) has a nominal output power of not less than 0.75 kW (1 horsepower) and not more than 375 kW (500 horsepower);
(d) has a cage or squirrel-cage design;
(e) is rated for continuous duty or S1 operation;
(f) is designed to operate at a single speed;
(g) has a nominal voltage of not more than 600 V AC;
(h) has a nominal frequency of 50 Hz, 50/60 Hz or 60 Hz;
(i) has a two-, four-, six- or eight-pole construction;
(j) has an open or enclosed construction; and
(k) has an IP code from 00 to 67.

It does not include any of the following:

(l) a motor that is cooled by air that is forced over the motor by a fan or blower that is not an integral part of the motor;
(m) a liquid-cooled motor;
(n) an inverter-only motor; or
(o) a motor that is designed to operate continuously only while immersed. (*moteur électrique*)

explosion-proof motor means an electric motor

(a) in respect of which measures have been taken to prevent excessive temperatures and the production of arcs or sparks by the motor; or
(b) that is encased in an enclosure that can withstand the explosion of any flammable gas or vapour that might enter it, without being damaged and without transmitting the explosion to the outside. (*moteur antidéflagrant*)

footless means, in respect of an electric motor, that it does not have feet or detachable feet or that it is not designed to receive detachable feet. (*sans pieds*)

IEC 60034-5 means the IEC standard CEI/IEC 60034-5: 2006 entitled *Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electric machines (IP code) - Classification*. (*CEI 60034-5*)

IEC 60529 means the IEC standard CEI/IEC 60529: 2013 entitled *Degrees of Protection Provided by Enclosures (IP Code)*. (*CEI 60529*)

IEEE 112-2004 means the IEEE standard IEEE 112-2004 entitled *Standard Test Procedure for Polyphase Induction Motors and Generators*. (*IEEE 112-2004*)

integral gear assembly means a product that consists of an electric motor and a gear mechanism that are combined in such a manner that

(a) the end bracket or mounting flange forms an integral part of both the motor and the gear mechanism; and
(b) if the motor and the gear mechanism are separated, only one of them remains intact. (*assemblage d'engrenages intégrés*)

IP code means the classification of the degree of protection provided by an enclosure, as set out in IEC 60034-5, IEC 60529 or NEMA MG-1. (*code IP*)

NEMA MG-1 means the NEMA standard MG 1-2014 entitled *NEMA Standards Publication No. MG 1-2014 Motors and Generators*. (*NEMA MG-1*)

Energy-using product

750 (1) An electric motor is prescribed as an energy-using product.

Limits

(2) However, for the purposes of sections 4, 5, 751 and 752, an electric motor is not considered to be an energy-using product if

(a) it was manufactured before February 3, 1995;
(b) it was manufactured before November 27, 1999 and is an explosion-proof motor or is part of an integral gear assembly;
(c) it was manufactured before January 1, 2011 and it
(i) has an eight-pole construction,
(ii) has NEMA U frame dimensions,
(iii) is a NEMA design C or an IEC design H,
(iv) is a close-coupled pump motor,
(v) is a vertically mounted solid shaft normal thrust motor,
(vi) is a fire-pump motor or other NEMA design B motor with a nominal output power of more than 150 kW (200 horsepower) or is an IEC design N motor with a nominal output power of more than 150 kW (200 horsepower), or
(vii) is footless;
(d) it was manufactured before June 1, 2016 and it
(i) is a NEMA design A with a nominal output power of more than 150 kW (200 horsepower),
(ii) is an enclosed NEMA design with a NEMA frame number of 56,
(iii) has NEMA frame dimensions other than T or U,
(iv) has an IEC frame number of 80 or more but less than 90,
(v) is a partial electric motor, a brake motor or a vertical hollow shaft motor,
(vi) is designed to operate continuously in free air, but can operate continuously for a period of at least 30 minutes while completely immersed,
(vii) has a separately powered blower,
(viii) has a base, end shields or flanges that are not within the dimensions specified in NEMA MG-1, or
(ix) has a NEMA shaft that is not a standard shaft, R-shaft or S-shaft, as specified in NEMA MG-1; or
(e) it was manufactured before June 1, 2017 and is a medical-imaging motor.

Energy efficiency standards

751 (1) The energy efficiency standards set out in column 3 of the table to this section apply to electric motors described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) An electric motor complies with the energy efficiency standard if it meets the standard when tested at 100% of its nominal full load in accordance with testing procedures established by the standard set out in column 2 that are applicable to an *electric motor* as defined in section 749.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Electric motors that are fire-pump motors	CSA C390-10	CSA C390-10, Table 2	On or after February 3, 1995
2	Electric motors that are medical-imaging motors	CSA C390-10 or IEEE 112-2004	NEMA MG-1, Table 12-12	On or after June 1, 2017
3	Electric motors that are part of an integral gear assembly;	CSA C390-10	CSA C390-10, Table 2	On or after November 27, 1999 and before June 1, 2016
4	Electric motors that are close-coupled pump motors	CSA C390-10	CSA C390-10, Table 2	On or after January 1, 2011 and before June 1, 2016
5	Electric motors that are vertically-mounted solid shaft normal thrust motors	CSA C390-10	CSA C390-10, Table 2	On or after January 1, 2011 and before June 1, 2016
6	Electric motors that **(a)** have an eight-pole construction; **(b)** have NEMA U frame dimensions; **(c)** are a NEMA design C or an IEC design H; **(d)** have a nominal output power of more than 150 kW (200 HP) and are a NEMA design B or an IEC design N; or **(e)** are footless.	CSA C390-10	CSA C390-10, Table 2	On or after January 1, 2011 and before June 1, 2016
7	Electric motors other than motors described in items 1 to 6	CSA C390-10	CSA C390-10, Table 3	On or after February 3, 1995 and before June 1, 2016
8	Electric motors other than fire-pump motors or medical-imaging motors	CSA C390-10 or IEEE 112-2004	NEMA MG-1, Table 12-12	On or after June 1, 2016

Information

752 For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of an electric motor:

(a) in respect of an electric motor for which a unique motor identifier was not provided under paragraph 5(1)(c),

(i) its nominal output power, expressed in kilowatts (horsepower),

(ii) the number of poles, and

(iii) its construction — namely, open construction or enclosed construction; and

(b) in respect of an electric motor described in column 1 of the table to this section, the information set out in column 3, which must be collected in accordance with the standard set out in column 2.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
1	Electric motors manufactured on or after February 3, 1995 and before June 1, 2016	CSA C390-10	**(a)** nominal efficiency value; **(b)** NEMA or IEC design of motor; **(c)** frame type; **(d)** motor configuration, namely, close-coupled pump motor, vertically mounted solid shaft normal thrust motor, fire-pump motor or motor that is part of an integral gear assembly; **(e)** shaft type; **(f)** mounting type; and **(g)** motor configuration, namely, footless, with feet or with detachable feet.
2	Electric motors manufactured on or after June 1, 2016	CSA C390-10 or IEEE 112-2004	**(a)** nominal efficiency value; **(b)** NEMA or IEC design of motor; and **(c)** motor configuration, namely, fire-pump motor, medical-imaging motor or another configuration.

SUBDIVISION B

Small Electric Motors

Definitions

753 The following definitions apply in this Subdivision.

CSA C747-09 means the CSA standard CSA C747-09 entitled *Energy efficiency test methods for small motors*. (*CSA C747-09*)

IEEE 114-2010 means the IEEE standard IEEE 114-2010 entitled *IEEE Standard Test Procedure for Single-Phase Induction Motors*. (*IEEE 114-2010*)

small electric motor means a machine that converts electrical power into rotational mechanical power and that

(a) has a nominal output power of not less than 0.18 kW (0.25 horsepower) and not more than 2.2 kW (3 horsepower);
(b) is a NEMA design with a two-digit frame number or an IEC design with a frame number of 63 or 71;
(c) has a nominal frequency of 50/60 Hz or 60 Hz;
(d) has a two-, four- or six-pole construction;
(e) operates using alternating current;
(f) is one of the following types, namely, capacitor-start capacitor-run, capacitor-start induction-run or polyphase;
(g) has an open construction;
(h) is rated for continuous duty or S1 operation;
(i) is designed to operate at a single speed; and
(j) is designed as a general purpose motor.

It does not include a split-phase motor, shaded pole motor or permanent split-capacitor motor. (*petit moteur électrique*)

10 C.F.R. §431.446 means section 431.446 of Subpart X, Part 431 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §431.446*)

Energy-using product

754 (1) A small electric motor is prescribed as an energy-using product.

Limits

(2) However, for the purposes of sections 4, 5 and 755, a small electric motor is not considered to be an energy-using product if it was manufactured before March 9, 2015 or it is incorporated into any other product that is subject to these Regulations.

Energy efficiency standards

755 (1) The energy efficiency standards set out in the applicable table in paragraph (a) of 10 C.F.R. §431.446 apply to a small motor.

Testing standard

(2) A small electric motor complies with the energy efficiency standard if it meets that standard when

(a) the product's average full load efficiency is determined using horsepower and kilowatt ratings that are determined in accordance with paragraph (b) of 10 C.F.R. §431.446;
(b) the product is tested at 100% of its nominal full load; and
(c) the product is tested in accordance with testing procedures established by one of the following standards that are applicable to a *small electric motor* as defined in section 753:
(i) if the motor is polyphase and has a nominal output power ≥ 0.18 kW (0.25 horsepower) but ≤ 0.75 kW (1 horsepower), CSA C747-09 or IEEE 112-2004, Test Method A,
(ii) if the motor is polyphase and has a nominal output power > 0.75 kW (1 horsepower) but ≤ 2.2 kW (3 horsepower), CSA C390-10 or IEEE 112-2004, Test Method B, or
(iii) if the motor is capacitor-start capacitor-run or capacitor-start induction-run, CSA C747-09 or IEEE 114-2010.

Information

756 (1) For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a small electric motor:

(a) its average full load efficiency;
(b) its type, namely, capacitor-start capacitor-run, capacitor-start induction-run or polyphase; and
(c) if the motor is one for which a unique motor identifier has not been provided under paragraph 5(1)(c), its nominal output power expressed in kilowatts (horsepower) and the number of poles.

Standard

(2) The information must be collected in accordance with one of the following standards:

(a) if the motor is polyphase and has a nominal output power ≥ 0.18 kW (0.25 horsepower) but ≤ 0.75 kW (1 horsepower), CSA C747-09 or IEEE 112-2004, Test Method A;
(b) if the motor is polyphase and has a nominal output power > 0.75 kW (1 horsepower) but ≤ 2.2 kW (3 horsepower), CSA C390-10 or IEEE 112-2004, Test Method B; or
(c) if the motor is capacitor-start capacitor-run or capacitor-start induction-run, CSA C747-09 or IEEE 114-2010.

[757 to 799 reserved]

DIVISION 13

Commercial Pre-Rinse Spray Valves

Definitions

800 The following definitions apply in this Division.

commercial pre-rinse spray valve means a handheld device for spraying water on food service items, that has a release-to-close valve and is designed and marketed to be used in conjunction with commercial dishwashing or commercial ware washing equipment. (*pulvérisateur de prérinçage commercial*).

10 C.F.R. §431.264 means the test method set out in section 431.264 of Subpart O, Part 431 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §431.264*)

10 C.F.R. §431.266 means the table to paragraph 431.266(b) of Subpart O, Part 431 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §431.266*)

Energy-using product

801 (1) A commercial pre-rinse spray valve is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 802, a commercial pre-rinse spray valve is not considered to be an energy-using product unless it is manufactured on or after June 27, 2016.

Energy efficiency standards

802 (1) The energy efficiency standards set out in column 2 of the table to this section apply to commercial pre-rinse spray valves described in column 1 that are manufactured during the periods set out in column 3.

Testing standard

(2) A commercial pre-rinse spray valve complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. §431.264 that are applicable to a *commercial pre-rinse spray valve* as defined in section 800.

TABLE

	Column 1	Column 2	Column 3
Item	Energy-using Product	Energy Efficiency Standard	Period of Manufacture
1	Commercial pre-rinse spray valves	Maximum water flow rate ≤ 6.1 L/min (1.6 gallons/min)	On or after June 27, 2016 and before January 28, 2019
2	Commercial pre-rinse spray valves that have a spray force ≤ 1.39 N (5.0 ounce-force)	Maximum water flow rate ≤ flow rate for "Product Class 1" commercial pre-rinse spray valve set out in 10 C.F.R. §431.266	On or after January 28, 2019
3	Commercial pre-rinse spray valves that have a spray force > 1.39 N (5.0 ounce-force) but ≤ 2.22 N (8.0 ounce-force)	Maximum water flow rate ≤ flow rate for "Product Class 2" commercial pre-rinse spray valve set out in 10 C.F.R. §431.266	On or after January 28, 2019
4	Commercial pre-rinse spray valves that have a spray force > 2.22 N (8.0 ounce-force)	Maximum water flow rate ≤ flow rate for "Product Class 3" commercial pre-rinse spray valve set out in 10 C.F.R. §431.266	On or after January 28, 2019

Information

803 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with 10 C.F.R. §431.264 and provided to the Minister in respect of a commercial pre-rinse spray valve:

(a) the maximum water flow rate, in litres per minute (gallons per minute); and
(b) if it is manufactured on or after January 28, 2019, the spray force in newtons (ounce-force).

81 The Regulations are amended by replacing "ANSI C79.1" with "ANSI C78.79" in the following provisions:

(a) paragraphs 433(1)(e), (f) and (o);
(b) paragraph 436(a);
(c) paragraphs 437(1)(d), (e), (i) and (o); and
(d) paragraph 440(a).

Coming into Force

Six months after publication

82 (1) These Regulations, other than sections 3, 4 and 38 to 41, come into force on the day that, in the sixth month after the month in which they are published in the *Canada Gazette*, Part II, has the same calendar number as the day on which they are published or, if that sixth month has no day with that number, the last day of that sixth month.

On publication

(2) Sections 3, 4 and 38 to 41 come into force on the day on which these Regulations are published in the *Canada Gazette*, Part II.

REGULATORY IMPACT ANALYSIS STATEMENT

(*This statement is not part of the Regulations.*)

Executive summary

Issues: Greenhouse gases are primary contributors to climate change, which has an impact on Canada's economy and environment. Canada's building sector represents a significant portion of national greenhouse gas emissions given the amount of energy used to heat space and water and the amount of electricity this sector consumes from the grid. National policies and strategies such as the Pan-Canadian Framework on Clean Growth and Climate Change, the Canadian Energy Strategy, *Build Smart – Canada's Building Strategy*, and the recent report from the Generation Energy Council demonstrate the important role of energy efficiency and the Government of Canada's commitments to improve energy efficiency standards for appliances and equipment and take action on climate change. The Government of Canada is also committed to reducing regulatory burden through alignment with the United States (U.S.) given the integrated nature of the markets. Achieving these commitments will provide benefits to Canadians through energy cost savings and improved environmental outcomes, which lead to increased productivity, competitiveness and energy affordability.

In December 2016, First Ministers adopted the Pan-Canadian Framework on Clean Growth and Climate Change, which presents the country's plan to reduce greenhouse gas emissions to at least 30% below 2005 levels by 2030, grow the economy, and build resilience to a changing climate. Further mitigation efforts are needed to support the achievement of Canada's greenhouse gas emissions reduction target. Ministers also agreed to work collaboratively on energy efficiency standards in the building sector. This builds on the August 2016 publication of a framework and action plan for energy efficiency standards under the Energy and Mines Ministers' Conference and collaborative efforts with provinces and territories to implement the Canadian Energy Strategy.

In March 2016, the Prime Minister of Canada and the President of the United States committed to better align and further improve energy efficiency standards by 2020. This builds on the 2014 Canada–United States Regulatory Cooperation Council commitment to align new and updated energy efficiency standards and test methods. The support for continued bilateral regulatory cooperation was reaffirmed in the February 2017 joint statement by Prime Minister Trudeau and President Trump. Since 2011, the U.S. Department of Energy has implemented changes to its regulations across several product categories. These changes have to be implemented in Canada to reduce unnecessary regulatory differences, support cross-border trade and investment, and ultimately reduce costs to citizens, businesses and economies.

Description: This amendment to the *Energy Efficiency Regulations, 2016* [the Amendment] (a) introduces minimum energy performance standards, labelling and reporting requirements for six new product categories; (b) introduces more stringent minimum energy performance for 11 currently regulated product categories; (c) makes minor changes to existing standards,

test procedures or reporting requirements for currently regulated product categories; and (d) provides flexibility for testing requirements and removes import reporting requirements for certain product categories.

Cost-benefit statement: The benefits and costs associated with the Amendment have been estimated using a methodology consistent with that used for the *Energy Efficiency Regulations, 2016*, with previous modifications to the *Energy Efficiency Regulations* and with other energy efficiency regulators, such as the U.S. Department of Energy. Based on this methodology, the present value of net benefits of the Amendment is estimated to be $4.55 billion by 2030, with total benefits exceeding total costs by a ratio of almost five to one. By 2030, the present value of benefits and costs from the Amendment is estimated to be $5.75 billion and $1.20 billion, respectively. On an annualized average basis, this equates to benefits and costs of $724 million and $152 million, respectively.

The quantified benefits are calculated as the sum of the energy savings over the service life of products shipped by 2030 and the benefits of reductions in greenhouse gas emissions. The quantified costs include incremental technology costs to meet the more stringent standards, and incremental costs to Government associated with regulatory implementation. The retail prices for regulated energy-using products may increase if incremental technology costs are passed on to consumers. These costs will be more than recovered through energy savings. The analysis found payback ranges of less than eight years for all product categories, with nine product categories having paybacks of two years or less.

The Amendment is estimated to result in an annual reduction of 1.54 megatonnes (Mt) of greenhouse gas emissions in 2030. For industries using regulated energy-using products, improvements in energy efficiency translate into energy and operating cost savings, which in turn lead to increased productivity and competitiveness.

“One-for-One” Rule and small business lens: The Amendment is considered an “OUT” under the “One-for-One” Rule. While the Amendment will increase some administrative costs via the introduction of regulatory requirements for new product categories, these will be more than offset by the elimination of import reporting requirements for certain existing products. The Amendment will thus result in a net $543,896 reduction in annualized average administrative costs to affected businesses.

The small business lens applies, given that the Amendment impacts small business importers of affected products. However, the impact on these small businesses is a net reduction in administrative costs resulting from the elimination of import reporting requirements.

Domestic and international coordination and cooperation: Implementation of the Amendment will reduce unnecessary regulatory differences between Canada and the United States, consistent with binational commitments made under the Canada–United States Regulatory Cooperation Council, and the commitments made by the Prime Minister of Canada and the President of the United States. It also supports the objectives of the *Memorandum of Understanding between the Treasury Board of Canada Secretariat and the United States Office of Information and Regulatory Affairs Regarding the Canada-United States Regulatory Cooperation Council* signed in June 2018. The Amendment seeks to foster alignment of federal regulations where feasible and appropriate. Domestically, the Amendment will reduce regulatory differences that exist between federal and provincial regulations.

Background

In 1992, Parliament passed Canada’s *Energy Efficiency Act* (the Act) and amended multiple times since then. The Act provides for the making and enforcement of regulations requiring energy-using products that are imported or shipped inter-provincially for the purpose of sale or lease to meet minimum energy performance standards (MEPS), [2] for product labelling, and for the promotion of energy efficiency and alternative energy use, including the collection of data and statistics on energy use.

The *Energy Efficiency Regulations* were introduced in 1995 as a means to reduce greenhouse gas (GHG) emissions in Canada. In 2016, the *Energy Efficiency Regulations* were repealed and replaced to remove references to obsolete and out-of-date standards and improve the organization of the regulatory text and became the *Energy Efficiency Regulations, 2016* (the Regulations). The Regulations prescribe MEPS for certain consumer and commercial energy-using products. They also prescribe labelling requirements for certain products to disclose and compare the energy use of a given product model relative to others in their category. They are regularly amended to introduce new energy-using products and to update existing requirements.

Since most energy-using products must cross provincial or international borders to reach their markets, federally prescribed MEPS are an effective tool to raise the level of energy efficiency in Canada. Prescribed MEPS are one component of Canada's program to reduce GHG emissions and energy consumption associated with energy-using products because they eliminate the least efficient product models from the market. Natural Resources Canada also administers the ENERGY STAR® labelling program, which sets voluntary specifications for 75 product categories that identify the top 15 to 30% of energy efficiency performers, making the choice of energy-efficient products simple for consumers and businesses.

When combined, MEPS and labelling programs drive product innovation by raising requirements for minimum energy performance to pull the market forward with labels to inform consumers of top performing products. Through cycles of continuous improvement, this approach eliminates the least efficient products while encouraging innovation as manufacturers produce products to achieve increasing ENERGY STAR levels, making affordable, higher efficiency products available to consumers and businesses. MEPS and labelling programs are among the most cost-effective GHG reduction policies and are the cornerstone of energy efficiency and climate change programs in more than 80 countries. [3]

Policy context

Canada committed to reduce its GHG emissions by 30% below 2005 levels by signing the Paris Agreement in 2015. Building on this commitment, First Ministers agreed to take ambitious action in support of meeting or exceeding this target. They also agreed that a collaborative approach between provincial, territorial, and federal governments is important to reduce GHG emissions and to enable sustainable economic growth.

Since August 2014, Canada and the U.S. Department of Energy have worked toward a goal of aligning new and updated energy efficiency standards and test methods for common product categories. This is accomplished through enhanced information sharing and a cooperative development and implementation process, to the extent practicable and permitted by law within the context of the Canada–United States Regulatory Cooperation Council. [4]

In December 2016, First Ministers adopted the Pan-Canadian Framework for Clean Growth and Climate Change, which presents the country's plan to meet its emissions reduction targets, grow the economy, and build resilience to a changing climate. The plan outlines an approach for the building sector that consists of four elements: (1) making new buildings more energy efficient; (2) retrofitting existing buildings, as well as fuel switching; (3) supporting building codes and energy-efficient housing in Indigenous communities; and (4) improving energy efficiency for appliances and equipment.

In June 2018, the Generation Energy Council released a report that highlighted the important role that energy efficiency can play in reducing greenhouse gas emissions in Canada. According to this report, fully one third of Canada's emission reduction target could be met through improvements in energy efficiency, which would also make Canadian businesses more competitive internationally and leave more money in consumers' pockets. These conclusions are supported by an Efficiency Canada report on the economic impacts of energy efficiency, which showed that implementing strong energy efficiency programs will increase Canada's gross domestic product and job growth.

Issues

GHG emissions are primary contributors to climate change, which has an impact on Canada's economy and environment. Carbon dioxide, a by-product of fossil fuel consumption, has been identified as the most significant GHG.

Canadian homes and commercial and institutional buildings (the building sector) are significant contributors to national GHG emissions. The building sector accounted for about 17% of national GHG emissions in 2014. The level of emissions in the building sector is impacted by the energy-using products it contains. Equipment that combusts fuel to generate heat leads to direct carbon dioxide emissions at the site, while equipment that consumes electricity contributes to GHG emissions at the point of generation.

GHG emissions from Canadian homes declined by 1 Mt between 2005 and 2015, and are projected to decline by a further 3 Mt between 2015 and 2030. This is despite an expected 36% increase (or 4,4 million) in the number of Canadian households (a key driver of residential emissions growth) between 2005 and 2030. GHG emissions from Canada's commercial buildings increased by 1 Mt between 2005 and 2015, and are expected to remain relatively constant through 2030, despite an expected 32% increase in floor space from 2005 to 2030. [5] While technologies exist in the Canadian market to provide incremental reductions in GHG emissions and energy consumption in the building sector, there are market barriers that lead to consumers making economic or environmental choices with respect to energy efficiency that are less than optimal. These include a lack of

awareness and information available to consumers regarding energy-saving opportunities and actual energy use, a lack of capacity within organizations to understand and manage energy use, and split incentives (e.g. landlords may not purchase efficient equipment if tenants pay the energy bill).

In 2011, the Canada–United States Regulatory Cooperation Council stated that unnecessary regulatory differences and duplicative actions hinder cross-border trade and investment and ultimately impose a cost on citizens, businesses and economies. [6] Since 2011, the U.S. Department of Energy has implemented changes to its regulations across several product categories, by applying MEPS to new product categories, increasing the stringency of MEPS for some currently regulated product categories, and updating test procedures. These changes have not yet been made in Canada, which has resulted in an increasing number of unnecessary regulatory differences. In 2014, Natural Resources Canada and the U.S. Department of Energy established a goal of aligning new and updated energy efficiency standards and test methods under the Canada–United States Regulatory Cooperation Council.

Regulatory action is required to deliver these outcomes, given that voluntary measures will not be sufficient to phase out some low-efficiency product models from the Canadian market. It is also required to address unnecessary regulatory differences between Canada and the United States.

Objectives

The goals of the Amendment are to

- reduce GHG emissions and energy consumption associated with 17 product categories;
- reduce load on the electricity system associated with the building sector;
- reduce energy costs incurred by consumers and businesses; and
- reduce unnecessary regulatory differences between Canadian and U.S. regulations across new and existing product categories to support cross-border trade.

The desired outcomes of the Amendment are as follows:

- GHG emissions are reduced, contributing to Canada’s goal to reduce GHG emissions by at least 30% below 2005 levels by 2030;
- Electricity demand associated with space and water heating is reduced to contribute capacity to the electrification of other economic sectors;
- Consumers and businesses save money by purchasing higher efficiency product models that have lower costs over their lifetime;
- Businesses using regulated energy-using products experience cost savings that can lead to increased productivity and competitiveness; and
- Businesses benefit from common North American test procedures and MEPS for more product categories; therefore, obstacles to trade are reduced.

Description

The Amendment (a) introduces MEPS, labelling and reporting requirements for six new product categories; (b) introduces more stringent MEPS for eleven currently regulated product categories; (c) makes minor changes to existing standards, test procedures or reporting requirements for currently regulated product categories; and (d) provides flexibility for testing requirements and removes import reporting requirements in limited instances where products are a component of another product. Some provisions offering flexibility to dealers, including related import reporting provisions, will come into force upon publication, while the balance of the Amendment will come into force six months after the date of publication in the *Canada Gazette*, Part II.

The MEPS established by the Amendment will apply to energy-using products that are manufactured after particular dates generally aligned with those of the United States. Only the products that have been manufactured after those dates and that are being imported into Canada or shipped between provinces after the coming-into-force date of the Amendment will be impacted.

(A) Introduce MEPS, labelling and reporting requirements for new product categories

Battery chargers

Battery chargers are used to charge the batteries of end-use products such as power tools or cell phones. For battery chargers, not including uninterruptible power supplies manufactured on or after June 13, 2019, the Amendment will align Canada's MEPS and test procedures with those applied in the United States on June 13, 2018.

Commercial pre-rinse spray valves

Commercial pre-rinse spray valves are used in commercial applications to spray hot water on dishes, flatware, and other food service items for the purpose of removing food residue before cleaning them in a commercial dishwasher. Imposing a maximum flow rate would limit the quantity of hot water passing through the product, thereby lowering the energy used by the associated hot water heater.

- For products manufactured on or after June 27, 2016, and before January 28, 2019, the Amendment will align the Canada's MEPS and test procedures with those applied in the United States on those same dates.
- For products manufactured on or after January 28, 2019, the Amendment will align the Canada's MEPS and test procedures with those that will apply in the United States on that date.

Metal halide lamp ballasts

Metal halide lamp ballasts are used to start and maintain the flow of electricity to metal halide lamps that are commonly used for large area overhead lighting of commercial, industrial, and public spaces, such as parking lots, sports arenas, factories, and retail stores. For metal halide lamp ballasts manufactured on or after February 10, 2017 (December 31, 2017, for 347 volt capable ballasts), not including replacement metal halide lamp ballasts, the Amendment will align the MEPS and test procedures with those applied in the United States on February 10, 2017.

Microwave ovens

Microwave ovens are used in residential applications to cook or heat food by means of microwave energy. For products manufactured on or after March 31, 2019, the Amendment will align the MEPS and test procedures with those applied in the United States on June 17, 2016.

Small electric motors

Small electric motors are used in commercial and industrial applications to convert electrical power into mechanical power for equipment such as compressors and pumps. They can operate on single or polyphase power and range in size from 0.18 kW (0.25 horsepower) up to 2.2 kW (3 horsepower). For products manufactured on or after March 9, 2015, the Amendment will align MEPS and test procedures with those applied in the United States on that date.

Walk-in coolers and walk-in freezers

Walk-in coolers and walk-in freezers are enclosed storage spaces of less than 278.71 m^2 used primarily in the food service and food sales industry to temporarily store refrigerated or frozen food or other perishable goods. The Amendment applies to walk-in panels, walk-in door assemblies and walk-in refrigeration systems.

- For walk-in panels and walk-in door assemblies manufactured on or after June 5, 2017, the Amendment will align the Canada's MEPS, test procedures and labelling with those of the United States.
- For walk-in refrigeration systems (dedicated condensing) manufactured on or after January 1, 2020, the Amendment will align the MEPS and test procedures with those that will be applied in the United States on that same date.

(B) Introduce more stringent MEPS for currently regulated product categories

Ceiling fan light kits

Ceiling fan light kits add a lighting function to a ceiling fan. For products manufactured on or after January 7, 2019, the Amendment will introduce more stringent MEPS to reduce the maximum power for lighting from 190 W to 70 W. These standards are not completely aligned with those in the United States, which require that these products be packaged with lamps to fill all sockets. Therefore, the U.S. standards prescribe minimum lamp efficacy rather than a maximum wattage that

will be required by the Amendment. The Act does not provide Natural Resources Canada with the authority to require that lamps be included with ceiling fans for sale in Canada, but the Amendment will provide an equivalent degree of energy efficiency to that provided by the U.S. requirements.

Commercial refrigerators, refrigerator-freezers and freezers

Commercial refrigerators, refrigerator-freezers and freezers that are self-contained are used by commercial establishments to keep food cold or frozen. They are commonly found in convenience stores, grocery stores and restaurants, as well as a number of other businesses that sell food, such as drug stores and gas stations. The Amendment will expand the scope to include commercial refrigerators, freezers and refrigerator-freezers with remote condensing units, as well as ice-cream freezers, and will require that these products comply with MEPS that are equivalent to those in the United States since 2012. These products are often used in supermarkets to store and display refrigerated or frozen food, beverages or perishable goods. In addition, more stringent MEPS will be applied to all products in the expanded scope (both self-contained and remote) manufactured on or after March 27, 2017, to align the Canada's MEPS and test procedures with those applied in United States on that date.

Dehumidifiers

Dehumidifiers are used in residential applications to remove moisture from the air. For products manufactured on or after June 13, 2019, the Amendment will align MEPS and test procedures with those that will apply in the United States on that same date. This will include expanding the scope to include whole-home dehumidifiers that are designed to be installed with a ducted system.

Dry-type transformers

Dry-type transformers are used in commercial applications such as office buildings or hotels to change voltage, either to step up or step down, depending on the end-use requirement. For products manufactured on or after January 1, 2016, the Amendment will align Canada's MEPS and test procedures with those applied in the United States on that same date.

External power supplies

External power supplies (EPS) are used to supply power to a variety of electronic products such as laptop computers, printers and cordless phones. An EPS converts one type of electrical power into another that is suitable for the end-use product. For products manufactured on or after July 1, 2017, the Amendment will align the MEPS and test procedures with those of the United States. The Amendment will align Canada's periods of manufacture with those in Ontario. [7] This will include dividing the currently regulated energy-using products into "direct" and "indirect" EPS. The Amendment will expand the scope of direct EPS to include products with output power greater than 250 W, that supply multiple voltages, and that provide power to the battery chargers of motorized applications and detachable battery packs. Only the MEPS for direct EPS will be made more stringent.

Fluorescent lamp ballasts

Fluorescent lamp ballasts start and maintain the flow of electricity to tube lights that are commonly used for overhead lighting in offices and commercial spaces. For products manufactured on or after November 14, 2014, the Amendment will expand the scope of the category to align Canada's requirements with the current U.S. requirements.

Gas furnaces

Gas furnaces are used in residential applications to provide heat and are installed as part of a home's central heating system. For products manufactured on or after July 3, 2019, the Amendment will align Canada's MEPS and test procedures applicable to the electrical consumption of a furnace fan with those that will apply in the United States on that date. The Amendment will not change the current minimum annual fuel utilization efficiency of gas furnaces.

Large air conditioners

Large air conditioners are used in commercial and industrial applications to remove heat from buildings (ranging from 19 kW [65 000 Btu/h] to 223 kW [760 000 Btu/h]).

- For air-cooled large air conditioners manufactured on or after January 1, 2018, the Amendment will align Canada's MEPS and test procedures with the MEPS and test procedures for integrated energy efficiency ratio (IEER) [8] that applied in the United States in 2018, in addition to the currently required energy efficiency ratio (EER).

- For water-cooled and evaporative-cooled large air conditioners manufactured on or after January 1, 2018, the Amendment will align Canada's MEPS and test procedures with those applied in the United States since 2013 and 2014 respectively.

Large heat pumps

Large heat pumps are used in commercial and industrial applications to heat and cool buildings (ranging from 19 kW [65 000 Btu/h] to 223 kW [760 000 Btu/h]). For products manufactured on or after January 1, 2018, the Amendment will align Canada's MEPS and test procedures for integrated energy efficiency ratio (IEER) that applied in the United States in 2018, in addition to the currently required energy efficiency ratio (EER) and the heating coefficient of performance at both 8.3 °C and −8.3 °C to account for Canadian conditions.

Packaged terminal air conditioners

Packaged terminal air conditioners are used for cooling commercial and institutional buildings such as hotels and nursing homes, where each room needs its own climate control. For products manufactured on or after January 1, 2017, the Amendment will align Canada's MEPS and test procedures with those applied in the United States on that date.

Oil-fired furnaces

Oil-fired furnaces are used in residential applications to provide heat and are installed as part of a home's central heating system.

- For products manufactured on or after January 1, 2017, and before July 3, 2019, the Amendment will align Canada's MEPS and test procedures with those applied in the United States since January 1, 2009. This will include changing the energy efficiency standard metric from seasonal energy utilization efficiency to annual fuel utilization efficiency.
- For products manufactured on or after July 3, 2019, the Amendment will align Canada's MEPS and test procedures with those that will be applied in the United States for furnace fan energy consumption on that same date.

(C) Make minor changes to the scope of standards, test procedures or reporting requirements

Minor changes made to currently regulated product categories are described below.

Household appliances

The Amendment will add water consumption limits for dishwashers, clothes washers and the clothes washer function of integrated clothes washer-dryers to match the water consumption limits in the United States. Imposing a maximum flow rate will limit the quantity of hot water passing through the product, reducing the energy used by the associated hot water heater.

Chillers

Chillers are used in large commercial and institutional buildings to provide space cooling. The scope of the current Regulations includes chillers that do not have an integral refrigerant condenser. Because manufacturers do not know which condenser will be matched with their products at a future date, the Amendment will reduce the product scope by excluding chillers that do not have an integral refrigerant condenser.

Electronics — Audio, video and televisions

The Amendment will update the standby mode definition to clarify that network connected standby, if applicable, is excluded. Since the introduction of standby MEPS for compact audio products, audio-visual products and televisions, new technologies and new products have become available that provide connectivity to a network. Definitions have been clarified to ensure that power consumption while data is being exchanged (i.e. when connected to a network) is not covered by the Regulations.

Gas-fired storage water heaters and oil-fired water heaters

Gas-fired storage and oil-fired water heaters provide domestic hot water for use in cooking, cleaning, and bathing, using natural gas, propane or oil as the fuel source. For products manufactured on or after January 1, 2018, the Amendment will introduce a new test procedure that has been mandatory for all products in the United States since January 1, 2018, called the Uniform

Energy Factor (UEF) test. In Canada, products may be tested using the existing energy factor (EF) test procedure or the new UEF test procedure to demonstrate compliance to the MEPS. The current EF MEPS levels have been mathematically translated to UEF MEPS in a manner consistent with existing U.S. calculations.

General service incandescent reflector lamps

The Amendment modifies the exclusions to Canada's scope to ensure alignment with that of the United States.

Large condensing units

Large condensing units are used for space cooling in commercial and industrial buildings. The current Regulations apply to large condensing units with a cooling capacity of at least 19 kW (65 000 Btu/h) but not more than 70 kW (240 000 Btu/h). Following a request by industry to maintain alignment with ASHRAE standard 90.1, the Amendment will limit the scope of large condensing units to those with a cooling capacity of at least 40 kW (135 000 Btu/h) but not more than 70 kW (240 000 Btu/h).

Electric motors

The Amendment will correct the definition of electric motors. The intent of the definition is that an electric motor must contain all of the characteristics listed in items (a) through (k) and not just a minimum of one.

Traffic signal modules

The Amendment will modify the definition of traffic signal module to reflect nominal dimensions in line with the Institute of Transportation Engineers' standard entitled *Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Circular Signal Supplement* in order to align with those of the United States.

Updated standards

In addition, there are eight [9] product categories for which incorporated standards will be updated to refer to a newer version of those standards (Canadian Standards Association, American National Standards Institute or Illumination Engineering Society).

(D) Provide flexibility for testing requirements and remove import reporting requirements for certain product categories

Mathematical model

Canada's energy efficiency compliance and enforcement regime relies on third-party verification to ensure that all energy-using products imported into Canada and shipped between provinces are compliant with the standards referenced in the Regulations. This approach requires that most prescribed products bear an energy efficiency verification mark issued by a certification body accredited by the Standards Council of Canada. This Amendment will allow certification bodies greater flexibility in determining compliance with energy efficiency standards and verifying information related to a product's energy performance by using mathematical models. This Amendment will allow certification bodies to align their programs with the U.S. regulatory alternative or alternate efficiency determination methods (AEDM) or other best practices. Certification bodies will continue to be responsible for the integrity of their verification mark and its use. This provision comes into force upon publication.

Import reporting — Incorporated products

The Amendment will provide a limited exception to import reporting for certain energy-using products that are incorporated in any other product. Natural Resources Canada has determined that import reporting is not the most effective monitoring option, and other means of monitoring compliance are available for these products. To that end, the Amendment will remove import reporting for external power supplies, motors and fluorescent lamp ballasts that are imported as a component of another product. Battery chargers and small electric motors are being added in this Amendment and will follow the same approach. Upon publication of the Amendment, Natural Resources Canada will coordinate with the Canada Border Services Agency to remove the harmonization system codes that have been flagged. This provision comes into force upon publication.

Incorporation by reference — Repeal and revoke

In the event that a jurisdiction repeals or revokes a standard or test procedure set out in its laws that is incorporated by reference in the Regulations, the Amendment will introduce a provision to ensure that the repealed standard or test procedure continues to apply for the purposes of the Regulations. This matches the approach taken by the Province of Ontario, [10] which has adopted a similar clause in its energy efficiency regulations.

Regulatory and non-regulatory options considered

Maintaining the status quo

Maintaining the status quo would lead to fewer reductions in GHG emissions and energy consumption than taking regulatory action, and will not address the compliance costs associated with unnecessary regulatory differences between Canada and the United States.

Since 2010, the market share of product models that meet the more stringent MEPS in the Amendment has increased under the status quo. These changes in market share can be attributed to a combination of the regulated industry making changes to its product offerings in response to signals from Natural Resources Canada that regulatory changes could be made, and the regulated industry providing Canada with product models that would comply with more stringent U.S. MEPS. While the market share of more efficient products has increased, many products that do not meet the more stringent MEPS remain in the Canadian market. A regulatory approach will provide incremental benefits to the status quo approach, since it will ensure that all products imported or shipped interprovincially meet the more stringent MEPS.

The status quo option would also maintain an uneven playing field across regulated markets. Businesses that updated product offerings in preparation for regulatory changes have made investments that, in some cases, direct competitors did not. Further, as new regulations have come into effect in the United States, the number of unnecessary regulatory differences between the two countries has increased.

Voluntary approach (repeal the Regulations)

Under this approach, Canada would repeal the Regulations and rely on voluntary measures to reduce GHG emissions and energy consumption associated with energy-using products. This option would eliminate compliance costs associated with unnecessary regulatory differences; however, it will not address GHG emissions and energy consumption to the extent that a regulatory approach would. It will also be a significant departure from Canada’s approach to advance energy efficiency and the intent of the Act.

A voluntary approach would result in fewer GHG emission reductions than remaining with the status quo or taking a regulatory approach. Studies have shown that in countries where MEPS have been introduced for the first time, significant energy efficiency improvements have been observed. For example, a 32% energy efficiency improvement was achieved in one year (1994–1995) when Mexico first implemented MEPS for four product categories. [11] Such improvements have translated into large reductions in energy consumption and GHG emissions. Globally, the most mature national MEPS and labelling programs covering a broad range of products are estimated to save between 10% and 25% of national energy consumption. [12] There is strong evidence to show that significant and sustained improvements in energy efficiency occur where MEPS are subject to ongoing revision and updating to keep pace with the rate of improvement in new product models entering a market. [13] Given the global evidence of the significant benefits of MEPS, a voluntary approach would mean that these benefits would not be realized.

Incremental compliance costs associated with unnecessary regulatory differences between Canada and the United States occur only in situations where both countries enforce mandatory requirements. There are product categories currently regulated in the United States that are not regulated in Canada. In these cases, the regulatory regimes are different in each country, but do not create a burden for industry, since no energy efficiency requirements need to be satisfied in Canada.

Regulatory action

Taking regulatory action to increase the stringency of MEPS for the 17 product categories affected by the Amendment will lead to incremental benefits beyond the status quo.

Regulatory action will reduce compliance costs associated with unnecessary regulatory differences, since it will align requirements for 17 product categories with those of the United States. As a result, it will reduce the burden for companies that offer the same products in the United States and Canada.

This option addresses costs associated with unnecessary regulatory differences; however, subsequent amendments will probably be required to maintain alignment where it makes sense. This option also provides the largest reductions in GHG emissions and energy consumption of the three options considered.

Benefits and costs

Summary

Reduced energy consumption, lower GHG emissions and fewer unnecessary regulatory differences will result in significant net benefits over the lifetime of affected product models. The benefits vary by individual user depending on end-use sector, geographical location and operational practices.

Annual reductions in energy consumption associated with the Amendment are estimated to be 3.76 petajoules (PJ) in 2020, and to reach 15.76 PJ in 2030 as the sale of more efficient equipment steadily replaces the pre-regulation stock.

Annual reductions in GHG emissions resulting from these reductions in energy consumption are estimated to be 0.36 Mt in 2020, and to reach 1.54 Mt in 2030. It is estimated that, by applying a social cost of carbon to these reductions, the cumulative present value of economic benefits associated with GHG emission reductions will be $899 million by 2030. [14]

Canadian consumers will also realize economic co-benefits in the form of reduced energy costs due to the implementation of the Amendment. It is estimated that almost $5 billion in cumulative present value energy savings will be realized by 2030.

The cumulative present value of incremental technology costs and costs to Government associated with the Amendment are estimated to be $1.2 billion and $0.1 million, respectively, by 2030.

The present value of net benefits of the Amendment is estimated to be $4.55 billion by 2030, with total benefits exceeding total costs by a ratio of almost five to one. By 2030, the present value of benefits and costs from the Amendment is estimated to be $5.75 billion and $1.20 billion, respectively.

For all product categories affected by the Amendment, the analysis found that the reduction in energy costs over the lifetime of the product will be greater than any additional costs to manufacturers to bring non-compliant product models into compliance with the MEPS. The retail prices for some product models may increase if incremental technology costs are passed on to consumers. These costs will be more than recovered through energy savings during the life of the product. [15] The analysis found payback periods of fewer than eight years for all product categories, with nine product categories having payback period of two years or fewer.

Benefits and costs associated with the Amendment are presented in Table 1.

Table 1: Summary of benefits and costs associated with the Amendment

Monetized benefits	Costs (as applicable)	Quantified benefits
Energy (gas and electricity) savings	Technology and installation	Energy savings (PJ)
Avoided damages because of GHG reductions	Compliance and administrative	GHG savings (Mt)
Avoided costs associated with removal of burden	Government administration	

Interested parties seeking more details on this analysis can request a copy of the cost-benefit analysis document by contacting the individual named at the end of this document.

Methodology, assumptions and data

Natural Resources Canada analyzed the economic gains to be made through the more stringent MEPS and the impact on Canadian society within a cost-benefit analysis framework. The costs and benefits associated with the Amendment were obtained by comparing the following scenarios:

- the business-as-usual case (i.e. excluding the Amendment); and
- the policy case (i.e. the business-as-usual case including the Amendment).

Business-as-usual case

The Canadian and U.S. markets for regulated product categories are highly integrated. When the same MEPS are implemented in both countries, it is generally assumed that the same product models will be available to Canadian and American consumers. Each country develops regulatory amendments independently and undertakes separate analyses of the potential economic impacts of any changes, even in cases where MEPS are aligned. For analyses conducted in support of previous amendments to the Regulations, it was assumed that incremental costs and benefits in Canada were fully the result of the Canadian amendments, with no spillover effects from the United States. This assumption is consistent with other recent federal regulations [16] and provides an assessment of the full economic impacts of regulatory changes affecting Canadians. Canada and the United States do not account for costs and benefits outside their borders as a result of their regulations. It is recognized that this assumption may underestimate or overestimate changes in the market that occur in one country in response to similar regulations being announced or implemented in the other. These changes in the market are difficult to estimate but were considered in a sensitivity analysis.

For the purpose of this analysis, the business-as-usual case was defined in terms of Canadian market conditions assessed in 2016. This base case also includes an estimate of costs, if any, associated with unnecessary regulatory differences.

Policy case

The policy case is defined as the application of the more stringent MEPS across 17 product categories relative to markets defined by studies completed in 2016. The policy case for product categories for which U.S. regulations are already in effect includes the benefits, if any, associated with the reduced compliance costs resulting from the removal of unnecessary regulatory differences.

Benchmarks

For all product categories, benchmarks are chosen to represent the product models that do not meet the more stringent MEPS. Within those benchmarks, two efficiency levels are considered: (1) the least efficient; and (2) the efficiency of the average unit impacted. Where relevant, regional sensitivities were evaluated (e.g. a heat pump would save more energy per year in a colder location).

Social cost of carbon

The social cost of carbon was used to quantify the economic benefits of reducing GHG emissions. It represents an estimate of the economic value of avoided climate change damages at the global level for current and future generations as a result of reducing GHG emissions. The estimated values of the social cost of carbon used in this assessment draw on ongoing work undertaken by Environment and Climate Change Canada [17] in collaboration with a federal interdepartmental working group and in consultation with a number of external academic experts. This work involves reviewing existing literature and other countries' approaches to valuing GHG emissions. Preliminary recommendations, based on current literature and in line with the approach adopted by the U.S. Interagency Working Group on the Social Cost of Carbon, [18] are that it is reasonable to estimate social cost of carbon values at $37.4/tonne of carbon dioxide equivalent in 2013 (in 2012$), increasing each year with the expected growth in damages.

Methodology to estimate costs

The additional or "incremental" costs associated with the Amendment were determined as the difference between the cost of the inefficient product model, represented by the selected benchmark, and the cost of a modified version of that product model that would meet the more stringent MEPS. For each product category, the potential cost of modifying the benchmark product model so that it meets the more stringent MEPS was estimated (e.g. cost of adding extra insulation to a water heater; cost of

replacing an inefficient compressor in an air conditioner). These costs were then multiplied by the number of shipments of the product models in the business-as-usual case that were estimated to have an energy performance that is worse than what is required by the MEPS. Results were combined across all affected product categories to arrive at the estimate of total costs.

Additional incremental costs related to installation and maintenance costs or to the lifetime of the product were also evaluated, as applicable. Total costs reported as being attributable to the Amendment include manufacturing, compliance and administrative costs as well as those incurred by Government to implement the changes.

Methodology to estimate benefits

Energy savings for each product category were estimated by calculating the energy used by the selected benchmark product model, by simulating how it would be normally used in a year (e.g. number of operating days). The result is compared to the energy used by the modified version of that product model that would meet the more stringent MEPS. The difference was multiplied by the number of shipments of the product models in the business-as-usual case that were estimated to have an energy performance that is worse than what is required by the MEPS and the number of years the product is expected to last, in order to arrive at the total energy savings. Results were summed across all affected product categories to arrive at the estimate of total energy saved. This was then monetized by multiplying the results by the cost of energy per unit of energy saved (i.e. dollars per kilowatt-hour).

The reductions in GHG emissions were calculated by applying fuel-specific emissions factors, consistent with those published by Environment and Climate Change Canada, to the resulting energy savings. To remain consistent with the U.S. methodology and produce more realistic GHG savings, the reductions attributable to diminished electricity consumption were calculated by applying the emission factors associated with the marginal fuels [19] used to generate the electricity that will be saved through implementation of the Amendment. To allow comparison with outcomes reported under the Pan-Canadian Framework on Clean Growth and Climate Change, the reductions in GHG emissions were also calculated by applying an average emission factor. Annual reductions in GHG emissions with the average emission factor are estimated to be 0.11 Mt in 2020, increasing to 0.45 Mt in 2030 for a cumulative reduction of 3.46 Mt by 2030. GHG emissions were monetized and incorporated into the analysis using a social cost of carbon, as calculated by Environment and Climate Change Canada.

Assumptions

Key assumptions include the following:

- Business-as-usual case reflects Canadian market conditions in 2016;
- Benefits and costs are measured in real constant 2015 dollars;
- A 3% real discount rate; [20]
- Canadian average energy prices, based on data from the reference case of the National Energy Board *Canada's Energy Future 2016: Energy Supply and Demand Projections to 2040*;
- Valuation of the GHG emissions incorporated into the analysis is based on the social cost of carbon as calculated by Environment and Climate Change Canada;
- Incremental costs for more efficient technology are assumed to be passed on to consumers or end-users; and
- Incremental costs associated with more efficient technology were estimated in 2016 and are assumed to be constant, despite evidence [21] that such costs come down with time, owing to improvements in manufacturing processes and economies of scale, as higher volumes of product models with new technology enter the market. This assumption could lead to overestimates of manufacturing costs; however, it provides a conservative assessment of overall net benefits.

Data collection and sources

Data is collected on a product-by-product basis, through market studies. It provides key inputs to the analysis such as market size; the portion of the market that does not meet the more stringent MEPS; the benchmarks that best represent that portion of the market; energy savings from the business-as-usual case to the policy case; costs of moving from the business-as-usual case to the policy case; product lifetime; and installation costs.

Results

The methodology described above was applied to all product categories to develop an estimate of the benefits and costs attributable to the Amendment. The results vary by product category depending on the magnitude of the increase in stringency of the MEPS and the estimated portion of the market that will be impacted by the Amendment. The estimated benefits and costs for each product category are presented in Table 2. These results were then aggregated to present the overall impacts of the Amendment in Table 3.

Table 2: Benefits and costs per product category

Product category		**Cumulative total for product shipped by 2030 (millions of dollars)**		
		Product costs *	Product benefits **	Product net benefits
Battery chargers		$21	$88	$66
Ceiling fan light kits		$−0.3	$64	$64
Commercial refrigeration	Remote	$72	$251	$178
	Self-contained	$101	$1,188	$1,087
Dehumidifiers		$12	$30	$18
Dry-type transformers		$13	$45	$33
External power supplies		$97	$187	$89
Fluorescent lamp ballasts		$8	$180	$172
Gas furnaces		$246	$765	$519
Large air conditioners		$127	$405	$278
Large heat pumps		$6	$19	$13
Metal halide lamp ballasts		$3	$11	$8
Oil-fired furnaces		$0	$1	$1
Small electric motors		$250	$712	$461
Pre-rinse spray valves	Tier I	$0	$212	$212
	Tier II	$0	$77	$77
Walk-in coolers/freezers	Doors	$150	$320	$169
	Systems	$95	$1,194	$1,099
Total of all product categories		**$1,202**	**$5,747**	**$4,545**

* Costs for technology and installation.

** Benefits from energy savings and GHG emission reductions.

Note: Numbers may not add up to totals due to rounding.

Table 3: Summary of benefits and costs to Canadians

Costs, benefits and distribution			Aggregate annual totals		Total cumulative present value	Average annualized over period to 2030
			2020	2030	By 2030	
A. Quantified impacts ($) [millions in 2015 prices]						
Benefits	Energy (gas and electricity) savings	Canadians	$511	$517	$4,849	$610
	Avoided damages because of GHG reductions	Canadians	$90	$102	$899	$113
	Avoided costs associated with removal of burden for incorporated products	Canadians	$0.6	$0.6	$6.6	$0.8
Total benefits			**$602**	**$620**	**$5,754**	**$724**
Costs	Technology and installation costs	Canadians	$128	$126	$1,202	$151
	Compliance and administrative costs	Canadians	$0.1	$0.1	$1	$0.1
	Government administration	Government	$0.1	$0	$0.1	$0.01
Total costs			**$129**	**$126**	**$1,203**	**$152**
Net benefits					**$4,550**	
B. Quantified impacts (in non-$)						
Positive impacts on Canadians		Energy savings (petajoules)	3.76	15.76	121.23	—
		GHG emission reductions (megatonnes)	0.36	1.54	11.78	—

Note: Numbers may not add up to totals due to rounding.

Sensitivity analysis

As discussed above, the analysis assumed that incremental costs and benefits in Canada were fully the result of the Canadian amendments with no spillover effects from the United States. It is recognized that this assumption could underestimate or overestimate changes in the market that might occur in one country in response to similar regulations being announced or implemented in the other. To assess the sensitivity of the total results of this assumption, the number of product models in the Canadian market that will be impacted by the Amendment was reduced by 25% and 50% for the 11 MEPS [22] that, at the point of this analysis, are not yet in force in either Canada or the United States. The results show the level to which the total costs could be overestimated due to this analytical assumption.

Table 4 shows how the costs and benefits change under each of these scenarios. Even if only 50% of the product models are impacted by the Amendment, the total benefit to total cost ratio remains close to four to one (total benefits: $3,435; total costs: $785). The sensitivity analysis was not applied to the other MEPS since they are already in effect in the United States. In those cases, the business-as-usual case represents the Canadian market after it has been influenced by U.S. regulations.

Table 4: Business-as-usual case sensitivity analysis

	Costs (millions)			Benefits (millions)			Net benefits (millions)		
Reduction in the number of product models impacted by the Amendment	**0%**	**25%**	**50%**	**0%**	**25%**	**50%**	**0%**	**25%**	**50%**

Total of product categories subject to sensitivity analysis	$833	$626	$417	$4,623	$3,468	$2,312	$3,789	$2,842	$1,895
Total of all product categories	$1,202	$994	$785	$5,747	$4,591	$3,435	$4,545	$3,597	$2,650

Note: Figures may not add up to totals due to rounding.

Additional benefits and costs

For industries using affected energy-using products in their operations, an improvement in energy performance translates into energy and operating cost savings, increased productivity and competitiveness and improved environmental performance. When such companies spend these energy savings on expanding their businesses or factories, they create greater demand. This generates additional economic growth and creates more jobs throughout the economy. [23] Reduced electricity consumption from regulated energy-using products also benefits the utilities by reducing peak loads and the need to add more generating capacity.

The analysis has quantified costs and benefits for each product category relative to a business-as-usual case defined by market conditions assessed in 2016. In the case of three product categories (microwave ovens, packaged terminal air conditioners and heat pumps), the assessment showed that all product models being imported into Canada or shipped between provinces comply with the more stringent MEPS. While the analysis does not attribute any costs or benefits to the implementation of the MEPS for these three product categories, this Amendment will prevent future dumping of low-efficiency product models into the Canadian market.

Another benefit of the Amendment is related to the verified energy efficiency performance data of energy-using products that is collected by Natural Resources Canada through its compliance program. The data for new energy-using products will be posted to the Natural Resources Canada website [24] and provide readily accessible information to consumers or businesses. Consumers benefit from this information since it provides them with detailed information to make informed purchase decisions. Utilities and retailers also benefit from this information, since it supports programming to promote the sale of highefficiency products.

“One-for-One” Rule

It is estimated that this Amendment will generate an increase in administrative burden of $96,280 created by the introduction of regulatory requirements for new product categories. Dealers of these new products will be required to learn about the requirements of the Regulations and submit information before and at the time of importation in accordance with subsection 5(1) of the Act.

This Amendment is proposing to reduce administrative burden by approximately $640,000 by removing the requirement for reporting information at the time of importation for three existing energy-using products (electric motors, fluorescent lamp ballasts and external power supplies) when they are incorporated into any other product. This modification will not affect dealers’ obligation to comply with all other regulatory requirements of the Regulations.

The Amendment is therefore overall considered an “OUT” under the “One-for-One” Rule because it will decrease the administrative burden and result in net annualized savings of $543,896.

Assumptions underlying administrative burden estimates

Familiarization with the Amendment

Familiarization with new information obligations is a one-time internal administrative function for manufacturers of new energy-using products. The task involves reviewing the new requirements of the Regulations and the energy efficiency reporting form which Natural Resources Canada provides each stakeholder. This one-time event is estimated to take two hours and to be undertaken by someone with a technical background with a wage rate of approximately $42. The number of stakeholders impacted is estimated at 665, which represents the total number of manufacturers identified using the 34 ten-digit harmonized system codes identified for affected products.

Submitting information

The Amendment would introduce new import reporting requirements for certain new energy-using products. Importers of these new products will carry an incremental ongoing administrative burden, as they will be required to enter two data elements (brand name and model number) into the Canada Border Services Agency customs documentation. To estimate the frequency and time associated with this administrative action, Natural Resources Canada analyzed Canada Border Services Agency import data from four recent years (2012–2015). Based on this analysis, it is estimated that 22 189 businesses will be affected by this incremental activity, which will take 0.02 hours per event, and occur 11 times per year. It is assumed that clerical staff with a wage rate of approximately $30 will undertake this task.

The Amendment would also reduce import reporting requirements for certain energy-using products. Importers of these specific products will benefit from a reduction in ongoing administrative burden, as they will no longer be required to enter two data elements (brand name and model number) into the Canada Border Services Agency customs documentation. It is estimated that 37 795 stakeholders will save 0.02 hours per event, occurring 43 times per year. It is assumed that clerical staff with a wage rate of approximately $30 would have been undertaking this task.

Consultations

No comments were received from stakeholders on the impacts of the Amendment on administrative burden. In general, stakeholders were supportive of the approach to achieve alignment with U.S. regulations across these product categories, which includes the alignment of reporting requirements.

Small business lens

While the small business lens does apply, the overall impact of the Amendment will be positive (estimated cost savings of $544,000) due to the elimination of import reporting for some energy-using products that are incorporated in any other end-use product. The benefits from the reduction in reporting requirements apply to all businesses (37 795), especially small ones (26 456).

Natural Resources Canada consulted with the Canadian Federation of Independent Business to confirm the number of small businesses potentially affected by this proposal. The Canadian Federation of Independent Business was unable to provide an exact count; however, it did provide very useful data to assist in the development of the burden calculation methodology. While the impacts of the Amendment are estimated to result in a new reduction in administrative costs, the Canadian Federation of Independent Business also highlighted that the main challenge for small businesses results from a lack of awareness of new requirements and when they come into effect. Natural Resources Canada will undertake supplemental outreach activities specific to the Amendment, to educate importers and mitigate the risk that goods are refused entry into Canada due to the unintentional omission of data.

Consultation

Natural Resources Canada has ongoing activities that provide numerous opportunities to gather feedback from stakeholders and to inform them:

- *Energy Efficiency Regulations* web page of the Natural Resources Canada website at http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845 (http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845).
- *Ongoing bilateral discussions*. Natural Resources Canada is in close contact with the industry through major industry associations to discuss changes and updates to the products.
- *National Standards System.* The relevant Canadian Standards Association steering committees, technical committees and technical subcommittees, comprising stakeholders (including manufacturers, industry associations and other interested groups), provided input, and reviewed and voted upon changes to the test standards.
- *Market studies* to support decision making were conducted by third-party consultants who worked with manufacturers and industry associations to gather information.
- Stakeholders also receive information via targeted emails to key market channels. Many of these individuals and organizations in turn forwarded the information to provide access to a larger audience of stakeholders.

Consultation chronology

Stakeholders [25] were informed of the changes being considered in the Amendment and were provided opportunities to comment at several points since 2016, including the Forward Regulatory Plan, publication of a notice of intent in the *Canada Gazette*, Part I, detailed technical bulletins and webinars. These consultations evolved with time, and the content of the Amendment was modified accordingly prior to its publication in the *Canada Gazette*, Part I.

The Amendment was prepublished in the *Canada Gazette*, Part I, on March 31, 2018. The following outlines the key consultation activities that Natural Resources Canada undertook during the 75-day comment period:

- **April 2018:** An announcement was released to over 6 800 stakeholders inviting comments on the proposed regulatory text during the 75-day comment period.
- **April 2018:** A technical bulletin providing notice of an alternative energy efficiency verification scheme for battery chargers that was developed in consultation with certification bodies was posted to the website and distributed to interested stakeholders.
- **April 2018:** A webinar was hosted for Canadian lighting industry stakeholders including two industry associations. Approximately 40 stakeholders participated in discussions which included this Amendment.
- **April, May, July 2018:** Two conference calls and a bilateral meeting on battery chargers took place with two industry associations and their members. Approximately 50 stakeholders participated in discussions which included verification requirements and cost-benefit analysis methodology.
- **May 2018:** A webinar was hosted for the water heating industry attended by an industry association and two manufacturers to discuss the addition of the UEF test method to rate gas and oil-fired storage water heaters.
- **July 2018:** A webinar was hosted to discuss comments received on dry-type transformers with an industry association and their members. More than 20 stakeholders participated in discussions.

Canada Gazette*, Part I, consultation — 75-day comment period*

Natural Resources Canada received written submissions from 34 organizations during the 75-day period from March 31, 2018, through to June 14, 2018, from stakeholders, representing industry/retail associations, manufacturers/suppliers, certification bodies, standards development committees, utilities, general interest organizations and governments. Most of the submissions required only clarifications related to the period of manufacture, test procedures, verification for new energy-using products and import reporting. In total 20 stakeholders (10 industry associations, a standards development committee and 9 manufacturers) expressed a mix of support and/or concerns about the regulatory text and its implications for specific products or issues. A general interest group provided a letter of general support for the Amendment. Six industry associations expressed their support for the Amendment and in particular with Canada's alignment with energy efficiency standards in the United States.

The following paragraphs summarize the major comments and topics of clarification raised by stakeholders during the comment period and Natural Resources Canada's views on each of them. No major comments were received for the following products with first time or more stringent MEPS: commercial pre-rinse spray valves, fluorescent lamp ballasts, packaged terminal air conditioners, oil-fired furnaces, small electric motors or components of walk-in coolers and walk-in freezers.

General comments

Coming into force upon publication — water heaters, import reporting for incorporated products and mathematical model

Natural Resources Canada received support from three industry associations for removing the six-month coming-into-force date for water heater provisions, which would allow manufacturers more flexibility in bringing new models into Canada. Natural Resources Canada agrees and has changed the coming-into-force date to the date of publication in the *Canada Gazette*, Part II, for the sections related to water heaters. Natural Resources Canada also determined that two other provisions would benefit from coming into force earlier where flexibilities are being introduced to benefit the industry and a six-month period is not required by dealers to adapt to new requirements. These provisions related to the option to use a mathematical model as an alternative to testing with the identified standard for the provision of information in respect of energy efficiency and to the removal of import reporting for five product categories when they are incorporated into any other product. The provision for

removal of import reporting is in force upon publication and although Canada Border Services Agency requires an 8- to 12-week implementation period to update their systems and inform affected stakeholders, importers are not required to provide Natural Resources Canada's other government department information for the affected Harmonized System codes.

Period of manufacture — aligned with the United States

Natural Resources Canada's general policy is to align Canada's periods of manufacture with U.S. dates even if those dates are in the past (see previous "Description" section). Three industry associations and a manufacturer raised concerns that this policy might cause confusion and recommended changes. Natural Resources Canada continues to support this policy in general, but will consider different periods of manufacture, specific to the Canadian market, on a case-by-case basis as discussed below for external power supplies and microwave ovens. After the Amendment is published, dealers will have six months before it comes into force (in accordance with World Trade Organization/Technical Barriers to Trade commitments) to ensure that energy-using products that are imported or shipped between provinces comply with the Regulations.

Energy Efficiency Act — implementing new authority

Five industry associations submitted a joint letter requesting that Natural Resources Canada, under the amended Act, [26] exercise the new ministerial regulating powers in order to more effectively maintain alignment with other jurisdictions. Natural Resources Canada agrees that aligning standards is a priority to meet commitments under the Canada–United States Regulatory Cooperation Council and federal-provincial-territorial collaboration under the Energy and Mines Ministers' Conference. However, in keeping with good regulatory practice, a broad stakeholder consultation must be conducted to understand when and how to use this new authority effectively. The outcomes of this consultation would be considered in future amendments to the Regulations.

Import reporting — incorporated products

An industry association supported the exception to import reporting for incorporated products and, along with a manufacturer, a government department and another industry association, requested clarification on the scope and implementation of the exception. Natural Resources Canada clarified that the exception is only from import reporting and then only if at the time of importation, external power supplies, battery chargers, electric motors, small electric motors, or fluorescent lamp ballasts are incorporated into or packaged for sale with their end-use product (not just with other energy-using products).

Verification — costs and alternative scheme for battery chargers

A number of stakeholders including three industry associations inquired or raised concerns over verification and its associated costs.

Canada's compliance approach differs from that taken in the United States, which allows manufacturers to directly submit test results along with a statement that attests that the product model is in compliance with all requirements.

Natural Resources Canada intends to continue to require a verification mark issued by a certification body accredited by the Standards Council of Canada, as the means of assessing compliance with the Regulations because it provides a level of independence, transparency and credibility to the regulatory program. By requiring verification, manufacturers are assured of a level playing field upfront, in that all products are treated with the same level of scrutiny and are assessed the same way. Natural Resources Canada does not assess costs of verification since these vary by product, dealer and certification body.

While Natural Resources Canada maintains that verification is key to the integrity of its compliance regime, it also recognizes the need to make the process as efficient as possible for certain products, specifically low-cost/high-volume/high-turnover products, such as battery chargers. To this end, Natural Resources Canada worked closely with certification bodies and the Standards Council of Canada to make an alternate energy efficiency verification scheme available to certification bodies for the verification of battery chargers. This scheme is both costeffective and supports the integrity of Natural Resources Canada's energy efficiency compliance system.

Product-specific comments

Battery chargers

- Requests for replacement, service or spare parts to be excluded from the definition of a battery charger were received from two industry associations. Natural Resources Canada will continue to align with the United States definition, and

therefore there is no change.

- An industry association and a manufacturer requested clarification as to whether inductive wireless battery chargers in a wet environment were included in the definition. Natural Resources Canada agrees with the comments and has made changes to indicate that inductive wireless battery chargers in a wet environment are included in the scope of battery chargers. This aligns with the United States.
- One industry association claimed that the data in the battery charger cost-benefit analysis is out-of-date and not representative of today's market. Natural Resources Canada disagrees as the cost-benefit analysis is based on a 2016 market study that used U.S. Department of Energy market data. This information is the most robust and accurate possible, given that battery charger regulations have only recently come into effect (June 13, 2018). The regulatory landscape has not changed since 2016.

Ceiling fan light kits

- Natural Resources Canada received conflicting comments on the period of manufacture for the application of the revised standard. One manufacturer and a retail industry association commented that they would prefer that Canada's periods of manufacture for ceiling fan light kits align with the U.S. date of January 21, 2020. [27] Another manufacturer and a lighting industry association, representing a broad base of manufacturers, supported Canada's proposed period of manufacture of January 7, 2019. Natural Resources Canada agrees with maintaining the proposed date given that the revised standard provides dealers with increased flexibility with regards to compliance.

Commercial refrigerators, refrigerator-freezers and freezers

- One manufacturer commented that the Canadian Standards Association (CSA) test procedure referenced in the Regulations has some minor irregularities and that it does not align fully with a test procedure clarification for how to determine total display area, published by the U.S. Department of Energy. Natural Resources Canada agrees and is working with the national standards system to issue an amendment to the test procedure to reflect the clarification, before it comes into force.

Dehumidifiers

- One industry association requested delaying the period of manufacture to align with purchasing cycles. Since the proposed period of manufacture is aligned with the United States and not until June 13, 2019, this was deemed as providing sufficient time to comply and no change was made.

Dry-type transformers

- Two industry associations supported Canada's intent to align regulations with the provinces and the United States, and one also requested that Natural Resources Canada not delay in publishing the Amendment.
- One manufacturer requested an exclusion for transformers having a low voltage winding with a basic impulse insulation level greater than 30 kV. Although these products have been included in the scope of the Regulations since they were introduced in 2006, they have been excluded from the test standard CSA C802.2. This has caused some confusion and, with the introduction of higher MEPS, some concern for the industry for a very small subset of this product category. Natural Resources Canada will not make changes at this time as there is not enough information available to assess the implications of this suggested change nor the risks of misalignment with provinces and the United States. However, Natural Resources Canada acknowledges the concern and will investigate further with the intent to make changes as appropriate in a future amendment.
- The Canadian standards development committee (representing a number of stakeholders) requested that transformers with two or more independent windings for more than one independent output voltage be excluded from the Regulations since the testing standard is unclear as to how they are to be tested and which MEPS apply. Natural Resources Canada is not providing an exemption for transformers with multiple output windings at this time but may re-examine the test method in a future Amendment. Natural Resources Canada hereby clarifies that units should be tested and meet the MEPS in the configuration that results in the highest losses. This clarification is aligned with the energy efficiency regulations of the provinces and the United States. Natural Resources Canada also clarifies that the Regulations are intended to cover products used for mains power transformation and does not intend to cover windings used to power small auxiliary devices.

External power supplies

- Two industry associations requested that external power supply drivers for solid-state lighting and ceiling fan motors be excluded from the Regulations. On January 12, 2018, the United States approved a bill [28] that modifies the definition of external power supplies to exclude a power supply circuit, driver, or device that is designed to exclusively power solid-state lighting or a ceiling fan that uses a direct current motor. Natural Resources Canada agrees and has amended the definition to maintain alignment with the United States.
- One industry association recommended delaying the period of manufacture of February 10, 2016, to 2019. One industry association recommended aligning the period of manufacture with Ontario. Natural Resources has changed the date from February 10, 2016, to July 1, 2017, to align with Ontario. [29]

Gas furnaces

- One manufacturer suggested that because Canada already has more stringent standards for the fuel efficiency of gas furnaces than the United States that aligning with the U.S. MEPS for the fan energy rating (FER) will again significantly increase consumer costs and further limit choice in the Canadian market, resulting in potential fuel switching or consumers choosing lower fuel efficient models. Natural Resources Canada disagrees that consumers will fuel switch or make different purchasing decisions due to the incremental cost of a more efficient fan motor and has not made changes to the Amendment.

Gas-fired storage water heaters

- Stakeholders support the Amendment to allow testing and reporting of water heaters to the new UEF rating metric (see previous “Coming into force upon publication — water heaters, import reporting for incorporated products and mathematical model” section). Three industry associations and two manufacturers requested support from Natural Resources Canada to educate consumers on the new rating metric. Natural Resources Canada agrees that it has a role to play in consumer awareness and will work with the industry.
- Three industry associations and one manufacturer requested clarification regarding the use of measured and nominal volume in the Amendment and recommended following U.S. tolerance limits for measured volume. Natural Resources Canada agrees and will provide guidance on this matter in the Guide to the Regulations.
- Three industry associations raised concerns regarding how the metric conversions were calculated for volume correction in the MEPS equations. Natural Resources Canada reviewed the conversions and adjusted the MEPS equations to make them equivalent to U.S. imperial measurements.
- Three industry associations and one manufacturer raised concerns about the accuracy of the UEF MEPS equation for models with volumes greater than 208 L (55 US gallons). The industry is concerned that the testing completed by Natural Resources Canada might not be sufficient to be statistically valid. Natural Resources Canada is confident that the UEF MEPS equation is valid. Additionally, dealers can continue to report EF ratings for these models.
- Three industry associations and one manufacturer recommended that the Amendment allow EF ratings to continue only for existing models, and that all new models entering the market be required to rate with UEF. The Amendment provides flexibility to report either UEF or EF. Natural Resources Canada expects that new models entering the market will be predominantly rated using the UEF metric and as such disagrees that there is a need to limit the flexibility provided in the Amendment.

Large air conditioners and heat pumps

- Two industry associations and one manufacturer sought to remove the EER metric and retain only the IEER metric to align with the United States. Natural Resources Canada does not agree to remove the EER metric given that it is used by the industry to better understand peak load requirements, is already reported to Natural Resources Canada and does not add incremental testing requirements since it is measured as part of the IEER metric.
- Two industry associations recommended that water-cooled products over 70 kW and evaporative-cooled products be eliminated from the scope of the Regulations because they are not currently covered under the scope of their certification program. Natural Resources Canada disagrees with this recommendation and will continue to align the Canadian scope with that of the United States.
- Two industry associations and one manufacturer recommended that in order to align with U.S. requirements, Natural Resources Canada only specify coefficient of performance (COP) values at 8.3 °C for large heat pumps, rather than at both 8.3 °C and −8.3 °C, as is currently required in Canada. Natural Resources Canada does not agree to remove the

−8.3 °C COP metric, given that it is used by the industry for the sizing and the selection of heat pumps in Canada and is already reported to Natural Resources Canada.
- Two industry associations requested that Natural Resources Canada suspend any labelling requirements for dedicated outdoor air systems. Natural Resources Canada issued a letter of clarification in January 2018 where they clarified the regulatory requirements for make-up air-conditioners and direct expansion dedicated outdoor air systems.

Metal halide lamp ballasts

- One industry association and one manufacturer requested an extension to the period of manufacture for all metal halide lamp ballasts capable of operating at 347 V. Natural Resources Canada agrees and has changed the period of manufacture for metal halide lamp ballasts capable of operating at 347 V from February 10, 2017, to December 31, 2019, to allow manufacturers time to adapt their production for ballasts using this unique Canadian voltage.
- One industry association requested that replacement metal halide lamp ballasts, which are not subject to MEPS, not be subject to reporting requirements to align with the United States. Natural Resources Canada agrees and has made modifications to the regulatory text to exclude replacement metal halide lamp ballasts from the energy-using product definition, but will continue to monitor the market for replacement metal halide lamp ballasts.

Microwave ovens

- One industry association put forward a request to change the period of manufacture. Natural Resources Canada agrees and has changed the date from June 17, 2016, to March 31, 2019.

Regulatory cooperation

The Amendment has resulted from significant cooperation — both with the United States and domestically — to contribute to the achievement of domestic goals for the reduction of GHG emissions and energy consumption.

In August 2014, Natural Resources Canada and the U.S. Department of Energy established a goal of aligning new and updated energy efficiency standards and test methods for energy-using equipment through enhanced information sharing and cooperative development and implementation, to the extent practicable and permitted by law. This included a commitment to annually share work plans for test procedures and standards; develop guidelines for frequency of interaction and information sharing (e.g. test data, market analyses); mutually participate in the process to establish standards and testing requirements; and leverage multilateral initiatives to advance energy efficiency objectives. [30]

The Amendment also supports the objectives of the *Memorandum of Understanding between the Treasury Board of Canada Secretariat and the United States Office of Information and Regulatory Affairs Regarding the Canada-United States Regulatory Cooperation Council* [31] signed in June 2018.

In August 2016, federal, provincial and territorial energy ministers published a framework and action plan for energy efficiency standards under the Energy and Mines Ministers' Conference. The framework outlines an approach by which federal, provincial and territorial governments collaborate to achieve greater harmonization on energy efficiency standards. The Amendment will reduce regulatory differences that exist between federal and provincial regulations by adding energy-using products to the Regulations that would otherwise be only regulated in one or a few provinces.

Rationale

The Amendment will benefit Canadians by both reducing GHG emissions and removing unnecessary regulatory differences between Canada and the United States.

According to the International Energy Agency, policies and programs that address energy efficiency are the most cost-effective way to lower GHG emissions and could complement carbon pricing schemes as an overall strategy to effectively achieve climate change policy objectives. [32] Improving energy efficiency also provides economic benefits to consumers and businesses through lower energy bills.

In the absence of a regulatory approach, a market for low-efficiency products will continue. Consumers who purchase such products could be motivated by lower purchase costs even though they would pay higher operational costs over the life of the product. The analysis of the Amendment has shown that more stringent MEPS for all products will generate reductions in GHG

emissions and energy consumption. The associated energy savings will generate net monetary benefits for Canadian consumers. The analysis has shown that the costs of technologies that will be required to bring low-efficiency products into compliance with the MEPS are outweighed by the benefits attributable to those technologies.

The development of the Amendment was informed by stakeholder views. Industry supports an approach that is aligned with that of the United States since most product models are designed to serve the Canada–United States market. Provinces support federal regulatory action on energy efficiency.

The *Energy Efficiency Regulations* were first introduced in 1995 and including the Regulations, have been amended 13 times to increase the stringency of existing MEPS and introduce MEPS for new product categories. Through the use of third-party verification and regular post-market compliance activities, a high compliance rate with regulated requirements has been observed. This provides confidence that estimated outcomes are being achieved and that Canadians are experiencing the associated benefits.

Implementation, enforcement and service standards

Some provisions of the Amendment will come into force upon publication in the *Canada Gazette*, Part II, while the rest of the Amendment will come into force six months after publication in the *Canada Gazette*, Part II. The requirements will apply to the prescribed energy-using products based on their period of manufacture or date of import or interprovincial shipment.

The compliance and enforcement procedures already in place for all products prescribed under the Regulations will continue to be used following the coming-into-force dates of this Amendment. The main features of this system are as follows.

Verification marking and energy efficiency reporting

For products prescribed under the Regulations, Natural Resources Canada employs a third-party verification system using the services of certification bodies accredited by the Standards Council of Canada. Verified energy performance data is submitted to Natural Resources Canada by the dealer in an energy efficiency report as specified in the Regulations. This is required once for each product model before first importation or interprovincial shipment.

Import reporting and monitoring

Natural Resources Canada procedures already in place for the collection of information for commercial imports of prescribed products will apply to products affected by the Regulations. These procedures involve crosschecking required import data received from customs release documents with the energy efficiency reports that dealers have submitted to Natural Resources Canada. This crosschecking ensures that the compliance of prescribed products imported into Canada can be verified.

The Regulations will continue to require dealers of prescribed products to provide the information needed for customs monitoring.

Direct fieldwork: market survey and product testing

In addition to ongoing compliance and marketplace monitoring activities, Natural Resources Canada surveys and tests products in the context of monitoring compliance outcomes with product-specific compliance audits. Depending on the product, in-store audits and/or testing of products are also conducted.

Natural Resources Canada also conducts product testing on a complaint-driven basis. The market is highly competitive and suppliers are cognizant of performance claims made by their competitors. Challenge procedures by which performance claims can be questioned exist in all verification programs.

Performance measurement and evaluation

The desired outcomes of the Regulations are presented in the following table along with the information that will be tracked to measure performance.

Table 5: Measuring performance of the Regulations

Outcome	Indicators	Information to measure performance
GHG emissions are reduced to contribute to Canada's goal to reduce GHG emissions by at least 30% below 2005 levels by 2030	Percentage of product models that meet MEPS	Energy efficiency reports Import reports Market data (shipments, trends) Lab testing Emission factors Energy prices
Consumers and businesses save money by purchasing higher efficiency product models that have lower costs over their lifetime		
Electricity demand associated with space and water heating is reduced to contribute capacity to the electrification of other economic sectors		
Businesses using regulated energy-using products experience cost savings that can lead to increased productivity and competitiveness		
Compliance costs associated with unnecessary regulatory differences are removed	Number of unnecessary regulatory differences removed	Comparison of Canadian and U.S. regulations

Performance will be monitored through a combination of product-specific compliance reporting, supported by third-party verification of energy efficiency performance, and ongoing collection of market data to assess broader trends affecting outcomes.

Information collected on the energy efficiency performance of regulated energy-using products informs both GHG emission impacts and consumer savings, since both are calculated as a function of changes in the amount of energy consumed by these products. [33]

A high compliance rate with the Regulations will be achieved through support from manufacturers, third-party verification, customs monitoring, cooperation with regulating provinces, communication activities, market surveys, and product testing, as required.

The standards contained in the Amendment are being implemented under the federal energy efficiency equipment standards and labelling program. Detailed accounts of progress towards achieving the objectives of this initiative will be found in departmental business plans, reports on plans and priorities, and the Report to Parliament under the *Energy Efficiency Act*.

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Footnotes

a S.C. 2009, c. 8, s. 5

b S.C. 1992, c. 36

1 SOR/2016-311

2 The use of the term “minimum energy performance standard” or “MEPS” throughout this document is in reference to the “energy efficiency standard” as defined in the Energy Efficiency Act.

3 International Energy Agency (IEA), 2015. Achievements of appliance energy efficiency standards and labelling programs: A GLOBAL ASSESSMENT, p. 2.

4 https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-forward-plan-august-2014.html (https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-forward-plan-august-2014.html)

5 Canada’s 7th National Communication and 3rd Biennial Report to the United Nations Framework Convention on Climate Change, p. 145: http://unfccc.int/files/national_reports/national_communications_and_biennial_reports/application/pdf/4623051_canada-br3-nc7-1-5108_eccc_can7thncomm3rdbi-report_en_04_web.pdf (http://unfccc.int/files/national_reports/national_communications_and_biennial_reports/application/pdf/4623051_canada-br3-nc7-1-5108_eccc_can7thncomm3rdbi-report_en_04_web.pdf).

6 https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-action-plan.html (https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-action-plan.html)

7 O. Reg. 404/12

8 IEER is a weighted efficiency metric to measure various partial loads and full load. EER is a measurement of the efficiency at full load.

9 Clothes dryers, general service lamps, modified spectrum general service incandescent lamps, general service fluorescent lamps, room air conditioners, external power supplies, packaged terminal heat pumps and exit signs.

10 O. Reg. 404/12

11 International Energy Agency, 2015. Achievements of appliance energy efficiency standards and labelling programs: A GLOBAL ASSESSMENT, p. 3.

12 Ibid., p. 1

13 Ibid., p. 3

14 Calculated as the value of avoided damages from GHG emissions reductions.

15 For the purpose of this analysis, it is assumed that incremental costs for more efficient technology and compliance, as well as for product development and production, are passed on to consumers or end users. This assumption simplifies the methodology, since individual business decisions that affect actual product prices are unknown.

16 *Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* (SOR/2014-207) and other regulations made under the *Canadian Environmental Protection Act, 1999*.

17 Contact Environment and Climate Change Canada’s Economic Analysis Directorate for any questions regarding methodology, rationale or policy.

18 U.S. Government, U.S. Interagency Working Group on the Social Cost of Carbon (IWGSCC), 2010. *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866*.

19 Marginal fuels represent the last power plant that is needed to meet the electricity demand at a given time. The costs and emissions from that power plant are used to calculate the reduced emissions owing to the Regulations.

20 Consistent with the discount rate used by the Pan-Canadian Framework on Clean Growth and Climate Change and in accordance with Treasury Board Secretariat recommendations for environmental and health regulations.

21 IEA, 2015. *Achievements of appliance energy efficiency standards and labelling programs: A GLOBAL ASSESSMENT*, p. 6.

22 Battery chargers, ceiling fan light kits, commercial refrigeration (partial), dehumidifiers, gas furnaces, large air conditioners, large heat pumps, metal halide lamp ballasts, oil furnaces (partial), pre-rinse spray valves, walk-in coolers/freezers.

23 *Maximizing Canada's Energy Advantage — Canadian Industrial Energy Efficiency*, Energy and Mines Ministers' Conference, July 2015.

24 http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845 (http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845)

25 Stakeholders that were informed include all organizations and individuals with an interest in the proposed Regulations. Groups that provided input include, but are not limited to, manufacturers, distributors, retailers, industry associations, provincial, federal and international governments, energy utilities, general interest groups, certification bodies, custom brokers, consumer associations, contractors, and builders.

26 http://www.nrcan.gc.ca/regulations/20641 (http://www.nrcan.gc.ca/regulations/20641)

27 https://www.energy.gov/sites/prod/files/2017/01/f34/cf-ecs-extension-of-final-rule-effective-date-1-24-17.pdf (https://www.energy.gov/sites/prod/files/2017/01/f34/cf-ecs-extension-of-final-rule-effective-date-1-24-17.pdf)

28 https://www.congress.gov/bill/115th-congress/house-bill/518/all-info (https://www.congress.gov/bill/115th-congress/house-bill/518/all-info)

29 O. Reg. 404/12

30 https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-forward-plan-august-2014.html (https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-forward-plan-august-2014.html)

31 https://www.canada.ca/en/treasury-board-secretariat/news/2018/06/canada-and-united-states-sign-memorandum-of-understanding-for-regulatory-cooperation.html (https://www.canada.ca/en/treasury-board-secretariat/news/2018/06/canada-and-united-states-sign-memorandum-of-understanding-for-regulatory-cooperation.html)

32 IEA/OECD, 2011. *Summing up the Parts — Combining Policy Instruments for Least-Cost Climate Mitigation Strategies*, p. 8.

33 GHG emissions are quantified by applying the appropriate emission factors to the changes in energy, by fuel. Consumer savings are quantified by applying the appropriate energy prices to the changes in energy, by fuel.

Government of Canada activities and initiatives

#YourBudget2018 – Advancement



(https://www.budget.gc.ca/2018/docs/themes/advancement-advancement-en.html?utm_source=CanCa&utm_medium=Activities_e&utm_content=Advancement&utm_campaign=CAbdgt18)
Advancing our shared values

#YourBudget2018 – Reconciliation



(https://www.budget.gc.ca/2018/docs/themes/reconciliation-reconciliation-en.html?utm_source=CanCa&utm_medium=%20Activities_e&utm_content=Reconciliation&utm_campaign=CAbdgt18)
Advancing reconciliation with Indigenous Peoples

#YourBudget2018 – Progress



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October 20, 2018

Statutory authority
Energy Efficiency Act

Sponsoring department
Department of Natural Resources

REGULATORY IMPACT ANALYSIS STATEMENT

(*This statement is not part of the Regulations*.)

Executive summary

Issues: Greenhouse gases are primary contributors to climate change, which has an impact on Canada's economy and environment. Canada's building sector represents a significant portion of national greenhouse gas (GHG) emissions given the amount of energy used to heat space and water and the amount of electricity this sector consumes from the grid. National policies and strategies such as the Pan-Canadian Framework on Clean Growth and Climate Change, the Canadian Energy Strategy, *Build Smart — Canada's Buildings Strategy*, and the recent report from the Generation Energy Council demonstrate the important role of energy efficiency and the Government of Canada's commitments to improve energy efficiency standards for appliances and equipment and take action on climate change. Achieving these commitments will provide benefits to Canadians through energy cost savings and improved environmental outcomes, which lead to increased productivity, competitiveness and energy affordability.

In December 2016, provincial, territorial and federal First Ministers adopted the Pan-Canadian Framework on Clean Growth and Climate Change, which presents the country's plan to reduce greenhouse gas emissions to at least 30% below 2005 levels by 2030, grow the economy, and build resilience to a changing climate. Further mitigation efforts are needed to support the achievement of Canada's greenhouse gas emissions reduction target.

In 2017, federal, provincial and territorial energy ministers agreed to collaborate on market transformation strategies for windows, space heating and water heating systems given that next-generation technologies can greatly reduce energy use in the building sector. Ministers released a series of aspirational goals for the energy performance in these areas, including a goal that, by 2025, all fuel-burning technologies sold in Canada and used for water heating and primary space heating will be at least 90% efficient.

Description: The proposed amendment to the *Energy Efficiency Regulations, 2016* (the Amendment) would introduce or update minimum energy performance standards, testing standards, and reporting requirements to improve the energy efficiency of 12 heating and ventilation product categories. The Amendment would affect residential and commercial product categories, four of which are currently regulated federally. Specifically, the Amendment is designed to (a) introduce minimum energy performance standards, labelling and reporting requirements for seven new product categories; (b) introduce more stringent minimum energy performance standards and/or update testing standards for four currently regulated product

categories; and (c) introduce labelling and reporting requirements for one new product category. This is the third of several planned amendments to support Canada's 2030 greenhouse gas emission reduction target and the transition to a low-carbon economy.

Cost-benefit statement: The Amendment is estimated to result in an annual reduction of 0.92 megatonnes of greenhouse gas emissions by 2030. The benefits and costs associated with the Amendment have been estimated using a methodology consistent with that of previous modifications to the *Energy Efficiency Regulations* and the *Energy Efficiency Regulations, 2016*, and of other energy efficiency regulators, such as the United States Department of Energy. Based on this methodology, the present value of net benefits of the Amendment is estimated to be $1.80 billion by 2030, with total benefits exceeding total costs by more than two to one. By 2030, the present value of benefits and costs from the Amendment is estimated to be $2.84 billion and $1.04 billion, respectively. On an annualized average basis, this equates to benefits and costs of $286 million and $105 million, respectively.

The quantified benefits have been calculated as the sum of the energy savings and the benefits of reductions in greenhouse gas emissions over the service life of energy-using products shipped by 2030. The quantified costs include incremental technology costs to meet the more stringent standards, administrative costs and costs to Government associated with regulatory implementation.

While not quantified as part of this analysis, energy efficiency improvements also provide broader economic and non-energy benefits. For example, businesses benefit from energy and operating cost savings, which can increase productivity and competitiveness. Households benefit from increased comfort, improved air quality, and reduced noise resulting from higher performance products.

"One-for-One" Rule and small business lens: The Amendment is considered an "IN" under the "One-for-One" Rule. It would increase the administrative costs by $72,161 in annualized average administrative costs to affected businesses.

The Amendment would also impact 10 small Canadian manufacturers of affected products. The majority of these are not expected to face incremental costs, as they already manufacture compliant products and are demonstrating compliance with similar requirements in other jurisdictions. Small manufacturers that are expected to assume incremental costs have been engaged in consultations, but have not raised any compliance issues associated with the size of their company.

Domestic and international coordination and cooperation: The Amendment has resulted from significant cooperation — both domestically and with the United States — to contribute to national GHG emission and energy consumption goals. Cooperative efforts between federal, provincial and territorial governments contribute to the positioning of Canada as a global leader in efforts to improve the energy efficiency of equipment used to heat space and water in the building sector.

Domestic regulatory cooperation has been guided by Canada's First Ministers Conference and the Energy and Mines Ministers' Conference. The Amendment contributes to commitments agreed to by First Ministers in the Pan-Canadian Framework on Clean Growth and Climate Change and the aspirational goals released by the Energy and Mines Ministers' Conference. Through these collaborative efforts, the Amendment contributes to the objectives of the Regulatory Reconciliation and Cooperation Table (RCT) of the Canadian Free Trade Agreement (CFTA) to reduce and eliminate, to the extent possible, barriers to trade within Canada by harmonizing energy efficiency regulations.

The Amendment is also consistent with the objectives of the *Memorandum of Understanding between the Treasury Board of Canada Secretariat and the United States Office of Information and Regulatory Affairs Regarding the Canada–United States Regulatory Cooperation Council* signed in June 2018. The Amendment seeks to foster alignment of federal regulations where feasible and appropriate, primarily through the use of testing standards already used by the United States to assess product compliance against the minimum energy performance standards.

Background

In 1992, Parliament passed Canada's *Energy Efficiency Act* (the Act) and amended it multiple times since then. The Act provides for the making and enforcement of regulations requiring energy-using products that are imported or shipped inter-provincially for the purpose of sale or lease to meet minimum energy performance standards (MEPS) [1] for product labelling and for the promotion of energy efficiency and alternative energy use, including the collection of data and statistics on energy use.

The *Energy Efficiency Regulations* were introduced in 1995 as a means to reduce greenhouse gas (GHG) emissions in Canada. In 2016, the *Energy Efficiency Regulations* were repealed and replaced to remove references to obsolete and out-of-date standards and improve the organization of the regulatory text and became the *Energy Efficiency Regulations, 2016* (the Regulations). The Regulations prescribe MEPS for certain consumer and commercial energy-using products. They also prescribe labelling requirements for certain products to disclose and compare the energy use of a given product model relative to others in their category. They are regularly amended to introduce new energy-using products and to update existing requirements.

Since most energy-using products must cross provincial or international borders to reach their markets, federally prescribed MEPS are an effective tool to raise the level of energy efficiency in Canada. Prescribed MEPS are one component of Canada's program to reduce GHG emissions and energy consumption associated with energy-using products because they eliminate the least efficient products from the market. Natural Resources Canada also administers the ENERGY STAR® labelling program, which sets voluntary specifications for 75 product categories and identifies the top 15 to 30% of energy efficiency performers, making the choice of energy-efficient products simple for consumers and businesses.

When combined, MEPS and labelling programs drive product innovation through cycles of continuous improvement. Increasing the stringency of MEPS eliminates the least efficient products from the market while increasing the levels that must be met for a product to be certified as ENERGY STAR, and encourages manufacturers to produce affordable high-efficiency products that consumers and businesses will recognize as good choices to lower their energy costs. MEPS and labelling programs are among the most cost-effective GHG reduction policies and are the cornerstone of energy efficiency and climate change programs in more than 80 countries. [2]

Policy context

Canada committed to reduce its GHG emissions by 30% below 2005 levels by signing the Paris Agreement in 2015. Building on this commitment, First Ministers agreed to take ambitious action in support of meeting or exceeding this target. They also agreed that a collaborative approach between provincial, territorial, and federal governments is important to reduce GHG emissions and to enable sustainable economic growth.

In December 2016, First Ministers adopted the Pan-Canadian Framework on Clean Growth and Climate Change, which presents the country's plan to meet its GHG emissions reduction targets, grow the economy, and build resilience to a changing climate. The plan outlines an approach for the building sector that consists of four elements: (1) making new buildings more energy efficient; (2) retrofitting existing buildings, as well as fuel switching; (3) supporting building codes and energy-efficient housing in Indigenous communities; and (4) improving energy efficiency for appliances and equipment. To deliver on the fourth element of this approach, the federal government committed to set new standards for heating equipment and other key technologies to the highest level of efficiency that is economically and technically achievable.

This commitment builds on the August 2016 publication of a framework and action plan for energy efficiency standards under the Energy and Mines Ministers' Conference and collaborative efforts with provinces and territories to implement the Canadian Energy Strategy. *Build Smart — Canada's Buildings Strategy* identifies the achievement of this commitment as a core element of the national plan to reduce the energy consumption and greenhouse gas emissions from the building sector.

Consistent with these commitments, in 2017, Energy and Mines Ministers agreed to advance measures to accelerate energy efficiency and collaborate on market transformation strategies for windows, space heating and water heating systems in the building sector. [3] Ministers also released a series of short-, medium- and long-term aspirational goals for the energy performance of key equipment technologies. Ministers agreed to work towards a goal that, by 2025, all fuel-burning technologies for primary space heating and water heating for sale in Canada will meet an energy performance of at least 90% (i.e. condensing technology level). Ministers also released *Build Smart — Canada's Buildings Strategy*, which identifies the improvement of equipment energy efficiency as a key component of the country's efforts to transition towards a low-carbon built environment.

In June 2018, the Generation Energy Council released a report that highlighted the important role that energy efficiency can play in reducing GHG emissions in Canada. According to this report, fully one-third of Canada's emission reduction target could be met through improvements in energy efficiency, which would also make Canadian businesses more competitive

internationally and leave more money in consumers' pockets. [4] These conclusions are supported by an Efficiency Canada report on the economic impacts of energy efficiency, which showed that implementing strong energy efficiency programs will increase Canada's gross domestic product and job growth. [5]

Issues

GHGs are primary contributors to climate change, which has an impact on Canada's economy and environment. Carbon dioxide, a by-product of fossil fuel consumption, has been identified as the most significant GHG.

Canadian homes and commercial and institutional buildings (the building sector) are significant contributors to national GHG emissions. The building sector accounted for about 17% of national GHG emissions in 2014. The level of emissions in the building sector is impacted by the energy-using equipment it contains. Products that combust fuel to generate heat lead to direct carbon dioxide emissions at the site, while products that consume electricity contribute to GHG emissions at the point of generation.

GHG emissions from Canadian homes declined by 1 megatonne (Mt) between 2005 and 2015, and are projected to decline by a further 3 Mt between 2015 and 2030. This is despite an expected 36% (or 4.4 million) increase in the number of Canadian households (a key driver of residential emissions growth) between 2005 and 2030. GHG emissions from Canada's commercial buildings increased by 1 Mt between 2005 and 2015, and are expected to remain relatively constant through 2030, despite an expected 32% increase in floor space from 2005 to 2030. [6]

While technologies exist on the Canadian market to provide incremental reductions in GHG emissions and energy consumption in the building sector, there are market failures that lead to consumers making economic or environmental choices with respect to energy efficiency that are less than optimal. These include a lack of awareness and information available to consumers regarding energy-saving opportunities and actual energy use; a lack of capacity within organizations to understand and manage energy use; and split incentives (e.g. landlords may not purchase energy-efficient products if tenants pay the energy bill). Regulatory action is required given that voluntary measures will not be sufficient to phase out the least efficient product models from the Canadian market.

Objectives

The goals of the Amendment are to

- Reduce GHG emissions and energy consumption associated with 11 product categories in a manner that aligns with other jurisdictions, where feasible and appropriate; and
- Reduce energy costs assumed by consumers and businesses.

The desired outcomes of the Amendment are as follows:

- GHG emissions are reduced, contributing to Canada's goal to reduce GHG emissions by at least 30% below 2005 levels by 2030;
- Energy use for space and water heating in the building sector decreases per unit of floor space;
- Consumers and businesses save money by purchasing higher efficiency product models that have lower costs over their lifetime; and
- Businesses using regulated energy-using products experience cost savings that can lead to increased productivity and competitiveness.

Description

In March 2017, Natural Resources Canada published a notice of intent to inform stakeholders that the Department was initiating the development of a regulatory amendment to introduce or increase the stringency of MEPS for 17 product categories. A subsequent decision was made to address these product categories through two separate, sequential regulatory proposals. Product categories that were identified in the notice of intent but are not included in the Amendment will be addressed in a subsequent regulatory proposal.

The regulatory changes outlined below have been developed to support the federal government's commitment to set new standards for heating equipment and other key technologies to the highest level of efficiency that is economically and technically achievable. In some cases, this is achieved by proposing standards at ENERGY STAR levels; in others, proposed levels have been selected based on an assessment of their technical feasibility and associated economic impacts. Proposed testing standards are aligned with those used in other jurisdictions to avoid unnecessary compliance burden.

The Amendment would (A) introduce MEPS, labelling and reporting requirements for seven new product categories; (B) introduce more stringent MEPS and update testing standards, as necessary, for four currently regulated product categories; and (C) introduce labelling and reporting requirements for one new product category. The Amendment would come into force six months after the date of its publication in the *Canada Gazette*, Part II.

For the new product categories, import reports and energy efficiency reports would be required for the first time. The information requirements in the energy efficiency reports will be aligned to the extent possible with what is submitted in the United States.

The following is a list of changes that are being proposed to the Regulations.

(A) Introduce MEPS, labelling and reporting requirements for new product categories

Electric furnaces

Electric furnaces are those with an input capacity of not more than 65.92 kW (225 000 Btu/h) and use electricity as the primary heat source to provide heated air to a home through a home's built-in ductwork.

For electric furnaces manufactured on or after July 3, 2019, the Amendment would set the MEPS applicable to the electrical consumption of a furnace fan at levels that will apply on that same date in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States.

Gas boilers (commercial)

Commercial gas boilers are used for space heating in buildings and can either use hot water or steam as the working fluid to distribute heat throughout the space. They use gas or propane as the fuel source and have input ratings greater than or equal to 88 kW (300 000 Btu/h) and less than or equal to 2 930 kW (10 000 000 Btu/h).

For commercial gas boilers manufactured on or after January 1, 2023, the Amendment would set the MEPS at condensing technology levels and performance would be measured in accordance with testing standards aligned with those of the United States. The proposed MEPS are set at levels currently in place in Ontario [7] for new construction.

Gas-fired instantaneous water heaters (household and commercial)

Household and commercial gas-fired instantaneous water heaters are used in homes and businesses to heat water on demand as it flows for use in cooking, cleaning, and bathing. They use natural gas or propane as the fuel source.

For household and commercial instantaneous gas-fired water heaters manufactured on or after January 1, 2020, the Amendment would set MEPS at condensing technology levels equivalent to current ENERGY STAR performance levels. Performance would be measured in accordance with testing standards aligned with those of the United States.

Oil-fired boilers (commercial)

Commercial oil-fired boilers are used for space heating in buildings and can use either hot water or steam as the working fluid to distribute heat throughout the space. They have input ratings greater than or equal to 88 kW (300 000 Btu/h) and less than or equal to 2 930 kW (10 000 000 Btu/h).

For commercial oil-fired boilers manufactured on or after January 1, 2023, the Amendment would set the MEPS at levels proposed in the U.S. Department of Energy prepublished final rule on December 28, 2016. Performance would be measured in accordance with testing standards aligned with those of the United States.

Electric water heaters (commercial)

Commercial electric water heaters heat water for use in cooking, cleaning, and bathing. They use electricity as the source of energy and have input rates of greater than or equal to 12 kW (40 982 Btu/h) and a volume of at least 50 L (13 U.S. gal).

For commercial electric water heaters manufactured on or after January 1, 2020, the Amendment would set the MEPS at levels that are currently in place in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States.

Gas-fired storage water heaters (commercial)

Commercial gas-fired storage water heaters heat water for use in cooking, cleaning, and bathing. They use gas or propane as the fuel source and have input rates greater than 21.97 kW (75 000 Btu/h).

For commercial gas-fired storage water heaters manufactured on or after January 1, 2020, the Amendment would set the MEPS for residential-duty commercial units, marked as replacement units, at levels that are currently in place in the United States. For non-residential-duty commercial units marked as replacement units, the Amendment would set the MEPS at the current standby loss level in place in the United States, but at a slightly higher thermal efficiency level than is currently in place in the United States. For all other products, the Amendment would set the MEPS at condensing technology levels. Performance would be measured in accordance with testing standards aligned with those of the United States.

Oil-fired water heaters (commercial)

Commercial oil-fired water heaters heat water for use in cooking, cleaning, and bathing. They have input rates greater than 30.5 kW (105 000 Btu/h).

For commercial oil-fired water heaters manufactured on or after January 1, 2020, the Amendment would set the MEPS at levels that are currently in place in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States.

(B) Introduce more stringent MEPS for currently regulated product categories

Gas boilers (household)

Household gas boilers provide heat to a home and can use either hot water or steam as the working fluid to distribute heat throughout the space. They use propane or natural gas and have an input rate of less than 88 kW (300 000 Btu/h).

For household gas boilers manufactured on or after January 15, 2021, the Amendment would set the MEPS at the condensing technology level equivalent to the current ENERGY STAR performance level. Performance would be measured in accordance with an updated testing standard aligned with that of the United States.

Gas fireplaces

Gas fireplaces use propane or natural gas to provide an aesthetically pleasing flame. Decorative gas fireplaces direct minimal heat towards the room and heating gas fireplaces provide a heat source for a room. They are used in people’s homes and commercial establishments such as hotel lobbies and restaurants. Gas fireplaces may be freestanding, recessed, zero clearance or insert units.

For heating gas fireplaces manufactured on or after January 1, 2020, the Amendment would introduce MEPS and prescriptive requirements for pilots. For decorative gas fireplaces manufactured on or after January 1, 2020, the Amendment would introduce prescriptive requirements for pilots, main burner operation, and combustion air. The proposed requirements are designed to achieve similar outcomes as those that will apply in British Columbia on January 1, 2019, with differences resulting from the proposed use of more prescriptive requirements for decorative gas fireplaces than those in British Columbia. [8] The existing testing standard is not being changed.

Gas furnaces

Gas furnaces use propane or natural gas to provide heated air to a home through the home’s built-in ductwork. They have an input rate of not more than 117.23 kW (400 000 Btu/h), but do not currently include gas furnaces for mobile homes and recreational vehicles.

For gas furnaces manufactured on or after July 3, 2019, the Amendment would remove the exclusion given to gas furnaces for mobile homes and add an exclusion for park model trailers, and increase the annual fuel use efficiency MEPS to the current ENERGY STAR performance level, except for gas furnaces that are marked for use in a relocatable building. Performance

would be measured in accordance with an updated testing standard aligned with that of the United States.

Oil-fired boilers (household)

Household oil-fired boilers provide heat to a home and can use either hot water or steam as the working fluid to distribute heat throughout the space. They have an input rate of less than 88 kW (300 000 Btu/h).

For household oil-fired boilers manufactured on or after January 15, 2021, the Amendment would set the MEPS at levels that will apply on that same date in the United States. The existing testing standards are being updated but will remain aligned with those of the United States.

(C) Introduce labelling and reporting requirements for one new product category

Heat recovery ventilators and energy-recovery ventilators

Heat-recovery ventilators (HRVs) are mechanical devices that transfer heat from stale indoor air to fresh outdoor air. Energy-recovery ventilators (ERVs) are HRVs designed to transfer heat and moisture.

For HRVs and ERVs manufactured on or after January 1, 2020, the Amendment would require the submission of energy efficiency reports and importation reports. Performance would be measured in accordance with testing standards currently required for ENERGY STAR certification.

Regulatory and non-regulatory options considered

Maintaining the status quo

GHG emissions from Canadian homes are projected to decline by 8% between 2005 and 2030. During this same time frame, emissions from commercial buildings are projected to stay constant. Given Canada's commitment to reducing GHG emissions by 30% below 2005 levels by 2030 and the fact that Canada's building sector accounts for approximately 17% of national emissions, maintaining the status quo would not contribute incremental reductions towards the achievement of these goals. It would also lead to missed opportunities to reduce energy consumption, leaving consumers and businesses with higher energy costs for heating associated with the building sector.

The status quo option would not deliver on the federal government's commitment to set new standards for heating equipment and other key technologies to the highest level of efficiency that is economically and technically achievable as stated in the Pan-Canadian Framework on Clean Growth and Climate Change, nor would it contribute to the achievement of the aspirational goal agreed to by federal, provincial and territorial energy ministers that, by 2025, all fuel-burning technologies for primary space heating for sale in Canada will meet an energy performance of at least 90% (condensing technology level). Since the Amendment has been designed to achieve greater harmonization on federal and provincial energy efficiency standards, the status quo option would be inconsistent with the federal-provincial-territorial framework to encourage market transformation through collaboration on energy efficiency standards, released by the Energy and Mines Ministers' Conference in 2016.

Voluntary approach (repeal the Regulations)

Under this approach, Canada would repeal the Regulations and rely on voluntary measures to reduce GHG emissions and energy consumption associated with energy-using products. This option would reduce costs for the regulated industry, since there would be no mandatory requirements to meet; however, it would not address GHG emissions to the extent required to meet commitments made under the Pan-Canadian Framework on Clean Growth and Climate Change, nor would it reduce energy consumption to the extent that a regulatory approach would. A voluntary approach would also be a significant departure from Canada's approach to advancing energy efficiency and from the intent of the Act.

A voluntary approach would result in fewer GHG emission reductions than the status quo option or taking a regulatory approach. Studies have shown that in countries where MEPS have been introduced for the first time, significant energy efficiency improvements have been observed. For example, a 32% energy efficiency improvement was achieved in one year (1994–1995) when Mexico first implemented MEPS for four product categories. [9] Such improvements have translated into large reductions in energy consumption and GHG emissions. Globally, the most mature national MEPS and labelling programs covering a broad range of products are estimated to save between 10% and 25% of national energy consumption. [10] There is strong evidence to show that significant and sustained improvements in energy efficiency occur where MEPS are subject to

ongoing revision and updating to keep pace with the rate of improvement in new products entering a market. [11] Given the global evidence of the significant benefits of MEPS, a voluntary approach would mean that these benefits would not be realized.

Regulatory action

Taking regulatory action to increase the stringency of MEPS for the 11 product categories affected by the Amendment will lead to greater GHG emissions reductions than either the status quo or voluntary approach. This approach would provide important incremental GHG emission reductions to contribute to the achievement of Canada's commitments made under the Pan-Canadian Framework on Clean Growth and Climate Change; it would also contribute to achieving the aspirational goal agreed to by federal, provincial and territorial energy ministers that, by 2025, all fuel-burning technologies for primary space heating for sale in Canada will meet an energy performance of at least 90% (condensing technology level).

Benefits and costs

Summary

Reduced energy consumption and lower GHG emissions will result in significant net benefits over the lifetime of affected product models. The benefits vary by individual user depending on end-use sector, geographical location and operational practices.

Annual reductions in energy consumption associated with the Amendment are estimated to be 1.07 petajoules (PJ) in 2020 and are expected to reach 18.58 PJ in 2030 as the sale of more efficient products steadily replaces the pre-regulation stock.

Annual reductions in GHG emissions resulting from these reductions in energy consumption are estimated to be 0.05 Mt in 2020 and are expected to reach 0.92 Mt in 2030. It is estimated that, by applying a social cost of carbon to these reductions, the cumulative present value of economic benefits associated with GHG emission reductions will be $701 million by 2030. [12]

Canadian consumers will also realize economic benefits in the form of reduced energy costs due to the implementation of the Amendment. It is estimated that more than $2 billion in cumulative present value energy savings will be realized by 2030.

The cumulative present value of incremental technology costs and costs to Government associated with the Amendment are estimated to be $1.0 billion and $0.1 million, respectively, by 2030.

The present value of net benefits of the Amendment is estimated to be $1.80 billion by 2030, with total benefits exceeding total costs by more than two to one. By 2030, the present value of benefits and costs from the Amendment is estimated to be $2.84 billion and $1.04 billion, respectively.

Benefits and costs associated with the Amendment are presented in Table 1.

Table 1: Summary of benefits and costs associated with the Amendment

Monetized Benefits	Costs (if applicable)	Quantified Benefits	Unquantified Benefits
Energy (gas and electricity) savings	Technology costs	Energy savings (PJ)	Outside air quality, competiveness, job growth, non-energy benefits (home comfort, indoor air quality, minimizing depressurization in new construction, etc.)
Avoided damages because of GHG reductions	Installation costs	GHG savings (Mt)	
	Government administration		

Interested parties seeking more details on this analysis can request a copy of the cost-benefit analysis document by contacting the individual named at the end of this document.

Methodology, assumptions and data

Natural Resources Canada analyzed the economic gains to be made through the more stringent MEPS and the impact on Canadian society within a cost-benefit analysis framework. The costs and benefits associated with the Amendment were obtained by comparing the following scenarios:

- the business-as-usual case (i.e. excluding the Amendment); and
- the policy case (i.e. the business-as-usual case including the Amendment).

Business-as-usual case

For the purpose of this analysis, the business-as-usual case was defined in terms of Canadian market conditions assessed in 2016. Where Canadian MEPS are aligning with those of the United States, it was assumed that incremental costs and benefits in Canada were fully the result of the Canadian amendments, with no post-2016 spillover effects from the other jurisdictions such as the United States. This assumption is consistent with other recent federal regulations [13] and provides an assessment of the full economic impacts of regulatory changes affecting Canadians.

Policy case

The policy case is defined as the application of the more stringent MEPS across 11 product categories relative to markets defined by studies completed in 2016.

Benchmarks

For all product categories, benchmarks are chosen to represent the product models that do not meet the more stringent MEPS. Within those benchmarks, two efficiency levels are considered and weighted based on their relative market share: (1) the least efficient; and (2) the efficiency of the average unit impacted. Where relevant, regional sensitivities were evaluated (e.g. a gas furnace would save more energy per year in a colder location).

Social cost of carbon

The social cost of carbon was used to quantify the economic benefits of reducing GHG emissions. It represents an estimate of the economic value of avoided climate change damages at the global level for current and future generations as a result of reducing GHG emissions. The estimated values of the social cost of carbon used in this assessment draw on ongoing work undertaken by Environment and Climate Change Canada [14] in collaboration with a federal interdepartmental working group and in consultation with a number of external academic experts. This work involves reviewing existing literature and other countries' approaches to valuing GHG emissions. Preliminary recommendations, based on current literature and in line with the approach adopted by the U.S. Interagency Working Group on the Social Cost of Carbon, [15] are that it is reasonable to estimate social cost of carbon values at $37.4/tonne of carbon dioxide equivalent in 2013 (in 2012$), increasing each year with the expected growth in damages.

Methodology to estimate costs

The additional or "incremental" costs associated with the Amendment were determined as the difference between the cost of the inefficient product model, represented by the selected benchmark, and the cost of a modified version of that product model that would meet the more stringent MEPS. For each product category, the potential cost of modifying the benchmark product model so that it meets the more stringent MEPS was estimated (e.g. cost of adding insulation to a water heater). These costs were then multiplied by the number of shipments of the product models in the business-as-usual case that were estimated to have an energy performance that is worse than what is required by the MEPS. Results were combined across all affected product categories to arrive at the estimate of total costs.

Additional incremental costs related to installation and maintenance costs or to the lifetime of the product were also evaluated, as applicable. Total costs reported as being attributable to the Amendment include, when appropriate, manufacturing, compliance and administrative costs as well as those incurred by Government to implement the changes. The compliance costs do not include testing costs for products that are already being tested to enter the U.S. market or under voluntary programs. The added cost of third-party verification and marking is not included either because they are confidential business costs that vary based on business relationships. [16] However, they are estimated to be less than 10% of the total testing costs.

Methodology to estimate benefits

Energy savings for each product category were estimated by calculating the energy used by the selected benchmark product model by simulating how it would be normally used in a year (e.g. number of operating hours). The result was compared to the energy used by the modified version of that product model that would meet the more stringent MEPS. The difference was multiplied by the number of shipments of the product models in the business-as-usual case that were estimated to have an energy performance that is worse than what is required by the MEPS and the number of years the product is expected to last, in order to arrive at the total energy savings. Results were summed across all affected product categories to arrive at the estimate of total energy saved. This was then monetized by multiplying the results by the cost of energy per unit of energy saved (i.e. dollars per kilowatt hour).

The reductions in GHG emissions were calculated by applying fuel-specific emissions factors, consistent with those published by Environment and Climate Change Canada, to the resulting energy savings. To remain consistent with the U.S. methodology and produce more realistic GHG savings, the reductions attributable to diminished electricity consumption were calculated by applying the emission factors associated with the marginal fuels [17] used to generate the electricity that would be saved through implementation of the Amendment. To allow comparison with outcomes reported under the PanCanadian Framework on Clean Growth and Climate Change, the reductions in GHG emissions were also calculated by applying an average emission factor. Annual reductions in GHG emissions with the average emission factor are estimated to be 0.13 Mt in 2020, increasing to 1.03 Mt in 2030. GHG emissions were monetized and incorporated into the analysis using a social cost of carbon, as calculated by Environment and Climate Change Canada. The social cost of carbon represents an estimate of the economic value of avoided climate change damages at the global level — for current and future generations — as a result of reducing GHG emissions.

Assumptions

Key assumptions include the following:

- Analysis covers shipments impacted by the proposed Regulations between 2019 and 2030;
- Business-as-usual case reflects Canadian market conditions in 2016;
- Benefits and costs are measured in real constant 2018 dollars;
- A 3% real discount rate is applied to all benefits and costs with values discounted to 2018; [18]
- Canadian average energy prices, based on data from Environment and Climate Change Canada's 2017 Emission Trends;
- Valuation of the GHG emissions incorporated into the analysis is based on the social cost of carbon as calculated by Environment and Climate Change Canada;
- Costs assumed by manufactures and distributors to produce technology that is more efficient are assumed to be passed on to consumers or end-users; and
- Incremental costs associated with more efficient technology were estimated in 2016 and are assumed to be constant, despite evidence [19] that such costs come down with time, owing to improvements in manufacturing processes and economies of scale, as higher volumes of product models with new technology enter the market. This assumption could lead to overestimates of manufacturing costs; however, it provides a conservative assessment of overall net benefits. A 2018 study [20] found that each doubling of production for residential gas furnaces lead to a 5.7% to 8.9% decrease in manufacturing costs.

Data collection and sources

Data is collected on a product-by-product basis, through market studies. It provides key inputs to the analysis such as market size, the portion of the market that does not meet the more stringent MEPS, the benchmarks that best represent that portion of the market, energy savings from the business-as-usual case to the policy case, costs of moving from the business-as-usual case to the policy case, product lifetime, and installation costs.

Results

The methodology described above was applied to all product categories to develop an estimate of the benefits and costs attributable to the Amendment. The results vary by product category depending on the magnitude of the increase in stringency of the MEPS and the estimated portion of the market that will be impacted by the Amendment. The estimated benefits and costs for each product category are presented in Table 2 and are provided by product category, fuel-type and end-use levels.

Negative numbers in the table indicate that these particular subcategories present negative net benefits. Consistent with previous amendments, subcategories that do not generate net positive benefits are maintained in order to achieve the desired objectives and outcomes of the Amendment from which Canadians will benefit as a whole. These results are then aggregated to present the overall impacts of the Amendment in Table 3.

Table 2: Benefits and costs (technology and installation) per product category and subcategory used in analysis

Product Category (Subcategory)	Cumulative Total for Product Shipped by 2030 (Millions of Dollars) [2018$]		
	Product Costs *	Product Benefits **	Product Net Benefits
Household gas boilers	**$99.06**	**$164.20**	**$65.14**
• Intended for hot water systems	$99.03	$164.03	$65.00
• Intended for low pressure steam systems	$0.03	$0.17	$0.14
Household oil-fired boilers	**$6.86**	**$32.96**	**$26.10**
• Intended for hot water systems	$6.75	$32.55	$25.79
• Intended for low pressure steam systems	$0.11	$0.41	$0.31
Commercial gas boilers	**$589.75**	**$973.53**	**$383.78**
• Intended for hot water systems	$573.56	$935.50	$361.94
• Intended for low pressure steam systems	$16.19	$38.03	$21.84
Commercial oil-fired boilers	**$3.27**	**$13.62**	**$10.35**
• Intended for hot water systems	$3.07	$12.68	$9.61
• Intended for low pressure steam systems	$0.20	$0.93	$0.74
Gas fireplaces	**$95.99**	**$1,049.58**	**$953.60**
• Heating	$51.26	$480.97	$429.71
• Decorative	$44.73	$568.61	$523.88
Household gas-fired instantaneous water heaters	**$0.00**	**$29.63**	**$29.63**
Commercial gas-fired water heaters	**$29.42**	**$47.23**	**$17.81**
Commercial gas-fired storage water heater	$15.01	$42.01	$27.00
Residential-duty commercial gas-fired storage water heater	$5.53	$1.53	-$4.00
Commercial gas-fired instantaneous water heater	$8.88	$3.69	-$5.19
Gas furnaces	**$199.65**	**$515.46**	**$315.82**
Electric furnaces [21]	**$15.16**	**$18.33**	**$3.17**

* Costs for technology and installation.

** Benefits from energy savings and GHG emission reductions.

Note: Numbers may not add up to totals due to rounding. Covers shipments impacted by the proposed Regulations between 2019 and 2030. All benefits and costs are discounted at 3% to the year 2018.

Table 3: Summary of benefits and costs to Canadians

Costs, Benefits and Distribution			Aggregate Annual Totals		Total Cumulative Present Value	Average Annualized Over Period to 2030
			2020	2030	By 2030	
A. Quantified impacts ($) [millions in 2018 prices]						
Benefits	Pre-tax fuel (gas and electricity) savings	Canadians	$131.79	$279.58	$2,143.96	$215.39
	Avoided GHG damages	Canadians	$35.38	$98.63	$700.59	$70.38
Total benefits			**$167.17**	**$378.21**	**$2,844.54**	$285.77
Costs	Technology and installation costs	Canadians	$34.68	$146.50	$1,039.16	$104.40
	Compliance and administrative costs	Canadians	$0.11	$0.12	$1.23	$0.12
	Government administration	Government	$0.10	$0	$0.10	$0.01
Total costs			**$34.89**	**$146.67**	**$1,040.49**	$104.53
Net benefits			**$132.28**	**$231.54**	**$1,804.06**	$181.24
B. Quantified impacts (in non-$)						
Positive impacts on Canadians	Energy savings (petajoules)		1.07	18.58	101.63	—
	GHG emission reductions (megatonnes)		0.05	0.92	5.03	—

Note: Numbers may not add up to totals due to rounding. The information in this table covers shipments impacted by the proposed Regulations between 2019 and 2030. All benefits and costs are discounted at 3% to the year 2018.

Additional benefits and costs

For industries using affected energy-using products in their operations, an improvement in energy performance translates into energy and operating cost savings, increased productivity and competitiveness, and improved environmental performance. When such companies spend these energy savings on expanding their businesses or factories, they create greater demand.

Because of the lack of data, the analysis has not quantified widely accepted benefits, such as reduced air pollution, and non-energy benefits related to energy efficiency, such as increased occupant comfort, better indoor air quality and minimizing risks of depressurization in new constructions with better envelopes.

The analysis has quantified costs and benefits for each product category relative to a business-as-usual case defined by market conditions assessed in 2016. In the case of three product categories (commercial electric water heaters, commercial oil-fired water heaters and residential-duty commercial oil-fired water heaters), the assessment showed that all product models being imported into Canada or shipped between provinces comply with the proposed MEPS. While the analysis does not attribute any costs or benefits to the implementation of the MEPS for these three product categories, this Amendment will prevent future dumping of low-efficiency product models into the Canadian market.

Another benefit of the Amendment is related to the verified energy efficiency performance data of energy-using products that is collected by Natural Resources Canada through its compliance program. The data for new energy-using products will be posted to the Natural Resources Canada website [22] and will provide readily accessible information to consumers or businesses. Consumers benefit from this information since it provides them with detailed information to make informed purchase decisions. Utilities and retailers also benefit from this information, since it supports programming to promote the sale of high- efficiency products.

"One-for-One" Rule

It is estimated that the Amendment would generate an increase in administrative burden of $72,161 created by the introduction of regulatory requirements for new product categories. Dealers of these new products will be required to learn about the requirements of the Regulations and submit information before and at the time of importation in accordance with subsection 5(1) of the Act.

The Amendment is considered an "IN" under the "One-for-One" Rule. It would result in an increase of $72,161 in annualized average administrative costs to industry.

Assumptions underlying administrative burden estimates

Familiarization with the Amendment

Familiarization with new information obligations is a one-time administrative function that applies to manufacturers of regulated products. The task involves reviewing and understanding the new requirements of the Amendment, as well as the energy efficiency reporting form that Natural Resources Canada provides to each stakeholder. This one-time event is estimated to take two hours and to be undertaken by someone with a technical background who receives a wage rate of approximately $42. The number of stakeholders impacted is estimated as 710, which represents the sum of total companies identified under the following three Harmonized system (HS) codes:

- 332410 — Power Boiler and Heat Exchanger Manufacturing
- 333413 — Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing
- 333416 — Heating Equipment and Commercial Refrigeration Equipment Manufacturing

The use of these codes likely overestimates the total number of companies that would be directly impacted by the Amendment. Natural Resources Canada does not have access to more detailed information that would allow for a more precise stakeholder estimate and decided, for the purpose of this calculation, to apply estimates of incremental burden to all 710 stakeholders.

Submitting import reports

The Amendment would introduce import reporting requirements for new energy-using products. Importers of these new products will carry an incremental ongoing administrative burden, as they will be required to provide information for 21 new 10-digit HS codes at the time of importation. To estimate the frequency and time associated with this administrative action, Natural Resources Canada analyzed Canada Border Services Agency import data from four recent years (2012–2015) to establish number of importers, average number of transactions per year and the average number of transactions per year per HS code. Based on this analysis, it is estimated that 1 984 importers will be affected by this incremental activity, which will occur 85 times per year. It is assumed that clerical staff with a wage rate of approximately $30 will undertake this task.

To estimate the time required per event, Natural Resources Canada relied upon a U.S. Department of Energy assessment of the time it takes to populate a similar report in a similar context: information is readily available and must simply be entered into the proper place in the report. The U.S. Department of Energy estimated that it took approximately 22 seconds per data element to populate this report. To account for minor differences between the complexities of the data elements in Canada's import reports and those that were the subject of the U.S. Department of Energy analysis, Natural Resources Canada estimates that it would take 36 seconds per data element, with each report requiring two data elements. These activities would be undertaken by administrative support with a wage rate of approximately $29.

Submitting efficiency reports

The Amendment would introduce an administrative burden associated with the reporting of energy performance information before an energy-using product is imported. The added burden would apply to product models that have reporting elements that differ from reporting requirements already in place in other jurisdictions.

The data used to calculate incremental administrative burden costs was obtained from a variety of sources, such as internal compliance databases, numerous product market studies, Statistics Canada, the Canada Border Services Agency, the Canadian Federation of Independent Business, and the U.S. Department of Energy. Analysis of the data indicates that 8% of shipments may be impacted by new reporting requirements, which require inputting data into fields of the energy efficiency reports. This percentage was applied to the total number of estimated manufacturers (710) to arrive at 57 total stakeholders that would be affected by this incremental burden. The time required to input the data has been estimated to take 36 seconds per data element. These activities would be undertaken by administrative support staff with a wage rate of approximately $29.

Consultations

No comments were received from stakeholders on the impacts of the Amendment on administrative burden. In general, stakeholders are supportive of the approach to align reporting requirements with other jurisdictions when feasible.

Small business lens

The small business lens applies to the Amendment since it would require that data and information be reported for the first time for eight product categories by close to 1 400 small importers. The reporting requirements are minor and represent the minimum amount of information required to assess that an individual product model meets the prescribed standards; however, the Amendment is estimated to increase the administrative costs for small importers by $50,513 in annualized average administrative costs, or approximately $36 per business. These costs represent the portion of the total administrative burden calculated for the “One-for-One” Rule that are assumed by importers.

Natural Resources Canada held discussions with an organization representing the interests of small, independent businesses to better understand the potential impacts of the amendments to the Regulations. The organization indicated that the main challenge for these companies results from a lack of awareness of the new requirements and when they come into force. To mitigate this challenge, Natural Resources Canada intends to undertake supplemental outreach activities specific to the Amendment to educate importers and mitigate the risk that goods are refused entry into Canada due to the unintentional omission of data or information.

Natural Resources Canada estimates that the Amendment would also impact 10 small manufacturers of affected products. Six of these companies are manufacturers of heat/energy recovery ventilators, for which the Amendment would introduce reporting for the first time. The reporting requirements are minor and represent the minimum amount of information required to achieve the objective of ensuring that a standardized method is used to quantify the energy performance of these products.

One small manufacturer of gas fireplaces was identified and an assessment of its product offerings indicates that they already comply with the proposed requirements. Three small manufacturers of gas-fired boilers were also identified and engaged in consultations to develop the Amendment. For one company, all of their 24 current model offerings would comply with the proposed requirements. For another, almost half of their 684 current model offerings would comply. For the third, neither of its 2 current product offerings would comply with the proposed MEPS that would come into force in 2023. None of these small manufacturers identified any compliance issues associated with the size of their company during pre- consultations; however, Natural Resources Canada will continue discussions with these companies and welcomes comments from them or any other small businesses that could be affected.

Consultation

Pre-consultation summary

The Amendment introduces or updates MEPS, testing standards and/or reporting requirements for 12 product categories and supports the market transformation strategies released by federal, provincial and territorial energy ministers in 2017. Stakeholders [23] were informed of the changes being considered in the Amendment and were provided opportunities to comment at several points since 2016. These consultations evolved with time, and the content of the Amendment was modified accordingly. The following outlines the key materials used to communicate details to the stakeholder community:

- **February 2016:** Natural Resources Canada released a discussion paper to seek stakeholder views and feedback on the list of products being considered for the next two amendments.
- **March 2017:** Natural Resources Canada published a notice of intent in the *Canada Gazette*, Part I, to inform

stakeholders that it was initiating the development of the Amendment and also updated the Forward Regulatory Plans to communicate the product categories being considered for inclusion in the Amendment as well as the overarching policy direction being taken.

- **2017–2018:** Detailed product-specific technical bulletins were published. A series of product-specific webinars and workshops were held with affected stakeholders to discuss the content of these bulletins. For complex products, [24] the webinars included details on the cost and benefit analysis. In many cases, the industry questioned the assumptions on specific scenarios that could impact the costs and benefits, and Natural Resources Canada made changes when appropriate. The best data available was used and any new data provided will be taken into consideration. The complete analysis is available in the cost-benefit document.

All the documents mentioned above were distributed to stakeholders via targeted emails. In turn, many of these individuals and organizations forwarded the information to provide access to a larger audience of stakeholders.

Natural Resources Canada also has ongoing activities that provide additional opportunities to gather feedback from stakeholders and to inform them:

- *Energy Efficiency Regulations web page (http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845)* of the Natural Resources Canada website.
- Ongoing bilateral discussions: Natural Resources Canada is in close contact with the industry through major industry associations to discuss changes and updates to the products.
- National Standards System: The relevant Canadian Standards Association steering committees, technical committees and technical subcommittees, comprising stakeholders (including manufacturers, industry associations and other interested groups), provided input, and reviewed and voted upon changes to the testing standards.
- Market studies to support decision making were conducted by third-party consultants who worked with manufacturers and industry associations to gather information.

Product-specific comments received during pre-consultation

Stakeholders were informed of the content of the Amendment through the activities outlined above, and they were generally supportive of the approach. The following section elaborates only where there were substantive discussions, describing how those discussions were taken into account in the development of the Amendment.

Gas and oil-fired boilers (commercial)

Natural Resources Canada pre-consulted on referencing the industry test procedure, AHRI 1500-2015, in the Amendment. Five manufacturers and three industry associations supported this inclusion but recommended adopting the U.S. Department of Energy revisions to AHRI 1500-2015 as well. Natural Resources Canada agrees, and has directly incorporated the U.S. testing standard. [25]

The U.S. Department of Energy prepublished a final rule that has not become law. Five manufacturers and three industry associations advocated delaying any future alignment until the rule becomes law. Natural Resources Canada disagrees with this approach, as space heating equipment has been specifically identified in the Pan-Canadian Framework on Clean Growth and Climate Change as an area in which standards should be set to the highest level of efficiency that is economically and technically achievable. This includes a short-term goal to have all fuel-burning technologies for primary space heating for sale in Canada meet condensing technology performance levels by 2025.

One manufacturer, one program design and delivery group, two engineering design/management firms, and three advocacy groups supported the proposed levels. Five of these stakeholders advocated moving the period of manufacture earlier by one year to better support Canada's climate change goals. One commenter stated that Canada's higher heat loads elevate the importance of efficient space heating equipment relative to the United States. One manufacturer indicated that given the long service life of boilers, MEPS should be raised to limit inefficient products being in place well into the future. Natural Resources Canada agrees that the proposed space heating standards are appropriate given that space heating is the largest energy use in the buildings sector but disagrees with accelerating the period of manufacture, so industry has sufficient time to adapt.

Three manufacturers recommended applying the proposed MEPS for oil-fired boilers intended for hot water systems to new construction only, and applying the current U.S. standards to boilers marked for use in replacement installations. They expressed concerns that the proposed MEPS can be problematic in certain replacement scenarios and that the solutions could

be very costly. While Natural Resources Canada acknowledges the existence of problematic replacement scenarios, technologically feasible options exist to address these issues. Natural Resources Canada is proposing to maintain harmonization with the U.S. Department of Energy's prepublished final rule and welcomes the submission of detailed information regarding problematic installations and their associated impacts and costs.

Five manufacturers, three associations, and one utility recommended applying the proposed MEPS for gas boilers intended for hot water systems to new construction only, and applying the current U.S. standards to boilers marked for use in replacement installations. These stakeholders felt that the proposed MEPS would "orphan" co-vented products such as water heaters, resulting in oversized chimneys; potentially damage buildings due to ice buildup; and encourage building owners to repair rather than replace older, potentially unsafe boilers. Natural Resources Canada acknowledges the existence of installation scenarios that could lead to challenges such as those raised by stakeholders. However, information collected to inform this proposal suggests that, given the large number of condensing boilers currently being installed in replacement scenarios in Canada, the industry is well equipped to perform non-condensing to condensing vent conversions. Proper venting and condensate drain installations are key to avoiding issues. For other more complex installation issues, technologically feasible options exist to address these issues. Natural Resources Canada is proposing to maintain condensing technology levels for gas hot water boilers and welcomes the submission of information and data from interested parties regarding the potential impacts of implementing these levels.

Five manufacturers and three associations stated that the proposed standards for gas boilers intended for hot water systems will not deliver the anticipated energy savings when a unit is installed into an existing high temperature distribution system. Natural Resources Canada agrees and the cost-benefit analysis accounted for reduced performance in these scenarios. One manufacturer, one program design and delivery group, two engineering design/management firms, and three advocacy groups commented that high efficiency boilers would still outperform lower efficiency boilers, regardless of operating parameters.

Four manufacturers, three associations, and one utility commented that the service life attributed to condensing boilers in the cost-benefit analysis was unrealistically long. The utility recommended a service life of 20 years as being appropriate. Natural Resources Canada is proposing to maintain the service life at 24 years, based on the 2016 U.S. Department of Energy Technical Support Document for commercial packaged boilers, [26] unless better data is identified.

Commercial water heaters

Three industry associations and two manufacturers suggested a three-year lead time for all standards that are not aligned with current standards in the United States. Market data suggests that all manufacturers have products available at the higher standards. Natural Resources Canada is therefore not considering a change to the date.

One manufacturer requested clarification regarding the use of measured and nominal volume in the Amendment. Industry recommended following the U.S. Department of Energy compliance strategy on tolerance limits for measured volume. Natural Resources Canada agrees and will provide guidance on this matter in the Guide to the Regulations.

Commercial electric water heaters

Three industry associations commented that the MEPS equation for commercial electric water heaters needed to be more precise in its conversion from imperial to metric. Natural Resources Canada agrees and modified the equation.

Residential-duty commercial gas-fired storage water heaters

Natural Resources Canada pre-consulted on MEPS levels for replacement units that went beyond the current standards in the United States. Three industry associations commented that this level was too stringent. Natural Resources Canada modified the proposal to align with U.S. levels for replacement units only. Natural Resources Canada has pre-consulted with industry on how units will be marked for replacement in retrofit applications only and would continue to provide additional guidance, as needed.

Three industry associations and one manufacturer commented that the MEPS proposed for units, other than those marked for replacement only, should align with the U.S. Department of Energy's Notice of Proposed Rulemaking, which is more stringent than the level initially proposed in the technical bulletin. Natural Resources Canada agrees and modified the MEPS equation.

Three industry associations and one manufacturer requested that the definition of residential duty commercial water heaters be more detailed and harmonize with the U.S. definition. Natural Resources Canada agrees and modified the definition.

Commercial gas-fired storage water heaters

Three industry associations and two manufacturers supported the proposed thermal efficiency MEPS but recommended aligning standby loss MEPS with the ENERGY STAR performance levels, rather than a standby loss MEPS that is aligned with a more stringent U.S. Department of Energy's Notice of Proposed Rulemaking. They argue that very few production models can meet this level of standby loss. Natural Resources Canada's market data suggests that over 30% of the market is already at this level; therefore, the Department does not agree that it is necessary to lower the standard.

Three industry associations and two manufacturers requested guidance on Natural Resources Canada's compliance policy for the marking of units for replacement use only. Natural Resources Canada provided clarification on the language and expectations about the marking provision.

One manufacturer raised a concern regarding vent safety issues for gas-fired products at the proposed MEPS level. The manufacturer recommends lowering the MEPS from 82% to 80% thermal efficiency to reduce the risk of condensation corrosion in the venting system. The Canadian Standards Association standard, CSA B149 – Natural gas and propane installation code, suggests that there is no difference in the vent category specified for products with thermal efficiencies of 80% and 82%; therefore, Natural Resources Canada believes that the risk of vent corrosion is low.

Commercial gas-fired instantaneous water heaters

Three industry associations and one manufacturer recommended changing the proposed MEPS from 94% to 90%. Natural Resources Canada disagrees with this recommendation given that market data suggests that the condensing products on the market are predominantly at the proposed MEPS.

Three industry associations and one manufacturer requested that the definition of commercial gas-fired instantaneous water heaters be aligned with that of the United States. Natural Resources Canada agrees and modified the definition.

One manufacturer expressed concern over the exclusion of commercial storage-type instantaneous water heaters from the scope. Market data suggests that this type of product has very limited market share in Canada; therefore, Natural Resources Canada did not include it.

Gas fireplaces

One industry association requested that the Amendment apply to products manufactured three years after final publication given that the changes would take time to implement. One manufacturer supported the timetable proposed. Natural Resources Canada notes that products commonly found in the marketplace already meet the proposed changes. Further, some of these regulatory provisions will apply in British Columbia on January 1, 2019.

Natural Resources Canada had initially proposed mandatory labelling for gas fireplaces but has removed it for this Amendment. The Department will work with industry to develop a way to make gas fireplace information more meaningful to consumers. One manufacturer commented that testing and rating of decorative gas fireplaces should not be required as there are no MEPS for these products. The manufacturer is concerned that this will confuse consumers, and increase costs and complexity. Natural Resources Canada disagrees given that, under current regulations, decorative gas fireplaces are tested and their efficiency labelled under a voluntary program.

Natural Resources Canada pre-consulted on limiting the type of ignition system and how long a pilot light would remain lit after main burner shut off (seven days for heating gas fireplaces and one day for decorative gas fireplaces). Some stakeholders commented that having different pilot light limits would result in different control valves and that would be costly. Natural Resources Canada agrees that both units would be subject to the same limit and changed it to seven days to be consistent with the CSA test procedure.

One manufacturer advocated the benefits of standing pilots in cold climates and recommended allowing the ignition system to be switched over to standing pilot during the colder months. Natural Resources Canada disagrees with this perspective and the Amendment is in line with a similar proposal to change gas fireplace safety standards.

Natural Resources Canada had initially proposed a 4-hour static operation limit for the main burner on decorative gas fireplaces. One association and one manufacturer requested that this limit be changed to 24 hours to accommodate commercial establishments such as hotels. One manufacturer supported the proposed 4-hour static operation limit. Natural Resources Canada agrees that 24 hours is more realistic, particularly in commercial establishments.

Some stakeholders recommended that the prescriptive nature of some of the regulatory provisions might disallow future technology that achieves the same energy efficiency goals. Natural Resources Canada agrees and removed the prescriptive nature of the ignition system requirements, in favour of performance-based requirements.

One manufacturer and one association requested that the fireplace efficiency testing method CSA P.4.1-15 be fundamentally revised to better reflect real-life usage patterns. In the last two revisions of the CSA test procedure, Natural Resources Canada supported revisions to the standard to better reflect usage. Until more data related to gas fireplace usage in Canada is available, Natural Resources Canada does not support updating the test method to reflect real-life usage patterns.

Gas furnaces

One industry association and one manufacturer opposed raising the MEPS to 95% annual fuel utilization efficiency (AFUE) and proposed 92% AFUE to align with existing standards in some provinces. The association believed that the higher costs of products meeting the higher standard would reduce consumer choice, encourage consumers to repair rather than replace their inefficient furnaces or cause consumers to switch to lower efficiency alternatives. The market study indicates that there is considerable choice for products that meet the proposed MEPS. Canadian manufacturers have most of their models meeting the proposed MEPS and are not unduly impacted. The cost-benefit analysis has shown that this proposal is economically favourable for consumers despite the initial increase in the cost of a compliant furnace. Natural Resources Canada disagrees that consumers will be driven to fuel switch or to make irrational repair decisions due to the incremental cost increase.

One industry association, two manufacturers, and one distributor commented that there is a distinction between new factory-built single section homes mounted on a permanent chassis and factory-built modular homes transported on a truck bed. They requested the former be considered mobile homes, with furnaces intended for installation in these dwellings in a separate product category with a distinct minimum energy efficiency standard. Natural Resources Canada understands that mobile home furnaces in the United States are a separate category, but products referred to as mobile homes in the United States are no longer manufactured in Canada. Factory-built single section homes mounted on a permanent chassis are considered manufactured homes in Canada, and new manufactured housing in respect of gas furnaces do not need special exemptions. Therefore, Natural Resources Canada disagrees that a separate category for mobile home furnaces is required for new mobile homes.

In respect of gas furnaces for existing mobile homes, one industry association, two manufacturers, and one distributor were concerned about the cost increase of replacing a mid-efficiency furnace with a condensing furnace, causing economic hardship to existing mobile home owners. Further, one manufacturer was concerned about condensing units not being able to fit in certain replacement scenarios for mobile homes. Natural Resources Canada disagrees with this, as drop-in replacement furnaces for mobile homes that are compliant with the proposal are available.

Natural Resources Canada pre-consulted on changing the exemption given to mobile homes to only recreational vehicles and park model trailers. Discussions with stakeholders indicated that mid-efficiency furnaces, currently exempted for mobile homes, were being installed in relocatable buildings. The proposal would have required furnaces for these relocatable buildings to meet the proposed MEPS. Stakeholders commented that these relocatable buildings, typically used in work camps, have had issues with condensate freezing, resulting in damaged furnaces when these buildings are relocated or put out of service during the heating season. In response to this comment, Natural Resources Canada has created a new, distinct category of furnaces for relocatable buildings with MEPS of 80% AFUE. In addition, these furnaces must be marked for the intended use, and must comply with the fan energy rating requirement for non-condensing furnaces.

Heat/energy recovery ventilators

Natural Resources Canada had pre-consulted on reporting fan efficacy at 0 °C, sensible heat recovery efficiency at 0 °C and −25 °C and the rated net supply airflow. Three manufacturers and one consultant commented that the sensible heat recovery efficiency is directly linked to the net supply airflow; thus, reporting them separately would serve no useful purpose. Natural Resources Canada agrees and modified the proposal to link the efficiency requirements with the associated airflow.

Three manufacturers and one industry association mentioned that there is no certification body for this product; therefore, they would not be able to comply with the proposed requirements. Natural Resources Canada believes that this situation is inherent to all unregulated products when they are introduced for the first time and that the issue will be resolved by the time the Amendment comes into force.

Natural Resources Canada pre-consulted on a scope limit for airflow capacity at 236 L/s. One manufacturer and one industry association requested that the scope be limited to an airflow capacity that is more commensurate with residential use. After reviewing the Home Ventilating Institute qualified product listings, Natural Resources Canada agrees and modified the definition to limit the scope to 142 L/s.

Two manufacturers and one industry association asked to place limits on the requirement to report sensible heat recovery efficiency at −25 °C, given that milder regions of Canada would not require products to operate at low outdoor temperatures. Natural Resources Canada agrees and will not require testing and reporting at −25 °C for products that are marked for installation in regions with mild winters.

One manufacturer recommended that the Amendment include mandatory product labelling and documentation of energy performance and airflow curves. Natural Resources Canada sees some merit in this recommendation for consumers, but it would unduly increase the reporting burden and compliance costs for manufacturers.

Natural Resources Canada pre-consulted on using the product's maximum rated airflow to define the product scope. One manufacturer and one consultant commented that maximum rated airflow should not be used to limit airflow capacity, as it has little correlation with the rated airflow of the unit that is chosen by the manufacturer for energy performance ratings. Energy performance tests are performed at lower than the product's maximum setting to obtain the rated net supply airflow specified by the manufacturer. Natural Resources Canada agrees and modified the definition so that scope is limited by rated net supply airflow.

One association and one consultant requested that the Passive House Institute testing standard be designated as an acceptable alternative to the proposed testing standard and that the Institute be designated an acceptable alternative to an accredited certification body under the Standards Council of Canada without making application for such an accreditation. Natural Resources Canada found that the Passive House Institute testing standard is not aligned with the proposed testing standard and, therefore, is not an acceptable alternative. Furthermore, the Regulations require that all certification bodies be accredited under the Standards Council of Canada.

Household boilers

Three industry associations and one manufacturer supported standards for the boiler categories that are aligned with the U.S. standards. [27]

Three industry associations and one manufacturer stated that the higher MEPS for gas boilers intended for hot water systems would require new venting systems to be installed in replacement scenarios, increasing costs for consumers and potentially leading to a loss of heat during a winter emergency repair. Natural Resources Canada disagrees with emergency repairs being widely problematic. The experience with condensing gas furnaces has shown that industry has adapted to solve difficult residential venting situations in a timely manner; Natural Resources Canada expects the same will occur with condensing gas hot water boilers. Natural Resources Canada agrees that some consumers will experience increased costs if the venting system must be replaced, but this effect is included in the cost-benefit analysis.

Three industry associations and one manufacturer stated that the replacement of a boiler that is co-vented with a water heater would result in additional costs to consumers to rework the water heater venting. In addition, some rework of the hydronic system may be required to accommodate a condensing boiler, adding to the installation costs. Manufacturers have commented that the installed costs of condensing boilers are in reality higher than the costs used in Natural Resources Canada's economic analysis, with one manufacturer providing supporting data. Natural Resources Canada performed the analysis based on the best data available.

Two manufacturers stated that the proposed standards for gas boilers intended for hot water systems will not deliver the anticipated energy savings when a unit is installed into an existing high temperature distribution system. The market analysis undertaken by Natural Resources Canada shows energy savings even in existing high temperature distribution systems. The cost-benefit analysis accounted for reduced performance in these scenarios.

Because of the potential increased costs to consumers and the possible reduction in energy performance noted above, most commenters advocated for a lower efficiency standard of 84% AFUE for gas boilers (hot water) intended for replacement installations, while maintaining the proposed condensing standard for new construction only. Market data shows that

consumers are choosing condensing gas hot water boilers, with 78% of shipments in this category already meeting the proposed MEPS, and that the majority of these are used as replacement boilers. As a result, Natural Resources Canada disagrees with the need to lower performance standards for the replacement market.

Household instantaneous gas-fired water heaters

Two industry associations and two manufacturers requested that the definition of this product be aligned with the U.S. definition, including limiting scope to input rates less than 200 000 Btu/h. Natural Resources Canada agrees and modified the definition.

One manufacturer recommended setting lower MEPS for this product so that homeowners with existing instantaneous water heaters continue to have a lower cost option. Natural Resources Canada's economic analysis suggests that the incremental cost of moving to the higher standard is negligible.

Regulatory cooperation

The Amendment is the result of significant cooperation — both domestically and with the United States — to contribute to the achievement of domestic goals for the reduction of GHG emissions and energy consumption.

Domestically, collaborative efforts to reduce GHG emissions from Canada's building sector has been guided by two federal, provincial and territorial forums.

Canada's First Ministers Conference — a meeting of the provincial and territorial premiers and the prime minister. These events are held at the call of the prime minister and, since 1950, have typically been held annually. In 2016, First Ministers adopted the Pan-Canadian Framework on Clean Growth and Climate Change, which included a commitment that the federal government would set new standards for heating equipment and other key technologies to the highest level of efficiency that is economically and technically achievable.

Canada's Energy and Mines Ministers Conference — an annual gathering of federal, provincial and territorial ministers responsible for energy and mining portfolios. At these meetings, ministers discuss shared priorities for collaborative action to advance energy and mining development across the country. In 2016, the ministers released a framework that defined how federal, provincial and territorial governments would achieve greater harmonization on energy efficiency standards and encourage market transformation through increased collaboration. In 2017, the ministers released market transformation strategies for energy-using equipment in the building sector and established short-, medium- and long-term aspirational goals for windows, space heating and water heating systems in the building sector. The ministers agreed to work towards a goal that, by 2025, all fuel-burning technologies for primary space heating and water heating for sale in Canada will meet an energy performance of at least 90% (condensing technology level).

Given that the Amendment has been informed by collaborative work with provincial and territorial governments, it would contribute to the objective of the Canadian Free Trade Agreement by reducing and eliminating, to the extent possible, barriers to the movement of goods within Canada.

Internationally, Canada has benefited from a long- standing cooperative relationship with U.S. Department of Energy regulators of energy efficiency. Federally, this relationship has been formalized under the Canada–United States Regulatory Cooperation Council and the 2015 signing of a Regulatory Partnership Statement. [28] Through binational cooperation, both countries have worked to reduce and eliminate instances of unnecessary regulatory differences and to develop coordinated approaches to achieving common policy objectives.

The Amendment is consistent with the objectives of the *Memorandum of Understanding between the Treasury Board of Canada Secretariat and the United States Office of Information and Regulatory Affairs Regarding the Canada–United States Regulatory Cooperation Council* signed in June 2018. The Amendment seeks to foster alignment of federal regulations where feasible and appropriate, primarily through the use of testing standards already used by other jurisdictions to assess energy-using product compliance with the MEPS.

Rationale

The Amendment will benefit Canadians by reducing GHG emissions and energy consumption in homes and buildings. Homeowners and businesses will benefit from reduced energy costs associated with the use of more efficient technologies.

According to the International Energy Agency, policies and programs that address energy efficiency are the most cost-effective way to lower GHG emissions and could complement carbon pricing schemes as an overall strategy to effectively achieve climate change policy objectives. [29]

In the absence of a regulatory approach, a market for low-efficiency products would continue. Consumers who purchase such products could be motivated by lower purchase costs even though they would pay higher operational costs over the life of the product. The analysis of the Amendment has shown that more stringent MEPS for all products would generate reductions in GHG emissions and energy consumption. The associated energy savings would generate net monetary benefits for Canadian consumers. The analysis has shown that the overall costs of technologies that will be required to bring low-efficiency products into compliance with the MEPS proposed in this Amendment are outweighed by the overall benefits.

The Amendment is supported by provincial and territorial governments as its development was influenced by work conducted under the framework released by the Energy and Mines Ministers' Conference in 2016 to achieve greater harmonization on U.S. energy efficiency standards with those of Canada and to encourage market transformation through increased collaboration. It also contributes to the federal commitment made under the Pan-Canadian Framework on Clean Growth and Climate Change to set new standards for heating equipment and other key technologies to the highest level of efficiency that is economically and technically achievable and the aspirational goal released by federal, provincial and territorial energy ministers that, by 2025, all fuel-burning technologies for primary space heating for sale in Canada will meet MEPS of at least 90% (condensing technology level).

The Amendment has been designed to contribute to this commitment and goal while minimizing the burden on the affected industries, primarily through the use of existing testing standards used by the industry or required by other jurisdictions to assess conformity with the proposed MEPS.

Prescribed MEPS are a proven cost-effective approach to achieving reductions in GHG emissions and energy consumption. The *Energy Efficiency Regulations* were first introduced in 1995 and, including the Regulations, have been amended 14 times to increase the stringency of existing MEPS and introduce MEPS for new energy-using products. Through the use of third-party verification and regular post-market compliance activities, a high compliance rate with regulated requirements has been observed. This provides confidence that estimated outcomes are being achieved and that Canadians are experiencing the associated benefits.

Implementation, enforcement and service standards

The Amendment will come into force six months after publication in the *Canada Gazette*, Part II. The requirements will apply to the prescribed energy-using products based on their period of manufacture, date of import or date of interprovincial shipment.

The compliance and enforcement procedures already in place for all products prescribed under the Regulations will continue to be used following the coming into force of this Amendment. The main features of this system are explained below.

Verification marking and energy efficiency reporting

For products prescribed under the Regulations, Natural Resources Canada employs a third-party verification system using the services of certification bodies accredited by the Standards Council of Canada. Verified energy performance data is submitted to Natural Resources Canada by the dealer in an energy efficiency report as specified in the Regulations. This is required once for each product model before first importation or interprovincial shipment.

Import reporting and monitoring

Natural Resources Canada procedures already in place for the collection of information for commercial imports of prescribed products will apply to products affected by the Regulations. These procedures involve crosschecking required import data received from customs release documents with the energy efficiency reports that dealers have submitted to Natural Resources Canada. This crosschecking ensures that the compliance of prescribed products imported into Canada can be verified.

The Regulations will continue to require dealers of prescribed products to provide the information needed for customs monitoring.

Direct fieldwork: market survey and product testing

In addition to ongoing compliance and marketplace monitoring activities, Natural Resources Canada surveys and tests products in the context of monitoring compliance outcomes with product-specific compliance audits. Depending on the product, in-store audits and/or testing of products are also conducted.

Natural Resources Canada also conducts product testing on a complaint-driven basis. The market is highly competitive and suppliers are cognizant of performance claims made by their competitors. Challenge procedures by which performance claims can be questioned exist in all verification programs.

Performance measurement and evaluation

The desired outcomes of the Regulations are presented in the following table along with the information that will be tracked to measure performance.

Table 4: Measuring performance of the Regulations

Outcome	Indicators	Information to Measure Performance
GHG emissions are reduced to contribute to Canada's goal to reduce GHG emissions by at least 30% below 2005 levels by 2030.	Percentage of product models that meet MEPS	Energy efficiency reports Import reports Market data (shipments, trends) Lab testing Emission factors Energy prices
Consumers save money by purchasing higher efficiency product models that have lower costs over their lifetime.		
Energy use for space and water heating decreases per home and per unit of commercial building floor space.		
Businesses using regulated energy-using products save money that can lead to increased productivity and competitiveness.		

Performance will be monitored through a combination of product-specific compliance reporting, supported by third-party verification of energy efficiency performance, and ongoing collection of market data to assess broader trends affecting outcomes.

Information collected on the energy efficiency performance of regulated products indicates both GHG emission impacts and consumer savings, since both are calculated as a function of changes in the amount of energy consumed by these products. [30]

A high compliance rate with the Regulations will be achieved through support from manufacturers, third-party verification, customs monitoring, co-operation with regulating provinces, communication activities, market surveys, and product testing, as required.

The standards contained in the Amendment are being implemented under the federal energy efficiency equipment standards and labelling program. Detailed accounts of progress towards achieving the objectives of this initiative will be found in departmental business plans, reports on plans and priorities, and the Report to Parliament under the *Energy Efficiency Act.*

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PROPOSED REGULATORY TEXT

Notice is given that the Governor in Council, pursuant to sections 20 [a] and 25 of the *Energy Efficiency Act* [b], proposes to make the annexed *Regulations Amending the Energy Efficiency Regulations, 2016 (Amendment 15)*.

Interested persons may make representations concerning the proposed Regulations within 70 days after the date of publication of this notice. All such representations must cite the *Canada Gazette*, Part I, and the date of publication of this notice, and be addressed to Jamie Hulan, Director, Equipment Division, Office of Energy Efficiency, Department of Natural Resources, 930 Carling Avenue (CEF, Building 3, Observatory Crescent), 1st Floor, Room 136-C, Ottawa, Ontario K1A 0Y3 (tel.: 613-996-4359; email: nrcan.equipment- equipement.rncan@canada.ca (mailto:nrcan.equipment-equipement.rncan@canada.ca)).

Ottawa, October 4, 2018

Jurica Čapkun
Assistant Clerk of the Privy Council

Regulations Amending the Energy Efficiency Regulations, 2016 (Amendment 15)

Amendments

1 The heading of Division 4 of Part 2 of the *Energy Efficiency Regulations, 2016* [31] is replaced by the following:

Furnaces, Fireplaces, Unit Heaters and Recovery Ventilators

2 The definition *FER* in section 256.1 of the Regulations is replaced by the following:

FER means, in respect of a gas furnace, an oil-fired furnace or an electric furnace, the fan energy rating, which is the annual electrical energy consumption of the furnace fan normalized by annual fan operating hours and the product's maximum airflow (Q_{max}). (*FER*)

3 (1) The definitions *CSA 2.3* and *gas furnace* in section 257 of the Regulations are replaced by the following:

CSA 2.3 means the CSA standard ANSI Z21.47-2016/CSA 2.3-2016 entitled *Gas-Fired Central Furnaces*. (*CSA 2.3*)

gas furnace means an automatic operating gas-fired central forced air furnace that uses propane or natural gas and has an input rate of not more than 117.23 kW (400,000 Btu/h). It does not include a furnace for a park model trailer or for a recreational vehicle. (*générateur d'air chaud à gaz*)

(2) Section 257 of the Regulations is amended by adding the following in alphabetical order:

gas furnace for relocatable buildings means a gas furnace that is intended for use in a temporary modular building that can be relocated from one site to another and is marked for use only in relocatable buildings. (*générateur d'air chaud à gaz pour bâtiments relocalisables*)

4 Subsection 258(2) of the Regulations is replaced by the following:

Limit

(2) However, for the purposes of sections 4, 5 and 259, a gas furnace is not considered to be an energy-using product if it was manufactured before February 3, 1995 or is a gas furnace for relocatable buildings that is manufactured before July 3, 2019.

5 (1) The portion of item 2.1 of the table to section 259 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	Energy-using Product
2.1	Gas furnaces, other than gas furnaces for relocatable buildings, that have an input rate of ≤ 65.92 kW (225,000 Btu/h), use single-phase electric current and do not have an integrated cooling component

(2) The portion of item 2.1 of the table to section 259 of the Regulations in column 3 is replaced by the following:

	Column 3
Item	Energy Efficiency Standard
2.1	Annual fuel utilization efficiency ≥ 95% FER ≤ FER for product class “Non-Weatherized, Condensing Gas Furnace Fan (NWG-C)”, set out in 10 C.F.R. §430.32(y)

(3) The portion of item 5.1 of the table to section 259 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	Energy-using Product
5.1	Gas furnaces, other than gas furnaces for relocatable buildings, that are through-the-wall, have an input rate of ≤ 65.92 kW (225,000 Btu/h), use single-phase electric current and have an integrated cooling component

(4) The portion of item 5.1 of the table to section 259 of the Regulations in column 3 is replaced by the following:

	Column 3
1Item	Energy Efficiency Standard
5.1	Annual fuel utilization efficiency ≥ 95% FER ≤ FER for product class “Non-Weatherized, Condensing Gas Furnace Fan (NWG-C)”, set out in 10 C.F.R. §430.32(y)

(5) The table to section 259 of the Regulations is amended by adding the following in numerical order:

	Column 1	Column 2	Column 3	Column 4
Item	Energy-using Product	Standard	Energy Efficiency Standard	Period of Manufacture
8	Gas furnaces for relocatable buildings	CSA P.2 for annual fuel utilization efficiency 10 C.F.R. Appendix AA, for fan energy rating	Annual fuel utilization efficiency ≥ 80% FER ≤ FER for product class “Non-Weatherized, Non-Condensing Gas Furnace Fan (NWG-NC)”, set out in 10 C.F.R. §430.32(y)	On or after July 3, 2019

6 The portion of item 2.1 of the table to section 260 of the Regulations in column 3 is amended by striking out “and” at the end of paragraph (f), by adding “and” at the end of paragraph (g) and by adding the following after paragraph (g):

	Column 3
Item	Information

2.1 **(h)** information that indicates whether product is gas furnace for relocatable buildings.

7 (1) The definition *gas fireplace* in section 265 of the Regulations is replaced by the following:

gas fireplace means a decorative gas fireplace or a heating gas fireplace. (*foyer à gaz*)

(2) Section 265 of the Regulations is amended by adding the following in alphabetical order:

automatic shut-off device means a device that automatically extinguishes the main gas burner flame if, in a 24-hour period,

(a) a person has not used the fireplace controls to adjust the flame height or appearance; or
(b) the fireplace has not received a signal indicating the presence of occupants in the room in which it is installed.
(*dispositif d'arrêt automatique*)

decorative gas fireplace means a vented fireplace that is fuelled by natural gas or propane, is marked for decorative use only and is not equipped with a thermostat or intended for use as a heater. (*foyer à gaz décoratif*)

heating gas fireplace means a vented fireplace that is fuelled by natural gas or propane and is not a decorative gas fireplace. (*foyer à gaz de chauffage*)

8 Subsection 266(2) of the Regulations is replaced by the following:

Limits

(2) However, a gas fireplace is not considered to be an energy-using product

(a) for the purposes of sections 4, 5 and 7, unless it is manufactured on or after June 1, 2003; or
(b) for the purpose of section 266.1, unless it is manufactured on or after January 1, 2020.

9 The Regulations are amended by adding the following after section 266:

Energy efficiency standards

266.1 (1) The energy efficiency standards set out in column 3 of the table to this section apply to gas fireplaces described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) A gas fireplace complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *gas fireplace* as defined in section 265.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Decorative gas fireplaces	N\A	The product must be capable of **(a)** automatically extinguishing pilot flame when main gas burner flame is established; **(b)** automatically extinguishing pilot flame when main gas burner flame is extinguished; or **(c)** in absence of any automatic or manual adjustment to main gas burner flame height or appearance, preventing pilot flame from burning continuously for more than seven days. Must be equipped with automatic shut-off device and, unless it is marked for replacement use only, have a direct vent configuration.	On or after January 1, 2020
2			Fireplace efficiency ≥ 50% The product must be capable of	

Heating gas fireplaces	CSA P.4.1-15 for fireplace efficiency	**(a)** automatically extinguishing pilot flame when main gas burner flame is established; **(b)** automatically extinguishing pilot flame when main gas burner flame is extinguished; or **(c)** in absence of any automatic or manual adjustment to main gas burner flame height or appearance, preventing pilot flame from burning continuously for more than seven days.	On or after January 1, 2020

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10 (1) Paragraph 267(1)(e) of the Regulations is replaced by the following:

(e) the type of ignition system it uses;

(2) Subsection 267(1) of the Regulations is amended by adding the following after paragraph (f):

(g) information that indicates whether the product is a decorative gas fireplace or a heating gas fireplace; and
(h) if the product is a decorative gas fireplace that is manufactured on or after January 1, 2020, information that indicates whether it is intended for use as a replacement unit.

11 The Regulations are amended by adding the following after section 271:

SUBDIVISION E

Electric Furnaces

Definition of *electric furnace*

272 In this Subdivision, *electric furnace* means an automatic operating central forced air furnace that uses single-phase electric current to heat one or more electrical resistance heating elements and has an input rate of not more than 65.92 kW (225,000 Btu/h).

Energy-using product

273 (1) An electric furnace is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 274, an electric furnace is not considered to be an energy-using product unless it is manufactured on or after July 3, 2019.

Energy efficiency standard

274 (1) The energy efficiency standard that applies to an electric furnace is that its FER must be less than or equal to the FER for product class “Non-Weatherized, Electric Furnace/Modular Blower Fan”, set out in 10 C.F.R. §430.32(y).

Testing standard

(2) An electric furnace complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix AA that are applicable to an *electric furnace* as defined in section 272.

Information

275 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with 10 C.F.R. Appendix AA and provided to the Minister in respect of an electric furnace:

(a) its maximum heat input nominal capacity, expressed in kilowatts (British thermal units per hour);
(b) its FER, expressed in watts per 472 L/s (watts per 1000 cubic feet per minute); and
(c) its maximum airflow (Qmax), expressed in L/s (cubic feet per minute).

SUBDIVISION F

Recovery Ventilators

Interpretation

Definitions

276 The following definitions apply in this Subdivision.

CSA C439-18 means the CSA standard CAN/CSA-C439-18 entitled *Laboratory methods of test for rating the performance of heat/energy-recovery ventilators*. (*CSA C439-18*)

energy-recovery ventilator means a factory-built packaged unit that has fans or blowers, has a rated net supply airflow of not more than 142 L/s (300 cubic feet/minute) and transfers heat and moisture between two isolated airstreams. (*ventilateur-récupérateur d'énergie*)

heat-recovery ventilator means a factory-built packaged unit that has fans or blowers, has a rated net supply airflow of not more than 142 L/s (300 cubic feet/minute) and transfers heat between two isolated airstreams. (*ventilateur-récupérateur de chaleur*)

sensible heat recovery efficiency means, in respect of an energy-recovery ventilator or a heat-recovery ventilator, the ratio of the net sensible energy recovered by the unit's supply airstream, as adjusted to account for the unit's external and internal energy gains and losses, to the maximum sensible energy that would be recovered if the unit had an infinite transfer area. (*efficacité de récupération de chaleur sensible*)

Energy-recovery Ventilators

Energy-using product

277 (1) An energy-recovery ventilator is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4 and 5, an energy-recovery ventilator is not considered to be an energy-using product unless it is manufactured on or after January 1, 2020.

Information

278 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with CSA C439-18 and be provided to the Minister in respect of an energy-recovery ventilator:

(a) its rated net supply airflow;
(b) its sensible heat recovery efficiency at 0°C and the associated net supply airflow, expressed in L/s, and electrical power consumption, expressed in watts; and
(c) unless the unit is marked for use only where the outdoor design temperature is greater than or equal to -10°C, its sensible heat recovery efficiency at -25°C and the associated net supply airflow, expressed in L/s.

Heat-recovery Ventilators

Energy-using product

279 (1) A heat-recovery ventilator is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4 and 5, a heat-recovery ventilator is not considered to be an energy-using product unless it is manufactured on or after January 1, 2020.

Information

280 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with CSA C439-18 and be provided to the Minister in respect of a heat-recovery ventilator:

(a) its rated net supply airflow;
(b) its sensible heat recovery efficiency at 0°C and the associated net supply airflow, expressed in L/s, and electrical power consumption, expressed in watts; and

(c) unless the unit is marked for use only where the outdoor design temperature is greater than or equal to -10°C, its sensible heat recovery efficiency at -25°C and the associated net supply airflow, expressed in L/s.

12 Section 314 of the Regulations is amended by adding the following in alphabetical order:

CSA P.2 means the CSA standard CAN/CSA-P.2-13 entitled *Testing Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas-Fired or Oil-Fired Furnaces and Boilers*. (*CSA P.2*)

10 C.F.R. Appendix A means Appendix A to Subpart E, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for the Measurement of Thermal Efficiency and Combustion Efficiency of Commercial Packaged Boilers*, as amended from time to time. (*appendice A 10 C.F.R.*)

13 (1) The definition *CSA P.2* in section 315 of the Regulations is repealed.

(2) The definition *gas boiler* in section 315 of the Regulations is replaced by the following:

gas boiler means a boiler that uses exclusively propane or natural gas, is intended for application in a low pressure steam, or hot water, central heating system and has an input rate of not more than 2 930 kW (10,000,000 Btu/h). (*chaudière à gaz*)

14 The Regulations are amended by adding the following after section 315:

Type

315.1 For the purpose of these Regulations, a gas boiler is one of the following types:

(a) household, if it has an input rate of less than 88 kW (300,000 Btu/h); or
(b) commercial, if it is has an input rate of greater than or equal to 88 kW (300,000 Btu/h) but not more than 2 930 kW (10,000,000 Btu/h).

15 Subsection 316(2) of the Regulations is replaced by the following:

Limits

(2) However, a gas boiler is not considered to be an energy-using product

(a) for the purpose of section 4 unless
  (i) it is a household gas boiler that is manufactured on or after June 30, 1999, or
  (ii) it is a commercial gas boiler that is manufactured on after January 1, 2023; and
(b) for the purposes of sections 5 and 317 unless
  (i) it is a household gas boiler that is manufactured on or after December 31, 1998, or
  (ii) it is a commercial gas boiler that is manufactured on after January 1, 2023.

16 Section 317 of the Regulations is replaced by the following:

Energy efficiency standards — household

317 (1) The energy efficiency standards set out in column 3 of Table 1 to this section apply to household gas boilers described in column 1 that are manufactured during the periods set out in column 4.

Testing standard — household

(2) A household gas boiler complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 of Table 1 that are applicable to a *gas boiler* as defined in section 315.

Energy efficiency standards — commercial

(3) The energy efficiency standards set out in column 2 of Table 2 to this section apply to commercial gas boilers described in column 1 that are manufactured on or after January 1, 2023.

Testing standard — commercial

(4) A commercial gas boiler complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix A that are applicable to a *gas boiler* as defined in section 315.

TABLE 1

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Household gas boilers that are intended for low pressure steam systems	CGA P.2	Annual fuel utilization efficiency ≥ 75%	On or after December 31, 1998 and before September 1, 2010
2	Household gas boilers that are intended for low pressure steam systems	CSA P.2 for annual fuel utilization efficiency	Annual fuel utilization efficiency ≥ 80% No continuously burning pilot light	On or after September 1, 2010 and before January 15, 2021
2.1	Household gas boilers that are intended for low pressure steam systems	CSA P.2 for annual fuel utilization efficiency, standby power and off-mode power	Annual fuel utilization efficiency ≥ 82% No continuously burning pilot light Standby power ≤ 8 W Off-mode power ≤ 8 W	On or after January 15, 2021
3	Household gas boilers that are intended for hot water systems	CGA P.2	Annual fuel utilization efficiency ≥ 80%	On or after December 31, 1998 and before September 1, 2010
4	Household gas boilers that are intended for hot water systems	CSA P.2 for annual fuel utilization efficiency	Annual fuel utilization efficiency ≥ 82% No continuously burning pilot light	On or after September 1, 2010 and before September 1, 2012
5	Household gas boilers that are intended for hot water systems and have tankless domestic water heating coils	CSA P.2 for annual fuel utilization efficiency	Annual fuel utilization efficiency ≥ 82% No continuously burning pilot light	On or after September 1, 2012 and before January 15, 2021
5.1	Household gas boilers that are intended for hot water systems and have tankless domestic water heating coils	CSA P.2 for annual fuel utilization efficiency, standby power and off-mode power	Annual fuel utilization efficiency ≥ 90% No continuously burning pilot light Standby power ≤ 9 W Off-mode power ≤ 9 W	On or after January 15, 2021
6	Household gas boilers that are intended for hot water systems and do not have tankless domestic water heating coils	CSA P.2 for annual fuel utilization efficiency	Annual fuel utilization efficiency ≥ 82% No continuously burning pilot light Equipped with automatic water temperature adjustment device and not operable without the device	On or after September 1, 2012 and before January 15, 2021
7	Household gas boilers that are intended for hot water systems and do not have tankless domestic water heating coils	CSA P.2 for annual fuel utilization efficiency, standby power and off-mode power	Annual fuel utilization efficiency ≥ 90% No continuously burning pilot light	On or after January 15, 2021

		Equipped with automatic water temperature adjustment device and not operable without the device
		Standby power ≤ 9 W
		Off-mode power ≤ 9 W

TABLE 2

Item	Column 1 Energy-using Product	Column 2 Energy Efficiency Standard
1	Commercial gas boilers that have an input rate of ≥ 88 kW (300,000 Btu/h) but ≤ 733 kW (2,500,000 Btu/h) and are intended for hot water systems	Thermal efficiency ≥ 90%
2	Commercial gas boilers that have an input rate of > 733 kW (2,500,000 Btu/h) but ≤ 2 930 kW (10,000,000 Btu/h) and are intended for hot water systems	Combustion efficiency ≥ 90%
3	Commercial gas boilers that have an input rate of ≥ 88 kW (300,000 Btu/h) but ≤ 733 kW (2,500,000 Btu/h) and are intended for low pressure steam systems	Thermal efficiency ≥ 81%
4	Commercial gas boilers that have an input rate of > 733 kW (2,500,000 Btu/h) but ≤ 2 930 kW (10,000,000 Btu/h) and are intended for low pressure steam systems	Thermal efficiency ≥ 82%

17 (1) The portion of items 1 and 2 of the table to section 318 of the Regulations in column 1 is replaced by the following:

Item	**Column 1** **Energy-using Product**
1	Household gas boilers manufactured on or after December 31, 1998 and before September 1, 2010
2	Household gas boilers manufactured on or after September 1, 2010 and before January 15, 2021

(2) The table to section 318 of the Regulations is amended by adding the following after item 2:

Item	**Column 1** **Energy-using Product**	**Column 2** **Standard**	**Column 3** **Information**
3	Household gas boilers manufactured on or after January 15, 2021	CSA P.2 for information set out in paragraphs (a) to (f)	**(a)** type of fuel used; **(b)** type of central heating system for which product is intended; **(c)** maximum heat input and output nominal capacities, in kW (Btu/h); **(d)** annual fuel utilization efficiency; **(e)** standby power, in W; **(f)** off-mode power, in W; **(g)** information that indicates whether product has tankless domestic water heating coils; and **(h)** type of automatic water temperature adjustment device product has, if any.
4	Commercial gas boilers manufactured on or after January 1, 2023	10 C.F.R. Appendix A	**(a)** type of central heating system for which product is intended; **(b)** maximum heat input nominal capacity, in kW (Btu/h); and **(c)** thermal efficiency or, if product has an input rate of > 733 kW (2,500,000 Btu/h) but ≤ 2 930 kW (10,000,000 Btu/h) and is intended for

hot water systems, combustion efficiency.

18 The portion of the definition *oil-fired boiler* before paragraph (a) in section 319 of the Regulations is replaced by the following:

oil-fired boiler means a boiler that is intended for application in a low pressure steam, or hot water, central heating system, has an input rate of less than 2 930 kW (10,000,000 Btu/h) and is

19 The Regulations are amended by adding the following after section 319:

Type

319.1 For the purpose of these Regulations, an oil-fired boiler is one of the following types:

(a) household, if it has an input rate of less than 88 kW (300,000 Btu/h); or
(b) commercial, if it is has an input rate of greater than or equal to 88 kW (300,000 Btu/h) but not more than 2 930 kW (10,000,000 Btu/h).

20 Subsection 320(2) of the Regulations is replaced by the following:

Limits

(2) However, an oil-fired boiler is not considered to be an energy-using product

(a) for the purpose of section 4, unless
(i) it is a household oil-fired boiler that is manufactured on or after June 30, 1999, or
(ii) it is a commercial oil-fired boiler that is manufactured on after January 1, 2023; and
(b) for the purposes of sections 5 and 317, unless
(i) it is a household oil-fired boiler that is manufactured on or after December 31, 1998, or
(ii) it is a commercial oil-fired boiler that is manufactured on after January 1, 2023.

21 Section 321 of the Regulations is replaced by the following:

Energy efficiency standards — household

321 (1) The energy efficiency standards set out in column 3 of Table 1 to this section apply to household oil-fired boilers described in column 1 that are manufactured during the periods set out in column 4.

Testing standard — household

(2) A household oil-fired boiler complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 of Table 1 that are applicable to an *oil-fired boiler* as defined in section 319.

Energy-efficiency standards — commercial

(3) The energy efficiency standards set out in column 2 of Table 2 to this section apply to commercial oil-fired boilers described in column 1 that are manufactured on or after January 1, 2021.

Testing Standard — commercial

(4) A commercial oil-fired boiler complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix A that are applicable to an *oil-fired boiler* as defined in section 319.

TABLE 1

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture

1	Household oil-fired boilers	CSA B212	Seasonal energy utilization efficiency ≥ 80%	On or after December 31, 1998 and before September 1, 2010
2	Household oil-fired boilers that are intended for low pressure steam systems	ASHRAE 103	Annual fuel utilization efficiency ≥ 82%	On or after September 1, 2010 and before January 15, 2021
2.1	Household oil-fired boilers that are intended for low pressure steam systems	CSA P.2 for annual fuel utilization efficiency, standby power and off-mode power	Annual fuel utilization efficiency ≥ 85% Standby power ≤ 11 W Off-mode power ≤ 11 W	On or after January 15, 2021
3	Household oil-fired boilers that are intended for hot water systems	ASHRAE 103	Annual fuel utilization efficiency ≥ 84%	On or after September 1, 2010 and before September 1, 2012
4	Household oil-fired boilers that are intended for hot water systems and have tankless domestic water heating coils	ASHRAE 103	Annual fuel utilization efficiency ≥ 84%	On or after September 1, 2012 and before January 15, 2021
4.1	Household oil-fired boilers that are intended for hot water systems and have tankless domestic water heating coils	CSA P.2 for annual fuel utilization efficiency, standby power and off-mode power	Annual fuel utilization efficiency ≥ 86% Standby power ≤ 11 W Off-mode power ≤ 11 W	On or after January 15, 2021
5	Household oil-fired boilers that are intended for hot water systems and do not have tankless domestic water heating coils	ASHRAE 103 for annual fuel utilization efficiency	Annual fuel utilization efficiency ≥ 84% Equipped with automatic water temperature adjustment device and not operable without the device	On or after September 1, 2012 and before January 15, 2021
6	Household oil-fired boilers that are intended for hot water systems and do not have tankless domestic water heating coils	CSA P.2 for annual fuel utilization efficiency, standby power and off-mode power	Annual fuel utilization efficiency ≥ 86% Equipped with automatic water temperature adjustment device and not operable without the device Standby power ≤ 11 W Off-mode power ≤ 11 W	On or after January 15, 2021

TABLE 2

Item	Column 1 Energy-using Product	Column 2 Energy Efficiency Standard
1	Commercial oil-fired boilers that have an input rate of ≥ 88 kW (300,000 Btu/h) but ≤ 733 kW (2,500,000 Btu/h) and are intended for hot water systems	Thermal efficiency ≥ 87%

2	Commercial oil-fired boilers that have an input rate of > 733 kW (2,500,000 Btu/h) but ≤ 2 930 kW (10,000,000 Btu/h) and are intended for hot water systems	Combustion efficiency ≥ 88%
3	Commercial oil-fired boilers that have an input rate of ≥ 88 kW (300,000 Btu/h) but ≤ 733 kW (2,500,000 Btu/h) and are intended for low pressure steam systems	Thermal efficiency ≥ 84%
4	Commercial oil-fired boilers that have an input rate of > 733 kW (2,500,000 Btu/h) but ≤ 2 930 kW (10,000,000 Btu/h) and are intended for low pressure steam systems	Thermal efficiency ≥ 85%

22 (1) The portion of items 1 and 2 of the table to section 322 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	**Energy-using Product**
1	Household oil-fired boilers manufactured on or after December 31, 1998 and before September 1, 2010
2	Household oil-fired boilers manufactured on or after September 1, 2010 and before January 15, 2021

(2) The table to section 322 of the Regulation is amended by adding the following after item 2:

	Column 1	Column 2	Column 3
Item	**Energy-using Product**	**Standard**	**Information**
3	Household oil-fired boilers manufactured on or after January 15, 2021	CSA P.2 for information set out in paragraphs (a) to (e)	**(a)** type of central heating system for which product is intended; **(b)** maximum heat input and output nominal capacities, in kW (Btu/h); **(c)** annual fuel utilization efficiency; **(d)** standby power, in W; **(e)** off-mode power, in W; **(f)** information that indicates whether product has tankless domestic water heating coils; and **(g)** type of automatic water temperature adjustment device product has, if any.
4	Commercial oil-fired boilers manufactured on or after January 1, 2023	10 C.F.R. Appendix A	**(a)** type of central heating system for which product is intended; **(b)** maximum heat input nominal capacity, in kW (Btu/h); and **(c)** thermal efficiency or, if product has an input rate of > 733 kW (2,500,000 Btu/h) but ≤ 2 930 kW (10,000,000 Btu/h) and is intended for hot water systems, combustion efficiency.

23 Section 369 of the Regulations is amended by adding the following in alphabetical order:

10 C.F.R. Appendix A means Appendix A to Subpart G, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for the Measurement of Thermal Efficiency and Standby Loss of Gas-Fired and Oil-Fired Storage Water Heaters and Storage-Type Instantaneous Water Heaters*, as amended from time to time. (*appendice A 10 C.F.R.*)

24 (1) The definition *electric water heater* in section 370 of the Regulations is replaced by the following:

electric water heater means a stationary electric storage tank water heater that is intended for use on a pressurized water system and that has a V_r of at least 50 L (13.21 US gallons). (*chauffe-eau électrique*)

(2) Section 370 of the Regulations is amended by adding the following in alphabetical order:

10 C.F.R. Appendix B means Appendix B to Subpart G, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for the Measurement of Standby Loss of Electric Storage Water Heaters and Storage-Type Instantaneous Water Heaters*, as amended from time to time. (*appendice B 10 C.F.R.*)

25 The Regulations are amended by adding the following after section 370:

Type

370.1 For the purpose of these Regulations, an electric water heater is one of the following types:

(a) household, if it has an input rate of less than 12 kW (40,982 Btu/h); or
(b) commercial, if it is has an input rate of greater than or equal to 12 kW (40,982 Btu/h).

26 Subsection 371(2) of the Regulations is replaced by the following:

Limits

(2) However, an electric water heater is not considered to be an energy-using product for the purposes of sections 4, 5 and 372 unless

(a) it is a household electric water heater that is manufactured on or after February 3, 1995; or
(b) it is a commercial electric water heater that is manufactured on or after January 1, 2020.

27 Subsection 372(2) of the Regulations is replaced by the following:

Testing standard

(2) An electric water heater described in column 1 complies with the energy efficiency standard set out in column 3 if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to an *electric water heater* as defined in section 370.

TABLE

	Column 1	Column 2	Column 3
Item	Energy-using Product	Standard	Energy Efficiency Standard
1	Household electric water heaters that have a bottom inlet and a V_r of ≥ 50 L but ≤ 270 L	CSA C191-04	Standby loss, in W, ≤ 40 + 0.2 V_r
2	Household electric water heaters that have a bottom inlet and a V_r of > 270 L but ≤ 454 L	CSA C191-04	Standby loss, in W, ≤ 0.472 V_r - 33.5
3	Household electric water heaters that have a top inlet and a V_r of ≥ 50 L but ≤ 270 L	CSA C191-04	Standby loss, in W, ≤ 35 + 0.2 V_r
4	Household electric water heaters that have a top inlet and a V_r of > 270 L but ≤ 454 L	CSA C191-04	Standby loss, in W, ≤ 0.472 V_r - 38.5
5	Commercial electric water heaters	10 C.F.R. Appendix B	Standby loss, in %/hr ≤ 0.3 + 102.2/V_s

28 Section 373 of the Regulations is replaced by the following:

Information

373 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected in accordance with the standard set out in column 2 and provided to the Minister in respect of an electric water heater described in column 1.

TABLE

	Column 1	Column 2	Column 3
Item	Energy-using Product	Standard	Information
1			**(a)** its V_r;

	Household electric water heaters manufactured on or after February 3 1995	CSA C191-04, for information set out in paragraphs (a) to (c)	**(b)** nominal power input of upper and lower elements, in W; **(c)** its standby loss, in W; and **(d)** cold water inlet configuration, namely, top inlet or bottom inlet.
2	Commercial electric water heaters manufactured on or after January 1, 2020	10 C.F.R. Appendix B	**(a)** its V_r; **(b)** its V_s; **(c)** its standby loss, in %/hr; and **(d)** its input rate, in kW.

29 (1) The definition *gas-fired storage water heater* in section 374 of the Regulations is replaced by the following:

gas-fired storage water heater means a stationary gas-heated water container that uses propane or natural gas for fuel and has a V_r of at least 76 L (20 US gallons). (*chauffe-eau à réservoir alimenté au gaz*)

(2) Section 374 of the Regulations is amended by adding the following in alphabetical order:

replacement unit means a commercial gas-fired storage water heater that is marked for replacement installations only. (*unité de remplacement*)

30 The Regulations are amended by adding the following after section 374:

Type

374.1 For the purpose of these Regulations, a gas-fired storage water heater is one of the following types:

(a) household, if it has an input rate of less than or equal to 21.97 kW (75,000 Btu/h); or
(b) commercial, if it is has an input rate of greater than 21.97 kW (75,000 Btu/h).

31 Subsection 375(2) of the Regulations is replaced by the following:

Limits

(2) However, for the purposes of sections 4, 5 and 376, a gas-fired storage water heater is not considered to be an energy-using product unless

(a) it is a household gas-fired storage water heater that is manufactured on or after February 3, 1995; or
(b) it is a commercial gas-fired storage water heater that is manufactured on or after January 1, 2020.

32 (1) Subsections 376(1) and (2) of the Regulations are replaced by the following:

Energy-efficiency standards — household

376 (1) The energy efficiency standards set out in column 3 of Table 1 to this section apply to household gas-fired storage water heaters described in column 1 that are manufactured during the periods set out in column 4.

Testing standard — household

(2) A household gas-fired storage water heater complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *gas-fired storage water heater* as defined in section 374.

Energy efficiency standards — commercial

(3) The energy efficiency standards set out in column 2 of Table 2 to this section apply to commercial gas-fired storage water heaters described in column 1 that are manufactured on or after January 1, 2020.

Testing standard — commercial

(4) A commercial gas-fired storage water heater complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix A that are applicable to a *gas-fired storage water heater* as defined in section 374.

(2) The table to section 376 of the Regulations is renumbered as Table 1.

(3) The portion of items 1 to 6 of Table 1 to section 376 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	**Energy-using Product**
1	Household gas-fired storage water heaters
2	Household gas-fired storage water heaters
3	Household gas-fired storage water heaters that have a first-hour rating of < 68 L (18 US gallons)
4	Household gas-fired storage water heaters that have a first-hour rating of ≥ 68 L (18 US gallons) but < 193 L (51 US gallons)
5	Household gas-fired storage water heaters that have a first-hour rating of ≥ 193 L (51 US gallons) but < 284 L (75 US gallons)
6	Household gas-fired storage water heaters that have a first-hour rating of > 284 L (75 US gallons)

(4) Section 376 of the Regulations is amended by adding the following after Table 1:

TABLE 2

	Column 1	Column 2
Item	Energy-using Product	Energy Efficiency Standard
1	Commercial gas-fired storage water heaters, other than replacement units, that have an input rate of > 21.97 kW (75,000 Btu/h) but ≤ 30.5 kW (105,000 Btu/h), have a V_r of ≤454 L (120 US gallons), use single-phase power and limit water temperatures to < 82°C (180° F)	Uniform energy factor ≥ 0.8107-0.00021 V_s
2	Commercial gas-fired storage water heaters that are replacement units, that have an input rate of > 21.97 kW (75,000 Btu/h) but ≤ 30.5 kW (105,000 Btu/h), have a V_r of ≤ 454 L (120 US gallons), use single-phase power and limit water temperatures to < 82°C (180°F)	Uniform energy factor ≥ 0.6597-0.00024 V_s
3	Commercial gas-fired storage water heaters, other than those described in items 1 and 2, that are not replacement units	Thermal efficiency ≥ 90% Standby loss ≤ $0.63(Q/0.234 + 16.57\sqrt{V_s}$
4	Commercial gas-fired storage water heaters, other than those described in items 1 and 2, that are replacement units	Thermal efficiency ≥ 82% Standby loss ≤ $Q/0.234 + 16.57\sqrt{V_s}$

33 Section 377 of the Regulations is replaced by the following:

377 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected in accordance with the standard set out in column 2 and provided to the Minister in respect of a gas-fired storage water heater described in column 1.

TABLE

	Column 1	Column 2	Column 3
Item	Energy-using Product	Standard	Information
1		CSA P.3-04	**(a)** its input rate, in kW (Btu/h); **(b)** its recovery efficiency;

	Household gas-fired storage water heaters that are manufactured on or after February 3, 1995 and before January 1, 2018		**(c)** the fuel it uses; **(d)** its annual energy consumption, in kJ; **(e)** its first-hour rating, in L; **(f)** its V_r; and **(g)** its energy factor.
2	Household gas-fired storage water heaters that are manufactured on or after January 1, 2018	CSA P.3-04, if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(a), 4(a), 5(a) and 6(a) of Table 1 to section 376; CSA P.3-15, if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(b), 4(b), 5(b) and 6(b) of Table 1 to section 376.	**(a)** its input rate, in kW (Btu/h); **(b)** its recovery efficiency; **(c)** the fuel it uses; **(d)** its annual energy consumption, in kJ; **(e)** its first-hour rating, in L; **(f)** its V_r; **(g)** its energy factor, if a certification body has verified that it is in compliance with the energy efficiency standard set out in any of paragraphs 3(a), 4(a), 5(a) and 6(a) of Table 1 to section 376; and **(h)** its uniform energy factor and V_s, if a certification body has verified that it is in compliance with the energy efficiency standard set out in any of paragraphs 3(b), 4(b), 5(b) and 6(b) of Table 1 to section 376.
3	Commercial gas-fired storage water heaters, that have an input rate of > 21.97 kW (75,000 Btu/h) but ≤ 30.5 kW (105,000 Btu/h), have a V_r of ≤ 454 L (120 US gallons), use single-phase power, limit water temperatures to < 82°C (180°F) and are manufactured on or after January 1, 2020	CSA P.3-15	**(a)** its uniform energy factor; **(b)** its V_r; **(c)** its V_s; **(d)** its input rate, in kW (Btu/h); **(e)** the fuel it uses; and **(f)** information that indicates whether it is a replacement unit.
4	Commercial gas-fired storage water heaters, other than those described in item 3, that are manufactured on or after January 1, 2020	10 C.F.R. Appendix A	**(a)** its thermal efficiency; **(b)** its standby loss, in W; **(c)** its V_r; **(d)** its V_s; **(e)** its input rate, in kW (Btu/h); **(f)** the fuel it uses; and **(g)** information that indicates whether it is a replacement unit.

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34 The definition *oil-fired water heater* in section 378 of the Regulations is replaced by the following:

oil-fired water heater means a water heater that uses oil for fuel and that has a V_r of at least 76 L (20 US gallons). (*chauffe-eau à mazout*)

35 The Regulations are amended by adding the following after section 378:

Type

378.1 For the purpose of these Regulations, an oil-fired water heater is one of the following types:

(a) household, if it has an input rate of less than or equal to 30.5 kW (105,000 Btu/h); or
(b) commercial, if it is has an input rate of greater than 30.5 kW (105,000 Btu/h).

36 (1) Subsection 379(2) of the Regulations is replaced by the following:

Limits

(2) However, for the purposes of sections 4, 5 and 380, an oil-fired water heater is not considered to be an energy-using product unless

(a) it is a household oil-fired water heater that is manufactured on or after February 3, 1995; or
(b) it is a commercial oil-fired water heater that is manufactured on or after January 1, 2020.

37 (1) Subsections 380(1) and (2) of the Regulations are replaced by the following:

Energy efficiency standards — household

380 (1) The energy efficiency standards set out in column 3 of Table 1 to this section apply to household oil-fired water heaters described in column 1 that are manufactured during the period set out in column 4.

Testing standard — household

(2) An oil-fired water heater complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *oil-fired water heater* as defined in section 378.

Energy efficiency standards — commercial

(3) The energy efficiency standards set out in column 2 of Table 2 to this section apply to commercial oil-fired water heaters described in column 1 that are manufactured on or after January 1, 2020.

Testing standard — commercial

(4) A commercial oil-fired water heater complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix A that are applicable to a *oil-fired water heater* as defined in section 378.

(2) The table to section 380 of the Regulations is renumbered as Table 1.

(3) The portion of items 1 to 6 of Table 1 to section 380 of the Regulations in column 1 is replaced by the following:

	Column 1
Item	**Energy-using Product**
1	Household oil-fired water heaters
2	Household oil-fired water heaters
3	Household oil-fired water heaters that have a first-hour rating of < 68 L (18 US gallons)
4	Household oil-fired water heaters that have a first-hour rating of ≥ 68 L (18 US gallons) but < 193 L (51 US gallons)
5	Household oil-fired water heaters that have a first-hour rating of ≥ 193 L (51 US gallons) but < 284 L (75 US gallons)
6	Household oil-fired water heaters that have a first-hour rating of > 284 L (75 US gallons)

(4) Section 380 of the Regulations is amended by adding the following after Table 1:

TABLE 2

	Column 1	Column 2
Item	Energy-using Product	Energy Efficiency Standard

1	Commercial oil-fired storage water heaters that have an input rate of > 30.5 kW (105,000 Btu/h) but ≤ 40.99 kW (140,000 Btu/h), a V_r of ≤ 454 L (120 US gallons), use single-phase power, limit water temperatures to < 82°C (180°F) and are manufactured on or after January 1, 2020	Uniform energy factor ≥ 0.6740 - 0.00035 V_s
2	Commercial oil-fired storage water heaters, other than those described in item 1, that are manufactured on or after January 1, 2020	Thermal efficiency ≥ 80% Standby loss ≤ Q/0.234 + 16.57$\sqrt{V_s}$

38 Section 381 of the Regulations is replaced by the following:

Information

381 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected in accordance with the standard set out in column 2 and provided to the Minister in respect of an oil-fired storage water heater described in column 1.

TABLE

	Column 1	Column 2	Column 3
Item	Energy-using Product	Standard	Information
1	Household oil-fired water heaters that are manufactured on or after February 3, 1995 and before January 1, 2018	CSA B211-00	**(a)** its input rate, in kW (Btu/h); **(b)** its recovery efficiency; **(c)** its annual energy consumption, in kJ; **(d)** its first-hour rating, in L; **(e)** its V_r; and **(f)** its energy factor.
2	Household oil-fired water heaters that are manufactured on or after January 1, 2018	CSA B211-00, if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(a), 4(a), 5(a) and 6(a) of Table 1 to section 380; and CSA P.3-15, if a certification body has verified that the product is in compliance with the energy efficiency standard set out in any of paragraphs 3(b), 4(b), 5(b) and 6(b) of Table 1 to section 380.	**(a)** its input rate, kW (Btu/h); **(b)** its recovery efficiency; **(c)** its annual energy consumption, in kJ; **(d)** its first-hour rating, in L; **(e)** its V_r; **(f)** its energy factor, and **(g)** its uniform energy factor and V_s, if a certification body has verified that it is in compliance with the energy efficiency standard set out in any of paragraphs 3(b), 4(b), 5(b) and 6(b) of Table 1 to section 380.
3	Commercial oil-fired storage water heaters that have an input rate of > 30.5 kW (105,000 Btu/h) but ≤ 40.99 kW (140,000 Btu/h), a V_r of ≤ 454 L (120 US gallons), use single-phase power, limit water temperatures to < 82°C (180°F) and are manufactured on or after January 1, 2020	CSA P.3-15	**(a)** its input rate, in kW (Btu/h); **b)** its uniform energy factor; **(c)** its V_r; and **(d)** its V_s.
4	Commercial oil-fired water heaters, other than those described in item 3, that are manufactured on or after January 1, 2020	10 C.F.R. Appendix A	**(a)** its input rate, in kW (Btu/h); **(b)** its thermal efficiency; **(c)** its V_r;

(d) its V_s; and
(e) its standby loss, in W.

39 The Regulations are amended by adding the following after section 381:

SUBDIVISION D

Gas-Fired Instantaneous Water Heaters

Definitions

382 The following definitions apply in this Subdivision.

gas-fired instantaneous water heater means a flow-activated water heater that uses natural gas or propane for fuel, that has a V_r that is less than or equal to 37.85 L (10 US gallons) and has an input rate to V_r ratio of not less than 309 W/L (4,000 Btu/h/US gallon). (*chauffe-eau instantané au gaz*)

maximum flow rate means, in respect of a gas-fired instantaneous water heater, the maximum litres per minute (gallons per minute) of hot water that can be supplied by the water heater while operating in a steady state and maintaining a nominal temperature rise of 37.3°C (67°F). (*débit maximal*)

10 C.F.R Appendix C means Appendix C to the Subpart G, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for the Measurement of Thermal Efficiency and Standby Loss of Gas-Fired and Oil-Fired Instantaneous Water Heaters and Hot Water Supply Boilers (Other Than Storage-Type Instantaneous Water Heaters)*, as amended from time to time. (*appendice C 10 C.F.R.*)

Type

383 For the purpose of these Regulations, a gas-fired instantaneous water heater is one of the following types:

(a) household, if it has an input rate of less than 58.56 kW (200,000 Btu/h), has a V_r of no greater than 7.6 L (2 US gallons) and is designed to provide hot water at a temperature no greater than 82°C (180°F); or
(b) commercial, if it is a gas-fired instantaneous water heater that is not described in paragraph (a).

Energy-using product

384 (1) A gas-fired instantaneous water heater is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 385, a gas-fired instantaneous water heater is not considered to be an energy-using product unless it is manufactured on or after January 1, 2020.

Energy efficiency standards

385 (1) The energy efficiency standards set out in column 3 of the table to this section apply to gas-fired instantaneous water heaters described in column 1 that are manufactured on or after January 1, 2020.

Testing standards

(2) A gas-fired instantaneous water heater complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *gas-fired instantaneous water heater* as defined in section 382.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard
1	Household gas-fired instantaneous water heaters that have a maximum flow rate of < 6.4 L/min	CSA P.3-15	Uniform energy factor ≥ 0.86

2	Household gas-fired instantaneous water heaters that have a maximum flow rate of ≥ 6.4 L/min	CSA P.3-15	Uniform energy factor ≥ 0.87
3	Commercial gas-fired instantaneous water heaters	10 C.F.R. Appendix C	Thermal efficiency ≥ 94%

Information

386 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected in accordance with the standard set out in column 2 and provided to the Minister in respect of a gas-fired instantaneous water heater described in column 1.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
1	Household gas-fired instantaneous water heaters manufactured on or after January 1, 2020	CSA P.3-15	**(a)** its uniform energy factor; **(b)** its V_r; **(c)** the fuel it uses; **(d)** its input rate, in kW (Btu/h); and **(e)** its maximum flow rate.
2	Commercial gas-fired instantaneous water heaters manufactured on or after January 1, 2020	10 C.F.R. Appendix C	**(a)** its thermal efficiency; **(b)** its V_r; **(c)** the fuel it uses; **(d)** its input rate, in kW (Btu/h); and **(e)** its maximum flow rate.

Coming into Force

40 These Regulations come into force on the day that, in the sixth month after the month in which they are published in the *Canada Gazette*, Part II, has the same calendar number as the day on which they are published or, if that sixth month has no day with that number, the last day of that sixth month.

Footnotes

1 The use of the term “minimum energy performance standard” or “MEPS” throughout this document is in reference to the “energy efficiency standard” as defined in the *Energy Efficiency Act*.

2 International Energy Agency (IEA), 2015. *Achievements of appliance energy efficiency standards and labelling programs: A GLOBAL ASSESSMENT*, p. 2.

3 *Market transformation strategies for energy-using equipment in the building sector* (http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/emmc/pdf/Market-Transformation-Strategies_en.pdf)

4 Canada’s Energy Transition (https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/CoucilReport_june27_English_Web.pdf)

5 The Economic Impact of Improved Energy Efficiency in Canada (https://www.efficiencycanada.org/wp-content/uploads/2018/04/Economic-Impact-of-Pan-Canadian-Framework-Energy-Effciency.pdf)

6 *Canada's 7th National Communication and 3rd Biennial Report* (http://unfccc.int/files/national_reports/national_communications_and_biennial_reports/application/pdf/4623051_canada-br3-nc7-1-5108_eccc_can7thncomm3rdbi-report_en_04_web.pdf) to the United Nations Framework Convention on Climate Change, p. 145.

7 O. Reg. 404/12

8 B.C. Reg. 14/2015

9 International Energy Agency, 2015. *Achievements of appliance energy efficiency standards and labelling programs: A GLOBAL ASSESSMENT*, p. 3.

10 Ibid., p. 1.

11 Ibid., p. 3.

12 Calculated as the value of avoided damages from GHG emissions reductions.

13 *Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* (SOR/2014-207) and other regulations made under the *Canadian Environmental Protection Act, 1999*.

14 Any questions regarding methodology, rationale or policy should be directed to Environment and Climate Change Canada's Economic Analysis Directorate.

15 U.S. Government, U.S. Interagency Working Group on the Social Cost of Carbon (IWGSCC), 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866.

16 Varies by manufacturer and is based on a number of elements, such as the number of programs the manufacturer engages in with the certification body, e.g. safety certification, energy efficiency verification, as well as the number of products and models the manufacturer has.

17 Marginal fuels represent the last power plant that is needed to meet the electricity demand at a given time. The costs and emissions from that power plant are used to calculate the reduced emissions owing to the Regulations.

18 Consistent with the discount rate used by the Pan-Canadian Framework on Clean Growth and Climate Change and in accordance with Treasury Board Secretariat recommendations for environmental and health regulations.

19 IEA, 2015. Achievements of appliance energy efficiency standards and labelling programs: A GLOBAL ASSESSMENT, p. 6.

20 Study performed by Cosmos Energy Consulting Inc.

21 Although the overall net benefits for this product category are positive, about 27% of shipments do not have net benefits, reflecting areas in Canada with low ventilation or air conditioning loads.

22 Up-to-date information about energy efficiency standards for products and equipment that are regulated in Canada (http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845)

23 Stakeholders that were informed include all organizations and individuals with an interest in the proposed Amendment. Groups that provided input include, but are not limited to, manufacturers, distributors, retailers, industry associations, provincial, federal and international governments, energy utilities, general interest groups, certification bodies, custom brokers, consumer associations, contractors, and builders.

24 Commercial boilers, household boilers and water heaters.

25 Appendix A to Subpart E, Part 431, of Title 10 to the United States Code of Federal Regulations

26 2016 U.S. Department of Energy Technical Support Document (https://www.energy.gov/sites/prod/files/2016/12/f34/CPB_ECS_Final_Rule.pdf)

27 Primarily for oil boilers and gas steam boilers.

28 Regulatory Partnership Statement of the Department of Natural Resources of Canada and the United States Department of Energy (https://www.energy.gov/sites/prod/files/2015/05/f22/RPS%20PDF.PDF)

29 IEA/OECD, 2011. *Summing up the Parts — Combining Policy Instruments for Least-Cost Climate Mitigation Strategies*, page 8.

30 GHG emissions are quantified by applying the appropriate emission factors to the changes in energy, by fuel. Consumer savings are quantified by applying the appropriate energy prices to the changes in energy, by fuel.

31 SOR/2016-311

a S.C. 2009, c. 8, s. 5

b S.C. 1992, c. 36

Government of Canada activities and initiatives

#YourBudget2018 – Advancement



(https://www.budget.gc.ca/2018/docs/themes/advancement-advancement-en.html?utm_source=CanCa&utm_medium=Activities_e&utm_content=Advancement&utm_campaign=CAbdgt18)
Advancing our shared values

#YourBudget2018 – Reconciliation



(https://www.budget.gc.ca/2018/docs/themes/reconciliation-reconciliation-en.html?utm_source=CanCa&utm_medium=%20Activities_e&utm_content=Reconciliation&utm_campaign=CAbdgt18)
Advancing reconciliation with Indigenous Peoples

#YourBudget2018 – Progress



(https://www.budget.gc.ca/2018/docs/themes/progress-progres-en.html?utm_source=CanCa&utm_medium=Activities_e&utm_content=Progress&utm_campaign=CAbdgt18)
Supporting Canada's researchers to build a more innovative economy

Canada Gazette, Part I, Volume 152, Number 49: Regulations Amending the Energy Efficiency Regulations, 2016

December 8, 2018

Statutory authority
Energy Efficiency Act

Sponsoring department
Department of Natural Resources

REGULATORY IMPACT ANALYSIS STATEMENT

(*This statement is not part of the Regulations.*)

Executive summary

Issues: Greenhouse gases are primary contributors to climate change, which has an impact on Canada's economy and environment. Canada's building sector represents a significant portion of national greenhouse gas (GHG) emissions given the amount of energy used to heat space and water and the amount of electricity this sector consumes from the grid. National policies and strategies such as the Pan-Canadian Framework on Clean Growth and Climate Change, *Build Smart – Canada's Buildings Strategy*, and the recent report from the Generation Energy Council demonstrate the Government of Canada's commitments to improve energy efficiency standards for appliances and equipment and take action on climate change. The Government of Canada remains committed to reducing regulatory burden, continuing to support the Canada–United States Regulatory Cooperation Council's efforts to harmonize regulations between Canada and the United States, given the integrated nature of the markets. Achieving these commitments will provide benefits to Canadians through energy cost savings and improved environmental outcomes, which lead to increased productivity, competitiveness and energy affordability.

Since 2011, the United States Department of Energy has implemented changes to its regulations across several product categories. To reduce unnecessary regulatory differences, support cross-border trade and investment, and, ultimately, reduce costs for citizens, businesses and economies, it is necessary to implement amendments to the *Energy Efficiency Regulations, 2016*. This proposed amendment (the Amendment) is the third in a series of four amendments designed to remove all unnecessary regulatory differences between Canada and the United States that occurred since 2011.

In December 2016, First Ministers adopted the Pan-Canadian Framework on Clean Growth and Climate Change, which presents the country's plan to reduce GHG emissions to at least 30% below 2005 levels by 2030, grow the economy, and build resilience to a changing climate. Further mitigation efforts are needed to support the achievement of Canada's GHG emissions reduction target.

Description: The Amendment would introduce or update minimum energy performance standards, testing standards, and reporting requirements to improve the energy efficiency of nine residential and commercial product categories, two of which are not currently regulated federally. Specifically, the Amendment is designed to (a) introduce minimum energy

performance standards, labelling and reporting requirements for two new product categories; (b) introduce more stringent minimum energy performance standards and/or update testing standards for six currently regulated product categories; and (c) introduce reporting requirements for one new product category.

Cost-benefit statement: It is estimated that the Amendment would result in an annual reduction of 0.33 megatonnes of GHG emissions by 2030. The benefits and costs associated with the Amendment have been estimated using a methodology consistent with that of previous modifications to the *Energy Efficiency Regulations* and the *Energy Efficiency Regulations, 2016*, and of other energy efficiency regulators, such as the United States Department of Energy. Based on this methodology, the present value of net benefits of the Amendment is estimated to be $818 million by 2030, with total benefits exceeding total costs by more than three to one. By 2030, the present value of benefits and costs from the Amendment is estimated to be $1.15 billion and $335 million, respectively. On an annualized average basis, this equates to benefits and costs of $116 million and $34 million, respectively.

The quantified benefits have been calculated as the sum of the energy savings and the benefits of reductions in GHG emissions over the service life of products shipped by 2030. The quantified costs include incremental technology costs to meet the more stringent standards, administrative costs and costs to Government associated with regulatory implementation.

While not quantified as part of this analysis, energy efficiency improvements also provide broader economic and non-energy benefits. For example, businesses benefit from energy and operating cost savings, which can increase productivity and competitiveness. Households benefit from increased comfort, improved air quality, and reduced noise resulting from higher performance products.

“One-for-One” Rule and small business lens: The Amendment is considered an “IN” under the “One-for-One” Rule. It would increase the administrative burden by $55,508 in annualized average administrative costs to affected businesses.

The Amendment would impact seven small Canadian manufacturers of affected products. The majority of these seven manufacturers are not expected to face incremental costs, as they already manufacture products that comply with the proposed requirements and demonstrate compliance with similar requirements already in force in other jurisdictions. Small manufacturers that are expected to incur incremental costs have been engaged in consultations, but have not raised any compliance issues associated with the size of their respective companies.

Domestic and international coordination and cooperation: Implementation of the Amendment would reduce unnecessary regulatory differences between Canada and the United States, consistent with binational commitments made under the Canada–United States Regulatory Cooperation Council, and the commitments made by the Prime Minister of Canada and the President of the United States in 2016. It would also support the objectives of the *Memorandum of Understanding between the Treasury Board of Canada Secretariat and the United States Office of Information and Regulatory Affairs regarding the Canada–United States Regulatory Cooperation Council*, signed in June 2018, by seeking to foster alignment of federal regulations where feasible and appropriate. Domestically, the Amendment would reduce regulatory differences that currently exist between federal and provincial regulations for certain product categories, such as ceiling fans and clean water pumps.

Background

In 1992, Parliament passed Canada’s *Energy Efficiency Act* (the Act). The Act provides for the making and enforcement of regulations requiring energy-using products that are imported or shipped inter-provincially for the purpose of sale or lease to meet minimum energy performance standards (MEPS) [1] for product labelling and for the promotion of energy efficiency and alternative energy use, including the collection of data and statistics on energy use.

The *Energy Efficiency Regulations* were introduced in 1995 as a means to reduce greenhouse gas (GHG) emissions in Canada. In 2016, the *Energy Efficiency Regulations* were repealed and replaced to remove references to obsolete and out-of-date standards and improve the organization of the regulatory text and became the *Energy Efficiency Regulations, 2016* (the Regulations). The Regulations prescribe MEPS for certain consumer and commercial energy-using products. They also

prescribe labelling requirements for certain products to disclose and compare the energy use of a given product model relative to others in their category. They are regularly amended to introduce new energy-using products and to update existing requirements.

Since most energy-using products must cross provincial or international borders to reach their markets, federally prescribed MEPS are an effective tool to raise the level of energy efficiency in Canada. Prescribed MEPS are one component of Canada's program to reduce GHG emissions and energy consumption associated with energy-using products because they eliminate the least efficient products from the market. Natural Resources Canada also administers the ENERGY STAR® labelling program, which sets voluntary specifications for 75 product categories and identifies the top 15 to 30% of energy efficiency performers, making the choice of energy-efficient products simple for households and businesses.

When combined, MEPS and labelling programs drive product innovation through cycles of continuous improvement. Increasing the stringency of MEPS eliminates the least efficient products from the market while increasing the levels that must be met for a product to be certified as ENERGY STAR®, and encourages manufacturers to produce affordable high-efficiency products that households and businesses will recognize as good choices to lower their energy costs. MEPS and labelling programs are among the most cost-effective GHG emissions reduction policies and are the cornerstone of energy efficiency and climate change programs in more than 80 countries. [2]

Policy context

Canada committed to reduce its GHG emissions by 30% below 2005 levels by signing the Paris Agreement in 2015. Building on this commitment, First Ministers agreed to take ambitious action in support of meeting or exceeding this target. They also agreed that a collaborative approach between provincial, territorial, and federal governments is important to reduce GHG emissions and to enable sustainable economic growth.

Since August 2014, Canada and the United States have worked toward a goal of aligning new and updated energy efficiency standards and testing standards for energy-using appliances and equipment through enhanced information sharing and a cooperative development and implementation process, to the extent practicable and permitted by law within the context of the Canada–United States Regulatory Cooperation Council. [3]

In December 2016, First Ministers adopted the Pan-Canadian Framework on Clean Growth and Climate Change, which presents the country's plan to meet its GHG emissions reduction targets, grow the economy, and build resilience to a changing climate. The plan outlines an approach for the building sector [4] that consists of four elements: (1) making new buildings more energy efficient; (2) retrofitting existing buildings, as well as fuel switching; (3) supporting building codes and energy-efficient housing in Indigenous communities; and (4) improving energy efficiency for appliances and equipment.

In June 2018, the Generation Energy Council released a report that highlighted the important role that energy efficiency can play in reducing GHG emissions in Canada. [5] According to this report, fully one-third of Canada's emission reduction target could be met through improvements in energy efficiency, which would also make Canadian businesses more competitive internationally and leave more money in consumers' pockets. These conclusions are supported by an Efficiency Canada report on the economic impacts of energy efficiency, which showed that implementing strong energy efficiency programs will increase Canada's gross domestic product and job growth. [6]

Issues

GHGs are primary contributors to climate change, which has an impact on Canada's economy and environment. Carbon dioxide, a by-product of fossil fuel consumption, has been identified as the most significant GHG.

The building sector is a significant contributor to Canada's GHG emissions. This sector accounted for about 17% of national GHG emissions in 2014. The level of emissions in the building sector is impacted by the energy-using equipment it contains. For instance, products that combust fuel to generate heat lead to direct carbon dioxide emissions at the site, while products that consume electricity contribute to GHG emissions at the point of electricity generation.

GHG emissions from Canadian homes declined by 1 Mt between 2005 and 2015, and are projected to decline by a further 3 Mt between 2015 and 2030. This is despite an expected 36% increase (or 4.4 million) in the number of Canadian households (a key driver of residential emissions growth) between 2005 and 2030. GHG emissions from Canada's commercial buildings

increased by 1 Mt between 2005 and 2015, and are expected to remain relatively constant through 2030, despite an expected 32% increase in floor space from 2005 to 2030. [7]

While technologies exist in the Canadian market to provide incremental reductions in GHG emissions and energy consumption in the building sector, there are market failures that lead to consumers making economic or environmental choices with respect to energy efficiency that are less than optimal. These include a lack of awareness and information available to consumers regarding energy-saving opportunities and actual energy use, a lack of capacity within organizations to understand and manage energy use, and split incentives (e.g. landlords may not purchase efficient equipment if tenants pay the energy bill).

In 2011, the Canada–United States Regulatory Cooperation Council stated that unnecessary regulatory differences and duplicative actions hinder cross-border trade and investment and ultimately impose a cost on citizens, businesses and economies. [8] Since 2011, the U.S. Department of Energy has implemented changes to its regulations across several product categories, by applying energy efficiency standards to new product categories, increasing the stringency of energy efficiency standards for some currently regulated product categories, and updating test procedures. These changes have not all been made in Canada, which has resulted in an increasing number of unnecessary regulatory differences.

Regulatory action is required to address these issues, given that voluntary measures will not be sufficient to phase out some low-efficiency product models from the Canadian market. It is also required to address unnecessary regulatory differences between Canada and the United States.

Objectives

The goals of the Amendment are to

- reduce GHG emissions and energy consumption associated with nine product categories;
- reduce the load on the electricity system associated with the building sector;
- reduce energy costs incurred by households, businesses and institutions; and
- reduce unnecessary regulatory differences between Canada and the United States across new and existing product categories to support cross-border trade.

The desired outcomes of the Amendment are as follows:

- GHG emissions are reduced, contributing to Canada’s goal to reduce GHG emissions by at least 30% below 2005 levels by 2030;
- Consumers save money by purchasing higher efficiency product models that have lower costs over their lifetime;
- Businesses using regulated energy-using products experience cost savings that can lead to increased productivity and competitiveness; and
- Businesses benefit from common North American testing standards and energy efficiency standards for more product categories, which reduces obstacles to trade.

Description

In March 2017, Natural Resources Canada published a notice of intent to inform stakeholders that the Department was initiating the development of a regulatory amendment to introduce or increase the stringency of MEPS for 17 product categories. A subsequent decision was taken to address these product categories through two separate, sequential regulatory proposals. Product categories that were identified in the notice of intent but are not included in the Amendment were addressed in a previous regulatory proposal published in the *Canada Gazette*, Part I, on October 20, 2018. [9]

The Amendment aims to achieve the following: (a) introduce MEPS, labelling and rep orting requirements for two new product categories; (b) introduce more stringent MEPS and/or update testing standards for six currently regulated product categories; and (c) introduce reporting requirements for one new product category. The Amendment would come into force six months after the date of publication in the *Canada Gazette*, Part II.

For the new product categories, import reports and energy efficiency reports would be required for the first time. The information requirements in the energy efficiency reports will be aligned to the extent possible with what is submitted in the United States.

The following changes to the Regulations are being proposed.

(A) Introduce MEPS, labelling and reporting requirements for two new product categories

Clean water pumps

Clean water pumps are used in commercial and industrial applications. They move clean water by physical or mechanical action, and may be part of a pumping system that includes other mechanical equipment, drivers and controls. Clean water pumps covered by the scope of this amendment include end suction close-coupled pumps; end suction frame mounted with own bearings pumps; inline pumps; radially split, multi-stage, vertical inline diffuser casing pumps; and submersible turbine pumps.

For clean water pumps manufactured on or after January 27, 2020, the Amendment would set the MEPS at levels that will apply on that same date in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States.

Miscellaneous refrigeration products

Miscellaneous refrigeration products (MRPs) are used in residential applications and are designed for the cooling and storage of wine, food and other beverages. This new subcategory would include residential wine coolers that are already regulated (under wine chillers in the subcategory of refrigerators) and the scope would be expanded to cover coolers and combination cooler refrigeration products. For MRPs manufactured on or after October 28, 2019, the Amendment would set the MEPS at levels that will apply on that same date in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States. Similar to the residential wine coolers, the coolers and combination cooler refrigeration products would be required to carry an EnerGuide Label.

(B) Introduce more stringent MEPS and/or update testing standards for six currently regulated product categories

Ceiling fans

Ceiling fans are suspended from the ceiling and circulate air via the rotation of fan blades. For ceiling fans manufactured on or after January 21, 2020, the Amendment would set the MEPS applicable to air flow efficiency at levels that will apply on that same date in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States.

Central air conditioners and heat pumps (single package central air conditioner, split-system central air conditioner, single package heat pumps and split-system heat pumps)

Central air conditioners and heat pumps are single-phase and three-phase air-source air conditioners and heat pumps, with a rated capacity of less than 19 kW (65 000 Btu/h). These include single package, split system, ductless, space-constrained, and small-duct, high-velocity air conditioners and heat pumps used in residential and small commercial applications.

For central air conditioners and heat pumps under 19 kW (65 000 Btu/h) manufactured on or after January 1, 2017, the Amendment would set the MEPS applicable to off-mode energy consumption at levels that are currently in place in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States.

Chillers

Chillers are used in large commercial and institutional buildings to provide space cooling by removing heat from a liquid, usually water, which is then used to provide the cooling needs of the building.

For chillers manufactured on or after December 31, 2019, the Amendment would set the MEPS at levels that are currently in place in Ontario and in the U.S. states that have adopted the ASHRAE standard. Performance would be measured in accordance with testing standards aligned with those used in the United States and Ontario.

Refrigerated vending machines

Refrigerated vending machines are used in commercial applications to cool bottled or canned beverages and dispense them upon payment. Refrigerated vending machines that contain both a refrigerated and non-refrigerated compartment separated by a solid partition would also be subject to the Regulations.

For refrigerated vending machines that have been manufactured on or after January 8, 2019, the Amendment would set the MEPS at levels that will apply on that same date in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States.

Single package vertical air conditioners and heat pumps

Single package vertical air conditioners (SPVACs) are air-cooled commercial single packaged equipment that provide space cooling and may or may not provide heating. Single package vertical heat pumps (SPVHPs) are air-cooled commercial single packaged equipment that provide both space cooling and heating. SPVACs and SPVHPs have their major components arranged vertically and are generally used in modular classrooms, office buildings and telecommunications shelters. Performance in cooling (SPVACs and SPVHPs) and heating (SPVHPs only) would be measured in accordance with testing standards aligned with those of the United States:

- For SPVACs and SPVHPs with a cooling capacity <19 kW (<65 000 Btu/h) manufactured on or after September 23, 2019, the Amendment would set the MEPS to levels that will apply on that same date in the United States.
- For SPVACs and SPVHPs with a cooling capacity ≥19 kW and <39.5 kW (≥65 000 and <135 000 Btu/h) manufactured on or after October 9, 2015, the Amendment would set the MEPS to levels that are currently in place in the United States; and
- For SPVACs and SPVHPs with a cooling capacity ≥39.5 kW and <70 kW (≥135 000 and <240 000 Btu/h) manufactured on or after October 9, 2016, the Amendment would set the MEPS to levels that are currently in place in the United States.

Walk-in coolers and freezers

Walk-in coolers and freezers are enclosed commercial refrigerated storage spaces less than 278.71 m^2 (3 000 ft^2) that can be walked into. Walk-in coolers are designed to operate above 0 °C and walk-in freezers are designed to operate below 0 °C.

For walk-in coolers and freezers that have been manufactured on or after July 10, 2020, the Amendment would set the MEPS at levels that will apply on that same date in the United States. Performance would be measured in accordance with testing standards aligned with those of the United States.

(C) Introduce reporting requirements for one new product category

Portable air conditioners

Portable air conditioners (PACs) are residential self-contained portable systems that deliver cooled, conditioned air to a single room and include single and dual duct. They include a source of refrigeration and may include additional means for air circulation and heating. They typically sit on the floor and come with an installation kit for quick set up.

For PACs manufactured on or after October 1, 2017, the Amendment would require the submission of energy efficiency reports and importation reports. Performance would be measured in accordance with testing standards aligned with those of the United States.

Regulatory and non-regulatory options considered

Maintaining the status quo

GHG emissions from Canadian homes are projected to decline by 8% between 2005 and 2030. During this same time frame, emissions from commercial buildings are projected to stay constant. Given Canada's commitment to reducing GHG emissions by 30% below 2005 levels by 2030 and the fact that Canada's building sector accounts for approximately 17% of national emissions, maintaining the status quo would not contribute incremental reductions towards the achievement of this goal. It would also lead to missed opportunities to reduce energy consumption, leaving households and businesses with higher energy costs for heating associated with the building sector.

Since 2011, the U.S. Department of Energy has implemented changes to its regulations across several product categories by applying energy efficiency standards to new product categories, increasing the stringency of energy efficiency standards for some currently regulated product categories, and updating testing standards. These changes have not all been made in Canada. Maintaining the status quo would not address these unnecessary regulatory differences between Canada and the United States.

Voluntary approach (repeal the Regulations)

Under this approach, Canada would repeal the Regulations and rely on voluntary measures to reduce GHG emissions and energy consumption associated with energy-using products. This option would reduce costs for the regulated industry since there would be no mandatory requirements to meet; however, it would not address GHG emissions to the extent required to meet commitments made under the Pan-Canadian Framework on Clean Growth and Climate Change, nor would it reduce energy consumption to the extent that a regulatory approach would. A voluntary approach would also be a significant departure from Canada's approach to advancing energy efficiency and the intent of the Act.

A voluntary approach would result in fewer GHG emission reductions than the status quo option or taking a regulatory approach. Studies have shown that in countries where MEPS have been introduced for the first time, significant energy efficiency improvements have been observed. For example, a 32% energy efficiency improvement was achieved in one year (1994–1995) when Mexico first implemented MEPS for four product categories. [10] Such improvements have translated into large reductions in energy consumption and GHG emissions. Globally, the most mature national MEPS and labelling programs covering a broad range of products are estimated to save between 10% and 25% of national energy consumption. [11] There is strong evidence to show that significant and sustained improvements in energy efficiency occur where MEPS are subject to ongoing revision to keep pace with the rate of improvement in new products entering a market. [12] Given the global evidence of the significant benefits of MEPS, a voluntary approach would mean that these benefits would not be realized.

Incremental compliance costs associated with unnecessary regulatory differences between Canada and the United States occur only in situations where both countries enforce mandatory requirements. There are product categories currently regulated in the United States that are not regulated in Canada. In these cases, the regulatory regimes are different in each country, but do not create a burden for industry, since no energy efficiency requirements need to be satisfied in Canada.

Regulatory action

Taking regulatory action to introduce or increase the stringency of MEPS for eight product categories would lead to greater GHG emission reductions than either the status quo or the voluntary approach. This approach would provide important incremental GHG emission reductions to contribute to the achievement of Canada's commitments made under the Pan-Canadian Framework on Clean Growth and Climate Change and reduce compliance costs associated with unnecessary regulatory differences, since it would align requirements with those of the United States. As a result, regulatory action would reduce the burden for companies that offer the same products in the United States and Canada.

Benefits and costs

Summary

Reduced energy consumption, lower GHG emissions and fewer unnecessary regulatory differences would result in significant net benefits over the lifetime of affected product models. The benefits vary by individual user depending on end-use sector, geographical location and operational practices.

Annual reductions in energy consumption associated with the Amendment are estimated to be 0.4 petajoules (PJ) in 2020, and to reach 3.57 PJ in 2030 as the sale of more efficient equipment steadily replaces the pre-regulation stock.

Annual reductions in GHG emissions resulting from these reductions in energy consumption are estimated to be 0.04 Mt in 2020, and to reach 0.33 Mt in 2030. It is estimated that, by applying a social cost of carbon to these reductions, the cumulative present value of economic benefits associated with GHG emission reductions will be $177 million by 2030. [13]

Canadian consumers would also realize economic co-benefits in the form of reduced energy costs due to the implementation of the Amendment. It is estimated that almost $1 billion in cumulative present value energy savings would be realized by 2030.

The cumulative present value of incremental technology costs and costs to Government associated with the Amendment are estimated to be $334 million and $0.1 million, respectively, by 2030.

The present value of net benefits of the Amendment is estimated to be $818 million by 2030, with total benefits exceeding total costs by a ratio of more than three to one. By 2030, the present value of benefits and costs from the Amendment is estimated to be $1.15 billion and $335 million, respectively.

Benefits and costs associated with the Amendment are presented in Table 1.

Table 1: Summary of benefits and costs associated with the Amendment

<table>
<tr><th>Monetized Benefits</th><th>Costs (as applicable)</th><th>Quantified Benefits</th><th>Unquantified Non-Energy Benefits</th></tr>
<tr><td>Energy (gas and electricity) savings</td><td>Technology costs</td><td>Energy savings (PJ)</td><td rowspan="3">Outside air quality, competitiveness, job growth, home comfort, indoor air quality, minimizing depressurization in new construction, etc.</td></tr>
<tr><td>Avoided damages because of GHG reductions</td><td>Installation costs</td><td>GHG savings (Mt)</td></tr>
<tr><td></td><td>Government administration</td><td></td></tr>
<tr><td></td><td>Administrative burden [14]</td><td></td><td></td></tr>
</table>

Interested parties seeking more details on this analysis can request a copy of the cost-benefit analysis document by contacting the individual named at the end of this document.

Methodology, assumptions and data

Natural Resources Canada analyzed the economic gains to be made through the new and more stringent MEPS and the impact on Canadian society within a cost-benefit analysis framework. The costs and benefits associated with the Amendment were obtained by comparing the following scenarios:

- the business-as-usual case (i.e. excluding the Amendment); and
- the policy case (i.e. the business-as-usual case including the Amendment).

Business-as-usual case

For the purpose of this analysis, the business-as-usual case was defined in terms of Canadian market conditions assessed in 2016. Where Canadian MEPS are aligned with those of the United States, it was assumed that incremental costs and benefits in Canada were fully the result of the Canadian amendments, with no post-2016 spillover effects from the other jurisdictions such as the United States. This assumption is consistent with those of other recent federal regulations [15] and provides an assessment of the full economic impacts of regulatory changes affecting Canadians.

Policy case

The policy case is defined as the application of new and more stringent MEPS across eight product categories relative to markets defined by studies completed in 2016.

Benchmarks

For all product categories, benchmarks are chosen to represent the product models that do not meet the more stringent MEPS. Within those benchmarks, two efficiency levels are considered and weighted based on their relative market share: (1) the least efficient; and (2) the efficiency of the average unit impacted. Where relevant, regional sensitivities were evaluated (e.g. a heat pump would save more energy per year in a colder location).

Social cost of carbon

The social cost of carbon was used to quantify the economic benefits of reducing GHG emissions. It represents an estimate of the economic value of avoided climate change damages at the global level for current and future generations as a result of reducing GHG emissions. The estimated values of the social cost of carbon used in this assessment draw on ongoing work undertaken by Environment and Climate Change Canada [16] in collaboration with a federal interdepartmental working group and in consultation with a number of external academic experts. This work involves reviewing existing literature and other countries' approaches to valuing GHG emissions. Preliminary recommendations, based on current literature and in line with the approach adopted by the U.S. Interagency Working Group on the Social Cost of Carbon, are that it is reasonable to estimate social cost of carbon values at $46.84/tonne of carbon dioxide equivalent in 2018 (in 2018$), increasing each year with the expected growth in damages. [17]

Methodology to estimate costs

The additional or "incremental" costs associated with the Amendment were determined as the difference between the cost of the inefficient product model, represented by the selected benchmark, and the cost of a modified version of that product model that would meet the new or more stringent MEPS. For each product category, the potential cost of modifying the benchmark product model so that it meets the more stringent MEPS was estimated (e.g. cost of adding extra insulation to a water heater, cost of replacing an inefficient compressor in an air conditioner). These costs were then multiplied by the number of shipments of the product models in the business-as-usual case that were estimated to have an energy performance that is worse than what is required by the MEPS. Results were combined across all affected product categories to arrive at the estimate of total costs.

Additional incremental costs related to installation and maintenance costs or to the lifetime of the product were also evaluated, as applicable. Total costs reported as being attributable to the Amendment include, when appropriate, manufacturing, administrative burden and compliance costs, as well as those incurred by Government to implement the changes. Compliance costs for products that are already being tested to enter the U.S. market or under voluntary programs are not included. The added costs of third-party verification and marking is not included either because they are confidential business costs that vary based on business relationships. [18] However, they are estimated to be less than 10% of the total testing costs.

Methodology to estimate benefits

Energy savings for each product category were estimated by calculating the energy used by the selected benchmark product model by simulating how it would be normally used in a year (e.g. number of operating hours). The result is compared to the energy used by the modified version of that product model that would meet the more stringent MEPS. The difference was multiplied by the number of shipments of the product models in the business-as-usual case that were estimated to have an energy performance that is worse than what is required by the MEPS and the number of years the product is expected to last, in order to arrive at the total energy savings. Results were summed across all affected product categories to arrive at the estimate of total energy saved. This was then monetized by multiplying the results by the cost of energy per unit of energy saved (i.e. dollars per kilowatt hour).

The reductions in GHG emissions were calculated by applying fuel-specific emissions factors, consistent with those published by Environment and Climate Change Canada, to the resulting energy savings. To remain consistent with the U.S. methodology and produce more realistic GHG savings, the reductions attributable to diminished electricity consumption reported throughout this document were calculated by applying the emission factors associated with the marginal fuels [19] used to generate the electricity that would be saved through implementation of the Amendment. To allow comparison with outcomes reported under the Pan-Canadian Framework on Clean Growth and Climate Change, the reductions in GHG emissions were also calculated by applying an average emission factor. Annual reductions in GHG emissions with the average emission factor are estimated to be

0.012 Mt in 2020, increasing to 0.107 Mt in 2030. GHG emissions were monetized and incorporated into the analysis using a social cost of carbon, as calculated by Environment and Climate Change Canada. The social cost of carbon represents an estimate of the economic value of avoided climate change damages at the global level — for current and future generations — as a result of reducing GHG emissions.

Assumptions

Key assumptions include the following:

- Analysis covers shipments impacted by the proposed Regulations between 2019 and 2030;
- Business-as-usual case reflects Canadian market conditions in 2016;
- Benefits and costs are measured in real constant 2018 dollars;
- A 3% real discount rate is applied to all benefits and costs with values discounted to 2018; [20]
- Canadian average energy prices are based on data from Environment and Climate Change Canada's 2017 Emission Trends; [21]
- Valuation of the GHG emissions incorporated into the analysis is based on the social cost of carbon as calculated by Environment and Climate Change Canada;
- Costs incurred by manufacturers, distributors and installers to produce and install more efficient technologies as well as administrative burden costs are assumed to be passed on to consumers or end-users; and
- Incremental costs associated with more efficient technology were estimated in 2016 and are assumed to be constant, despite evidence [22] that such costs come down with time, owing to improvements in manufacturing processes and economies of scale, as higher volumes of product models with new technology enter the market. This assumption could lead to overestimates of manufacturing costs; however, it provides a conservative assessment of overall net benefits. A 2018 study [23] found that each doubling of production for residential gas furnaces lead to a 5.7% to 8.9% decrease in manufacturing costs.

Data collection and sources

Data is collected on a product-by-product basis, through market studies. It provides key inputs to the analysis such as market size; the portion of the market that does not meet the new or more stringent MEPS; the benchmarks that best represent that portion of the market; energy savings from the business-as-usual case to the policy case; costs of moving from the business-as-usual case to the policy case; product lifetime; and installation costs.

Results

The methodology described above was applied to all product categories to develop an estimate of the benefits and costs attributable to the Amendment. The results vary by product category depending on the magnitude of the increase in stringency of the MEPS and the estimated portion of the market that would be impacted by the Amendment. The estimated benefits and costs for each product category are presented in Table 2. Negative numbers in the table indicate that these particular subcategories present negative net benefits. Consistent with previous amendments, subcategories that do not generate net positive benefits remain subject to the Amendment in order to achieve the desired objectives and outcomes of the Amendment from which Canadians will benefit as a whole. These results were then aggregated to present the overall impacts of the Amendment in Table 3.

Table 2: Benefits and costs per product category

Product Category	**Cumulative Total for Product Shipped by 2030(Millions of Dollars) [2018$]**		
	ProductCosts [24]	Product Benefits [25]	Product Net Benefits
Ceiling fans	$66.50	$132.27	$65.77

Chillers	Air cooled	$12.20	$10.90	-$1.31
	Water cooled, displacement	$2.76	$1.65	-$1.11
	Water cooled, centrifugal	$12.69	$10.15	-$2.54
Clean water pumps		$5.50	$12.21	$6.71
Miscellaneous refrigeration products		$140.95	$422.19	$281.24
Refrigerated vending machines		$1.84	$38.07	$36.23
Single package vertical air conditioners		$28.21	$62.94	$34.73
Single package vertical heat pumps		$0.47	$0.85	$0.38
Walk-in coolers and freezers		$62.16	$461.38	$399.21
Total of all products		**$333.30**	**$1,152.60**	**$819.30**

Note: Numbers may not add up to totals due to rounding. Covers shipments impacted by the proposed Regulations between 2019 and 2030. All benefits and costs are discounted at 3% to the year 2018.

Table 3: Summary of benefits and costs to Canadians

Costs, Benefits and Distribution			**Aggregate Annual Totals**		**Total Cumulative Present Value**	**Average Annualized Over Period to 2030**
			2020	**2030**	**By 2030**	
A. Quantified impacts ($) [millions in 2018 prices]						
Benefits	Pre-tax fuel (gas and electricity) savings	Canadians	$98.91	$112.70	$976.48	$98.10
	Avoided GHG damages	Canadians	$17.49	$21.47	$176.91	$17.77
Total benefits			**$116.39**	**$134.17**	**$1,153.39**	**$115.87**
Costs	Technology and installation costs	Canadians	$36.17	$36.74	$333.93	$33.55
	Compliance costs and administrative burden [26]	Canadians	$0.09	$0.09	$0.92	$0.09
	Government administration	Government	$0.10	$0	$0.10	$0.01
Total costs			**$36.36**	**$36.83**	**$334.94**	**$33.65**
Net benefits			**$80.03**	**$97.34**	**$818.45**	**$82.22**
B. Quantified impacts (in non-$)						
Positive impacts on Canadians	Energy savings (petajoules)		0.40	3.57	23.64	—
	GHG emission reductions (megatonnes)		0.04	0.33	2.22	—

Note: Numbers may not add up to totals due to rounding. Covers shipments impacted by the proposed Regulations between 2019 and 2030. All benefits and costs are discounted at 3% to the year 2018.

Additional benefits and costs

For industries using affected energy-using products in their operations, an improvement in energy performance translates into energy and operating cost savings, increased productivity and competitiveness, and improved environmental performance. When such companies spend these energy savings on expanding their businesses or factories, they create greater demand. Reduced electricity consumption from regulated products also benefits the utilities by reducing peak loads and the need to add more generating capacity.

Because of the lack of data, the analysis has not quantified widely accepted benefits such as reduced air pollution, and non-energy benefits related to energy efficiency, such as increased occupant comfort, better indoor air quality and minimizing risks of depressurization in new constructions with better envelopes.

The analysis has quantified costs and benefits for each product category relative to a business-as-usual case defined by market conditions assessed in 2016. In the case of one product category (central air conditioners and heat pumps), the assessment showed that all product models being imported into Canada or shipped between provinces comply with the more stringent MEPS. While the analysis does not attribute any costs or benefits to the implementation of the MEPS for this product category, this Amendment would prevent future dumping of low-efficiency product models into the Canadian market.

Another benefit of the Amendment is related to the verified energy efficiency performance data of energy-using products that is collected by Natural Resources Canada through its compliance program. The data for new energy-using products will be posted to the Natural Resources Canada website [27] and will provide readily accessible information to households or businesses. Consumers benefit from this information since it provides them with detailed information to make informed purchase decisions. Utilities and retailers also benefit from this information, since it supports programming to promote the sale of high-efficiency products.

“One-for-One” Rule

It is estimated that this Amendment would generate an increase in administrative burden of $55,508 created by the introduction of regulatory requirements. Dealers of the prescribed products will be required to learn about the requirements of the Regulations and submit information before shipping or importing energy-using products in accordance with subsection 5(1) of the Act.

The Amendment is considered an “IN” under the “One-for-One” Rule. It would increase administrative burden by approximately $55,508 in annualized average administrative costs to industry.

Assumptions underlying administrative burden estimates

Familiarization with the Amendment

Familiarization with new information obligations is a one-time administrative function that applies to manufacturers of regulated products. The task involves reviewing and understanding the new requirements of the Amendment, as well as the associated reports. This one-time event is estimated to take two hours to be realized by someone with a technical background with a wage rate of approximately $42 per hour. The number of stakeholders impacted is estimated at 697, which represents the total number of companies identified under the following three Harmonized System (HS) codes:

- 333910 — Pump and Compressor Manufacturing;
- 335223 — Major Kitchen Appliance Manufacturing; and
- 333416 — Heating Equipment and Commercial Refrigeration Equipment Manufacturing.

The use of these codes likely over-estimates the total number of companies that would be directly impacted by the Amendment. Natural Resources Canada does not have access to more detailed information that would allow for a more precise stakeholder estimate and has decided, for the purpose of this calculation, to apply estimates of incremental burden to all 697 stakeholders.

Submitting import reports

The Amendment would introduce import reporting requirements for new energy-using products. Importers of these new products would carry an incremental ongoing administrative burden, as they would be required to provide information for 16 new 10-digit HS codes at the time of importation. To estimate the frequency and time associated with this administrative action, Natural Resources Canada analyzed Canada Border Services Agency import data from four years (2012–2015) to establish number of importers, average number of transactions per year and average number of transactions per year per HS code. Based on this analysis, it is estimated that 62 importers would be affected by this incremental activity, which would occur 2 082 times per year. It is assumed that clerical staff with a wage rate of approximately $30 would undertake this task.

To estimate the time required per event, Natural Resources Canada relied upon a U.S. Department of Energy assessment of the time it takes to populate a similar report in a similar context: information is readily available and must simply be entered into the proper place in the report. The U.S. Department of Energy estimated that it took approximately 22 seconds per data element to populate this report. To account for minor differences between the complexities of the data elements in Canada's import reports and those that were the subject of the U.S. Department of Energy analysis, Natural Resources Canada estimates that it would take 36 seconds per data element, with each report requiring two data elements to be submitted for the impacted products.

Submitting efficiency reports

The Amendment would introduce an administrative burden associated with the reporting of energy performance information before an energy-using product is imported or shipped across provinces. The added burden applies to products that have reporting elements that differ from reporting requirements already in place in other jurisdictions.

The data used to calculate incremental administrative burden costs was obtained from a variety of sources such as internal compliance databases, numerous product market studies, Statistics Canada, the Canada Border Services Agency, the Canadian Federation of Independent Business, and the U.S. Department of Energy. Analysis of the data indicates that around 30 manufacturers of residential portable air-conditioners may be impacted by new reporting requirements, which require inputting data into fields of the energy efficiency reports. The time required to input the data has been estimated to take 36 seconds per data element. These activities would be undertaken by administrative support with a wage rate of approximately $29 per hour.

Consultation — "One-for-One" Rule

During preconsultations, manufacturers commented that the proposed reporting requirements for portable air- conditioners would add a burden given that information is not required to be submitted in the United States. For all other products, stakeholders were generally supportive of the approach to achieve alignment with U.S. regulations across these product categories, which includes the alignment of reporting requirements. The calculations take into account that there is an administrative burden for portable air-conditioners.

Small business lens

The small business lens applies to the Amendment, since the proposal impacts small businesses and has nationwide cost impacts of over $1 million annually. Statistics Canada and Canada Border Services Agency data on the number of small businesses by industry sector indicates that 869 small importing and manufacturing businesses may be impacted by this regulatory proposal. The Amendment would increase the administrative burden for small importers by $61,577 (annualized average administrative cost), or approximately $288 per business, and increase the administrative burden for small manufacturers of affected products by $7,779 (annualized average administrative cost), or $12 per business. It should be noted that the proposed reporting requirements are minor, and represent the minimum amount of information required to assess that an individual product meets the prescribed standards. The estimated impacts on small businesses are presented in Table 4.

Information obtained during preconsultations indicates that seven small Canadian manufacturers might be impacted by the Amendment. The majority of these are not expected to face incremental costs, as they already manufacture compliant products and are demonstrating compliance with similar requirements already in force in other jurisdictions. Small manufacturers that are expected to assume incremental costs have been engaged in consultations, but have not raised any compliance issues associated with the size of their respective companies.

Table 4: Small business lens summary

Small Business Lens Summary		
Number of small businesses impacted		869
Number of years		10
Base year for costing		2012
Administrative Burden	**Annualized Value ($)**	**Present Value**
Submitting import reports	$61,577	$432,491
Submitting efficiency reports	$7,779	$54,636
Total cost (all impacted small businesses)	**$69,356**	**$487,128**
Cost per impacted small business	**$80**	**$561**

Note: Numbers may not add up to totals due to rounding.

Consultation

Preconsultation summary

Stakeholders [28] were informed of the changes being considered in the Amendment and were provided opportunities to comment at several points since 2016. These consultations evolved with time, and the content of the Amendment was modified accordingly. The following outlines the key materials used to communicate details to the stakeholder community.

- **February 2016:** Natural Resources Canada released a discussion paper to seek stakeholder views and feedback on the list of products being considered for future amendments.
- **March 2017:** Natural Resources Canada published a notice of intent in the *Canada Gazette*, Part I, to inform stakeholders that it was initiating the development of this Amendment and updated the Forward Regulatory Plans to communicate the product categories being considered for inclusion in the Amendment as well as the overarching policy direction being taken.
- **2017:** Detailed product-specific technical bulletins were published. Product-specific webinars and workshops were held with affected stakeholders to discuss the content of these bulletins.

All the documents mentioned above were distributed to stakeholders via targeted emails. Many of these individuals and organizations in turn forwarded the information to provide access to a larger audience of stakeholders.

Natural Resources Canada also has ongoing activities that provide additional opportunities to gather feedback from stakeholders and to inform them.

- *Energy Efficiency Regulations web page (http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845)* of the Natural Resources Canada website.
- *Ongoing bilateral discussions*. Natural Resources Canada is in close contact with the industry through major industry associations to discuss changes and updates to the Regulations.
- *National Standards System.* The relevant Canadian Standards Association steering committees, technical committees and technical subcommittees, comprising stakeholders (including manufacturers, industry associations and other interested groups), provided input, and reviewed and voted upon changes to the testing standards.
- *Market studies* were conducted by third-party consultants who worked with manufacturers and industry associations to gather information and support decision making.

Product-specific comments received during preconsultation

Stakeholders were informed of the content of the Amendment through the activities outlined above, and they were generally supportive of the approach. The following section elaborates only where there were substantive discussions, describing how those discussions were taken into account in the development of the Amendment.

Ceiling fans

One industry association and three manufacturers raised the issue of airflow stability during testing, specifically when testing at low speed. Natural Resources Canada acknowledges that there are airflow stability issues at low speeds and is proposing to adopt the U.S. testing standard and require that the MEPS be measured at high speed, where airflow is more stable.

One manufacturer asked whether there would be labelling requirements for ceiling fans in this Amendment, given that labelling requirements were introduced in the United States after formal consultations on the Amendment were completed. Natural Resources Canada does not intend to develop labelling requirements at this time.

One manufacturer raised concerns with the repeatability and stabilization requirements of the current testing standard of the Canadian Standards Association and recommended that Natural Resources Canada adopt the U.S. testing standard without the stabilization requirements. Natural Resources Canada proposes to adopt the U.S. testing standard.

Miscellaneous refrigeration products

One industry association requested that the scope of miscellaneous refrigeration products be harmonized with that of the United States to ensure thermoelectric products are included. Natural Resources Canada confirms that thermoelectric miscellaneous refrigeration products would be included in the scope.

Clean water pumps

One manufacturer suggested that all pumps be tested and reported as opposed to allowing for testing using select basic models or calculation-based methodology. Due to the vast number of configurations available (impeller sizes, with or without controls, motor options, etc.), Natural Resources Canada is proposing to maintain alignment with the United States requirements.

The same manufacturer also suggested that the proposed MEPS should be more stringent than those of the United States. Natural Resources Canada has analyzed the proposed efficiency levels and believes they are appropriate for the current Canadian market and is therefore proposing to maintain alignment with the United States requirements.

Four manufacturers and one association voiced concerns with third-party verification. They indicated that third-party verification would be complex and costly due to the high number of variations (pump, motor, controls). Natural Resources Canada relies on third-party verification as the means of assessing compliance with the Regulations for all products, since it provides a level of independence, transparency and credibility to the regulatory program. By requiring verification from a certification body accredited by the Standards Council of Canada, manufacturers and consumers are assured of a level playing field, in that all products are treated with the same level of scrutiny and are assessed the same way. For clean water pumps, testing is already required to demonstrate compliance with the U.S. requirements. Natural Resources Canada is proposing to maintain its third-party verification requirement for this product category.

Walk-in coolers and freezers

Two industry associations and two manufacturers commented that there is no certification body for walk-in coolers and walk-in freezers that could conduct third-party verification. Natural Resources Canada has consulted with certification bodies to inform them of the upcoming requirement for walk-in coolers and walk-in freezers and, based on previous experience, [29] is confident that certification will be available for these products.

One manufacturer and one industry association expressed concern that the proposed testing standard cannot be used for a single-package dedicated condensing refrigeration system without the product being disassembled, thereby affecting the system performance. One standards development organization commented that work is ongoing to develop an alternative testing standard for these products. Natural Resources Canada’s proposal is aligned with the U.S. testing standard. In Canada, the certification bodies determine how a regulated product can be tested as per a referenced testing standard.

In 2017, Natural Resources Canada consulted on product marking requirements in the context of a previous amendment, but did not formally propose these changes. Natural Resources Canada is now proposing product marking requirements for walk-in coolers and walk-in freezers, which would require a nameplate affixed to the product displaying the brand name, whether it is

intended for use in a walk-in cooler or freezer or both, the model number, the date of manufacture, and whether the product is intended for indoor use only. Walk-in process cooling refrigeration systems do not have proposed product marking requirements.

Chillers

The technical bulletins published in May 2017 mentioned that Natural Resources Canada was considering adopting the 2013 version of ASHRAE 90.1 [30] as the MEPS. Two industry associations recommended that Canada adopt the 2016 version, as the energy efficiency requirements are the same in both versions. Natural Resources Canada agrees and is proposing to incorporate directly ASHRAE 90.1-2016.

Natural Resources Canada proposed to reference ANSI/AHRI 551/591-2011 [31] with Addendum 1 as the testing standard. Two industry associations supported the proposition, but recommended that Natural Resources Canada reference the most recent 2015 version, which is also referenced by ASHRAE 90.1-2016. Natural Resources Canada agrees and is proposing to reference AHRI 551/591-2015 as the testing standard.

Two industry associations commented that, due to the level of customization, every chiller has a unique model number, and therefore reporting to Natural Resources Canada would indicate each manufacturer's market share of chillers sold in Canada. They requested that a secure mechanism be put in place to protect the information reported. Natural Resources Canada recognizes their concerns and the importance of not disclosing unique model information for identified custom chillers. Industry associations proposed to give Natural Resources Canada access to a secure database. Until the database is shared and a determination is made whether it can be used, Natural Resources Canada will update its reporting form to add an optional field to identify whether a model is a customer-specific product.

Single package vertical air conditioners and heat pumps

Two manufacturers recommended that Natural Resources Canada not require third-party verification, given that this is not required in the United States. Natural Resources Canada relies on third-party verification as the means of assessing compliance with the Regulations for all regulated products because it provides a level of independence, transparency and credibility to the regulatory program. By requiring verification from a certification body accredited by the Standards Council of Canada, manufacturers are assured of a level playing field upfront, in that all products are treated with the same level of scrutiny and are assessed the same way. Natural Resources Canada is proposing to maintain third-party verification for this product category.

Central air conditioners and heat pumps

Natural Resources Canada proposed to include off-mode power MEPS for both single- and three-phase equipment. Two industry associations recommended that Natural Resources Canada exclude three-phase equipment from off-mode power consumption requirements or conduct a study to determine appropriate off-mode MEPS, allow the use of an alternative efficiency determination method, and/or extrapolate the single-phase results to simulate the off-mode power consumption for three-phase equipment. Natural Resources Canada conducted a market study and concluded that more research would be required to determine appropriate MEPS for three-phase equipment, and therefore agrees to exclude three-phase equipment from off-mode power consumption requirements.

Portable air conditioners

One industry association requested that reporting and verification of the product's energy efficiency not be required to maintain a common North American market, since this is not required yet in the United States. It commented that this verification would come with both costs and resource implications. Although manufacturers are required to use the testing standards if they are making energy efficiency claims in the United States, there is no requirement to submit energy efficiency data. Natural Resources Canada believes that most manufacturers would make representation of their product's capacity or efficiency, and therefore is proposing to keep the reporting and verification requirements.

Regulatory cooperation

In August 2014, Natural Resources Canada and the U.S. Department of Energy established a goal of aligning new and updated energy efficiency standards and testing standards for energy-using equipment through enhanced information sharing and cooperative development and implementation, to the extent practicable and permitted by law. This included a commitment to annually share work plans for energy efficiency and testing standards, develop guidelines for frequency of interaction and information sharing (e.g. test data, market analyses), mutually participate in the process to establish standards and testing requirements and leverage multilateral initiatives to advance energy efficiency objectives. [32]

The Amendment is consistent with the objectives of the *Memorandum of Understanding between the Treasury Board of Canada Secretariat and the United States Office of Information and Regulatory Affairs regarding the Canada–United States Regulatory Cooperation Council*, signed in June 2018. The Amendment seeks to foster alignment of federal regulations where feasible and appropriate.

In August 2016, federal, provincial and territorial energy ministers published a framework and action plan for energy efficiency standards under the Energy and Mines Ministers' Conference. The framework outlines an approach by which provinces and territories collaborate to achieve greater harmonization on energy efficiency standards. The Amendment would reduce regulatory differences that exist between federal and provincial regulations by adding products to the Regulations that would otherwise be only regulated in one or a few provinces.

Rationale

The Amendment would benefit Canadians by reducing GHG emissions and energy consumption in homes and buildings, and removing unnecessary regulatory differences between Canada and the United States.

According to the International Energy Agency, policies and programs that address energy efficiency are the most cost-effective way to lower GHG emissions and could complement carbon pricing schemes as an overall strategy to effectively achieve climate change policy objectives. [33]

In the absence of a regulatory approach, a market for high energy consuming products would continue. Consumers who purchase such products could be motivated by lower purchase costs even though they would pay higher operational costs over the life of the product. The analysis of the Amendment has shown that new or more stringent MEPS would generate reductions in GHG emissions and energy consumption. The associated energy savings would generate net monetary benefits for Canadian consumers. The analysis has shown that the costs of technologies that would be required to bring low-efficiency products into compliance with the MEPS proposed in this Amendment are outweighed by the overall benefits.

The development of the Amendment was informed by stakeholder views. Industry supports an approach that is aligned with that of the United States when possible, since most product models are designed to serve a Canada–U.S. market. The Amendment is supported by provincial and territorial governments, as its development was informed by work conducted under the framework released by the Energy and Mines Ministers' Conference in 2016 to achieve greater harmonization on energy efficiency standards.

Prescribed MEPS are a proven cost-effective approach to achieving reductions in GHG emissions and energy consumption. The *Energy Efficiency Regulations* were first introduced in 1995 and have been amended 14 times to increase the stringency of existing MEPS and introduce MEPS for new energy-using products. Through the use of third-party verification and regular post-market compliance activities, a high compliance rate with regulated requirements has been observed. This provides confidence that estimated outcomes are being achieved and that Canadians are experiencing the associated benefits.

Implementation, enforcement and service standards

The Amendment would come into force six months after publication in the *Canada Gazette*, Part II. The requirements would apply to the prescribed products based on their date of manufacture or import or interprovincial shipment of the product.

The compliance and enforcement procedures already in place for all products prescribed under the Regulations would continue to be used following the coming into force of this Amendment. The main features of this system are as follows.

Verification marking and energy efficiency reporting

For products prescribed under the Regulations, Natural Resources Canada employs a third-party verification system using the services of certification bodies accredited by the Standards Council of Canada. Verified energy performance data is submitted to Natural Resources Canada by the dealer in an energy efficiency report as specified in the Regulations. This is required once for each product model before first importation or interprovincial shipment.

Import reporting and monitoring

Natural Resources Canada procedures, already in place, for the collection of information for commercial imports of prescribed products would apply to products affected by the Regulations. These procedures involve cross- checking the required import data received from customs release documents with the energy efficiency reports that dealers have submitted to Natural Resources Canada. This cross-checking ensures that the compliance of regulated products imported into Canada can be verified.

The Regulations would continue to require dealers of prescribed products to provide the information needed for customs monitoring.

Direct fieldwork: market survey and product testing

In addition to ongoing compliance and marketplace monitoring activities, Natural Resources Canada surveys and tests products in the context of monitoring compliance outcomes with product-specific compliance audits. Depending on the product, in-store audits and/or testing of products are also conducted.

Natural Resources Canada also conducts product testing on a complaint-driven basis. The market is highly competitive and suppliers are cognizant of performance claims made by their competitors. Challenge procedures by which performance claims can be questioned exist in all verification programs.

Performance measurement and evaluation

The desired outcomes of the Regulations are presented in the following table along with the information that would be tracked to measure performance.

Table 5: Measuring performance of the Regulations

Outcome	Indicators	Information to Measure Performance
GHG emissions are reduced to contribute to Canada's goal to reduce GHG emissions by at least 30% below 2005 levels by 2030.	Percentage of product models that meet MEPS	• Energy efficiency reports • Import reports • Market data (shipments, trends) • Lab testing • Emission factors • Energy prices
Consumers save money by purchasing higher efficiency product models that have lower costs over their lifetime.		
Businesses using regulated equipment save money that can lead to increased productivity and competitiveness.		

Performance would be monitored through a combination of equipment-specific compliance reporting, supported by third-party verification of energy efficiency performance, and ongoing collection of market data to assess broader trends affecting outcomes.

Information collected on the energy efficiency performance of regulated products informs both GHG emission impacts and consumer savings, since both are calculated as a function of changes in the amount of energy consumed by these products. [34]

A high compliance rate with the Regulations would be achieved through support from manufacturers, third-party verification, customs monitoring, cooperation with regulating provinces, communication activities, market surveys, and product testing, as required.

The standards contained in the Amendment are being implemented under the federal energy efficiency equipment standards and labelling program. Detailed accounts of progress towards achieving the objectives of this initiative would be found in departmental business plans, reports on plans and priorities, and the Report to Parliament under the *Energy Efficiency Act*.

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PROPOSED REGULATORY TEXT

Notice is given that the Governor in Council, pursuant to sections 20 [a] and 25 of the *Energy Efficiency Act* [b], proposes to make the annexed *Regulations Amending the Energy Efficiency Regulations, 2016*.

Interested persons may make representations concerning the proposed Regulations within 45 days after the date of publication of this notice. All such representations must cite the *Canada Gazette*, Part I, and the date of publication of this notice, and be addressed to Jamie Hulan, Director, Equipment Division, Office of Energy Efficiency, Department of Natural Resources, 930 Carling Avenue (CEF, Building 3, Observatory Crescent), 1st Floor, Room 136-C, Ottawa, Ontario K1A 0Y3 (tel.: 613-996-4359; email: nrcan.equipment-equipement.rncan@canada.ca (mailto:nrcan.equipment-equipement.rncan@canada.ca)).

Ottawa, November 29, 2018

Jurica Čapkun
Assistant Clerk of the Privy Council

Regulations Amending the Energy Efficiency Regulations, 2016

Amendments

1 The definition *CSA C300-00* in section 12 of the *Energy Efficiency Regulations, 2016* [35] is repealed.

2 Subsection 13(1) of the Regulations is replaced by the following:

EnerGuide label

13 (1) An energy-using product prescribed in any of Subdivisions A to G or K of this Division must be labelled in the form set out in Schedule 1.

3 (1) The definition *Type 5A combination refrigerator-freezer* in section 39 of the Regulations is repealed.

(2) The definitions *combination refrigerator-freezer* and *refrigerator* in section 39 of the Regulations are replaced by the following:

combination refrigerator-freezer means a household combination refrigerator-freezer that has

- **(a)** a defrost system, including a compressor-cycled automatic defrost system; and
- **(b)** a capacity of 1 105 L (39 cubic feet) or less. (*réfrigérateur-congélateur*)

refrigerator means a household refrigerator that has a capacity of 1 105 L (39 cubic feet) or less and that has a defrost system, including a compressor-cycled automatic defrost system. It does not include

(a) a household refrigerator that uses an absorption refrigeration system; or
(b) a miscellaneous refrigeration product. (*réfrigérateur*)

4 Paragraphs 40(a) to (p) of the Regulations are replaced by the following:

(a) less than 70 L (2.5 cubic feet);
(b) 70 to 126 L (2.5 to 4.4 cubic feet);
(c) 127 to 182 L (4.5 to 6.4 cubic feet);
(d) 183 to 239 L (6.5 to 8.4 cubic feet);
(e) 240 to 295 L (8.5 to 10.4 cubic feet);
(f) 296 to 352 L (10.5 to 12.4 cubic feet);
(g) 353 to 409 L (12.5 to 14.4 cubic feet);
(h) 410 to 465 L (14.5 to 16.4 cubic feet);
(i) 466 to 522 L (16.5 to 18.4 cubic feet);
(j) 523 to 579 L (18.5 to 20.4 cubic feet);
(k) 580 to 635 L (20.5 to 22.4 cubic feet);
(l) 636 to 692 L (22.5 to 24.4 cubic feet);
(m) 693 to 748 L (24.5 to 26.4 cubic feet);
(n) 749 to 805 L (26.5 to 28.4 cubic feet);
(o) 806 to 862 L (28.5 to 30.4 cubic feet); or
(p) 863 to 1 105 L (30.5 to 39.0 cubic feet).

5 Section 41 of the Regulations is replaced by the following:

Type

41 For the purposes of these Regulations, a refrigerator or combination refrigerator-freezer is one of the types described in the product types (1) to (7-BI) and (11) to (15I) of Table 1 to CSA C300-15.

6 The table to section 43 of the Regulations is replaced by the following:

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Refrigerators and combination refrigerator-freezers	CSA C300-12	CSA C300-12, Table 1	On or after February 3, 1995 and before September 15, 2014
2	Refrigerators and combination refrigerator-freezers	CSA C300-15	CSA C300-15, Table 1	On or after September 15, 2014

7 Paragraphs 44(2)(a) to (c) of the Regulations are replaced by the following:

(a) CSA C300-12, if the product was manufactured on or after February 3, 1995 and before September 15, 2014; or
(b) CSA C300-15, if the product is manufactured on or after September 15, 2014.

8 Section 45 of the Regulations is replaced by the following:

Definition of *freezer*

45 In this Subdivision, ***freezer*** means a household freezer that has a capacity of 850 L (30 cubic feet) or less.

9 Paragraphs 46(a) to (n) of the Regulations are replaced by the following:

(a) less than 155 L (5.5 cubic feet);

(b) 155 to 210 L (5.5 to 7.4 cubic feet);
(c) 211 to 267 L (7.5 to 9.4 cubic feet);
(d) 268 to 324 L (9.5 to 11.4 cubic feet);
(e) 325 to 380 L (11.5 to 13.4 cubic feet);
(f) 381 to 437 L (13.5 to 15.4 cubic feet);
(g) 438 to 494 L (15.5 to 17.4 cubic feet);
(h) 495 to 550 L (17.5 to 19.4 cubic feet);
(i) 551 to 607 L (19.5 to 21.4 cubic feet);
(j) 608 to 664 L (21.5 to 23.4 cubic feet);
(k) 665 to 720 L (23.5 to 25.4 cubic feet);
(l) 721 to 777 L (25.5 to 27.4 cubic feet);
(m) 778 to 833 L (27.5 to 29.4 cubic feet); or
(n) 834 to 850 L (29.5 to 30.0 cubic feet).

10 Section 47 of the Regulations is replaced by the following:

Type

47 For the purposes of these Regulations, a freezer is one of the types described in the product types (8) to (10A) and (16) to (18) of Table 1 to CSA C300-15.

11 The table to section 49 of the Regulations is replaced by the following:

TABLE

	Column 1	Column 2	Column 3	Column 4
Item	Energy-using Product	Standard	Energy Efficiency Standard	Period of Manufacture
1	Freezers	CSA C300-12	CSA C300-12, Table 1	On or after February 3, 1995 and before September 15, 2014
2	Freezers	CSA C300-15	CSA C300-15, Table 1	On or after September 15, 2014

12 Paragraphs 50(2)(a) to (c) of the Regulations are replaced by the following:

(a) CSA C300-12, if the product was manufactured on or after February 3, 1995 and before September 15, 2014; or
(b) CSA C300-15, if the product is manufactured on or after September 15, 2014.

13 The Regulations are amended by adding the following after section 69:

SUBDIVISION K

Miscellaneous Refrigeration Products

Definitions

70 The following definitions apply in this Subdivision.

10 C.F.R. Appendix A means Appendix A to Subpart B, Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Refrigerators, Refrigerator-Freezers, and Miscellaneous Refrigeration Products*, as amended from time to time, except for the waiver referred to in section 7 of that Appendix. (*appendice A 10 C.F.R.*)

10 C.F.R. §430.32(aa)(1) means the table to paragraph 430.32(aa)(1) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.32(aa)(1)*)

10 C.F.R. §430.32(aa)(2) means the table to paragraph 430.32(aa)(2) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.32(aa)(2)*)

miscellaneous refrigeration product means a household refrigeration product, which includes coolers and combination cooler refrigeration products, but does not include a refrigerator, a refrigerator-freezer or a freezer. (*appareil de réfrigération divers*)

Type

71 For the purposes of these Regulations, a miscellaneous refrigeration product is one of the following types:

(a) if it was manufactured on or after January 1, 2008 and before October 28, 2019, a type described in any of the product types (19) or (20) of Table 1 to CSA C300-15; or
(b) if it is manufactured after October 28, 2019, a cooler type described in 10 C.F.R. §430.32(aa)(1) or a combination cooler refrigeration product of a class described in 10 C.F.R. §430.32(aa)(2).

Energy-using product

72 (1) A miscellaneous refrigeration product is prescribed as an energy-using product.

Limits

(2) However, for the purposes of sections 4, 5, 13 to 15 and 73, a miscellaneous refrigeration product is not considered to be an energy-using product unless

(a) it is manufactured on or after January 1, 2008 and before October 28, 2019, and is a type (19) or (20) as described in Table 1 to CSA C300-15; or
(b) it is manufactured on or after October 28, 2019.

Energy efficiency standard

73 (1) The energy efficiency standards set out in column 3 of the table to this section apply to miscellaneous refrigeration products described in column 1 that are manufactured during the periods set out in column 4.

Testing standard

(2) A miscellaneous refrigeration product complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by the standard set out in column 2 that are applicable to a *miscellaneous refrigeration product* as defined in section 70.

TABLE

	Column 1	Column 2	Column 3	Column 4
Item	Energy-using Product	Standard	Energy Efficiency Standard	Period of Manufacture
1	Miscellaneous refrigeration products	CSA C300-12	CSA C300-12, Table 1	On or after January 1, 2008 and before September 15, 2014
2	Miscellaneous refrigeration products	CSA C300-15	CSA C300-15, Table 1	On or after September 15, 2014 and before October 28, 2019
3	Miscellaneous refrigeration products – coolers	10 C.F.R. Appendix A	10 C.F.R. §430.32(aa)(1)	On or after October 28, 2019
4	Miscellaneous refrigeration products – combination cooler refrigeration products	10 C.F.R. Appendix A	10 C.F.R. §430.32(aa)(2)	On or after October 28, 2019

Information

74 (1) For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a miscellaneous refrigeration product:

(a) its type;

(b) its adjusted volume; and
(c) its annual energy consumption, expressed in kilowatt-hours.

Standard

(2) The information must be collected in accordance with one of the following standards:

(a) CSA C300-12 if the product was manufactured on or after January 1, 2008 and before September 15, 2014;
(b) CSA C300-15 if the product was manufactured on or after September 15, 2014 and before October 28, 2019; or
(c) 10 C.F.R. Appendix A if the product is manufactured on or after October 28, 2019.

SUBDIVISION L

Ceiling Fans

Definitions

75 The following definitions apply in this Subdivision.

10 C.F.R. Appendix U means Appendix U to Subpart B, Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans*, as amended from time to time. (*appendice U 10 C.F.R.*)

10 C.F.R. §430.32(s)(2)(i) means the table to paragraph 430.32(s)(2)(i) of Subpart C, Part 430 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §430.32(s)(2)(i)*)

ceiling fan means a non-portable device that is suspended from a ceiling for circulating air via the rotation of fan blades. It does not include

(a) a ceiling fan if the plane of rotation of the fan blades is greater than 45 degrees from horizontal;
(b) a centrifugal ceiling fan;
(c) a belt-driven ceiling fan;
(d) an oscillating ceiling fan; and
(e) a ceiling fan with a maximum rotational speed of 90 RPM and a maximum airflow of 52.1 cubic metres/minute (1840 cubic feet/minute). (*ventilateur de plafond*)

Type

76 For the purposes of these Regulations, a ceiling fan is one of the following types:

(a) very small diameter;
(b) standard;
(c) hugger;
(d) high-speed small-diameter; or
(e) large-diameter.

Energy-using product

77 (1) A ceiling fan is prescribed as an energy-using product.

Limits

(2) However, for the purposes of sections 4, 5 and 78, a ceiling fan is not considered to be an energy-using product unless it is manufactured on or after January 21, 2020.

Energy efficiency standard

78 (1) The energy efficiency standard for a ceiling fan is the standard as set out in 10 C.F.R. §430.32(s)(2)(i).

Testing standard

(2) A ceiling fan complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix U that are applicable to a *ceiling fan* as defined in section 75.

Information

79 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with 10 C.F.R. Appendix U and provided to the Minister in respect of a ceiling fan:

(a) its type;
(b) its blade span;
(c) its airflow at high speed;
(d) its ceiling fan efficiency; and
(e) its standby power consumption, expressed in watts.

14 Section 107 of the Regulations is amended by adding the following in alphabetical order:

10 C.F.R. Appendix M means Appendix M to Subpart B, Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps*, as amended from time to time. (*appendice M 10 C.F.R*)

15 The definitions *CSA C370* and *portable air conditioner* in section 108 of the Regulations are repealed.

16 Section 124 of the Regulations is amended by adding the following in alphabetical order:

off mode power consumption means the power consumption when the unit is connected to mains power but is not providing cooling or heating. (*consommation d'énergie en mode arrêt*)

17 (1) Subsection 126(1) of the Regulations is replaced by the following:

Energy efficiency standards — single-phase

126 (1) The energy efficiency standards set out in column 3 of Table 1 to this section apply to single-phase single package central air conditioners described in column 1 that are manufactured during the periods set out in column 4.

Energy efficiency standards — three-phase

(1.1) The energy efficiency standards set out in column 3 of Table 2 to this section apply to three-phase single package central air conditioners described in column 1 that are manufactured during the periods set out in column 4.

(2) The heading of the table to section 126 is replaced by the following:

TABLE 2

(3) Section 126 is amended by adding the following before Table 2:

TABLE 1

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Single package central air conditioners, other than those that are through-the-wall or small-duct and high-velocity	CSA C656-05	Seasonal energy efficiency ratio ≥ 13.0	On or after February 3, 1995 and before January 1, 2017
2	Single package central air conditioners, other than those that are through-the-wall or small-duct and high-velocity	CSA C656-14 for seasonal energy efficiency ratio	Seasonal energy efficiency ratio ≥ 14.0	On or after January 1, 2017
		10 C.F.R. Appendix M for off mode power consumption	Off mode power consumption ≤ 30 W	
3	Single package central air conditioners that are through-the-wall	CSA C656-05		

			Seasonal energy efficiency ratio ≥ 10.6	On or after February 3, 1995 and before January 23, 2010
4	Single package central air conditioners that are through-the-wall	CSA C656-05	Seasonal energy efficiency ratio ≥ 12.0	On or after January 23, 2010 and before January 1, 2017
5	Single package central air conditioners that are through-the-wall	CSA C656-05 for seasonal energy efficiency ratio	Seasonal energy efficiency ratio ≥ 12.0	On or after January 1, 2017
		10 C.F.R. Appendix M for off mode power consumption	Off mode power consumption ≤ 30 W	
6	Single package central air conditioners that are small-duct and high-velocity	CSA C656-05	Seasonal energy efficiency ratio ≥ 13.0	On or after February 3, 1995 and before January 1, 2017
7	Single package central air conditioners that are small-duct and high-velocity	CSA C656-14 for seasonal energy efficiency ratio	Seasonal energy efficiency ratio ≥ 12.0	On or after January 1, 2017
		10 C.F.R. Appendix M for off mode power consumption	Off mode power consumption ≤ 30 W	

18 Section 127 of the Regulations is replaced by the following:

Information

127 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected and provided to the Minister in respect of a single package central air conditioner described in column 1 and, if applicable, the information must be collected in accordance with the standard set out in column 2.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
1	Single package central air conditioners, other than those that are through-the-wall, manufactured on or after February 3, 1995 and before January 1, 2017	CSA C656-05	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); and **(c)** seasonal energy efficiency ratio.
2	Single package central air conditioners that are single-phase, other than those that are through-the-wall, manufactured on or after January 1, 2017	CSA C656-14 for information set out in paragraphs (a) to (c) 10 C.F.R. Appendix M for off mode power consumption	**(a)** product classification set out in column II of Table 1 to CSA C656-14; **(b)** cooling capacity, in kW (Btu/h); **(c)** seasonal energy efficiency ratio; **(d)** off mode power consumption; and **(e)** phase of electric current.

3	Single package central air conditioners that are three-phase, other than those that are through-the-wall, manufactured on or after January 1, 2017	CSA C656-14 for information set out in paragraphs (a) to (c)	**(a)** product classification set out in column II of Table 1 to CSA C656-14; **(b)** cooling capacity, in kW (Btu/h); **(c)** seasonal energy efficiency ratio; and **(d)** phase of electric current.
4	Single package central air conditioners that are through-the-wall, manufactured on or after February 3, 1995 and before January 1, 2017	CSA C656-05	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); and **(c)** seasonal energy efficiency ratio.
5	Single package central air conditioners that are single-phase and through-the-wall, manufactured on or after January 1, 2017	CSA C656-05 for information set out in paragraphs (a) to (c) 10 C.F.R. Appendix M for off mode power consumption	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); **(c)** seasonal energy efficiency ratio; **(d)** off mode power consumption; and **(e)** phase of electric current.
6	Single package central air conditioners that are three-phase and through-the-wall, manufactured on or after January 1, 2017	CSA C656-05 for information set out in paragraphs (a) to (c)	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); **(c)** seasonal energy efficiency ratio; and **(d)** phase of electric current.

19 Subsection 129(2) of the Regulations is replaced by the following:

Limit

(2) However, for the purposes of sections 4, 5 and 130, a single package vertical air conditioner is not considered to be an energy-using product unless it is manufactured on or after January 1, 2011 and has a cooling capacity of less than 70 kW (240,000 Btu/h).

20 Section 130 of the Regulations is replaced by the following:

Energy efficiency standards

130 (1) The energy efficiency standards set out in column 2 of the table to this section apply to single package vertical air conditioners described in column 1 that are manufactured during the periods set out in column 3.

Testing standard

(2) A single package vertical air conditioner complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by CSA C746-17 that are applicable to a *single package vertical air conditioner* as defined in section 128.

TABLE

Item	Column 1 Energy-using Product	Column 2 Energy Efficiency Standard	Column 3 Period of Manufacture
1	Single package vertical air conditioners that have a cooling capacity of < 19 kW (65,000 Btu/h)	Energy efficiency ratio ≥ 9.0	On or after January 1, 2011 and before September 23, 2019
2	Single package vertical air conditioners that have a cooling capacity of < 19 kW (65,000 Btu/h)	Energy efficiency ratio ≥ 11.0	On or after September 23, 2019
3	Single package vertical air conditioners that have a cooling capacity of ≥ 19 kW (65,000 Btu/h) and < 39.5 kW (135,000 Btu/h)	Energy efficiency ratio ≥ 8.9	On or after January 1, 2011 and before October 9, 2015
4	Single package vertical air conditioners that have a cooling capacity of ≥ 19 kW (65,000 Btu/h) and < 39.5 kW (135,000 Btu/h)	Energy efficiency ratio ≥ 10.0	On or after October 9, 2015
5	Single package vertical air conditioners that have a cooling capacity of ≥ 39.5 kW (135,000 Btu/h) and < 70 kW (240,000 Btu/h)	Energy efficiency ratio ≥ 8.6	On or after January 1, 2011 and before October 9, 2016
6	Single package vertical air conditioners that have a cooling capacity of ≥ 39.5 kW (135,000 Btu/h) and < 70 kW (240,000 Btu/h)	Energy efficiency ratio ≥ 10.0	On or after October 9, 2016

21 The portion of section 131 of the Regulations before paragraph (b) is replaced by the following:

Information

131 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with CSA C746-17 and provided to the Minister in respect of a single package vertical air conditioner:

(a) its classification as set out in column II of Table 1 to CSA C746-17;

22 Section 132 of the Regulations is replaced by the following:

Definitions

132 The following definitions apply in this Subdivision.

off mode power consumption means the power consumption when the unit is connected to mains power but is not providing cooling or heating. (*consommation d'énergie en mode arrêt*)

split-system central air conditioner means a single-phase or three-phase central air conditioner that is a split-system with a cooling capacity of less than 19 kW (65,000 Btu/h). (*climatiseur central bibloc*)

23 (1) Subsection 134(1) of the Regulations is replaced by the following:

Energy efficiency standards — single-phase

134 (1) The energy efficiency standards set out in column 3 of Table 1 to this section apply to single-phase split-system central air conditioners described in column 1 that are manufactured during the periods set out in column 4.

Energy efficiency standards — three-phase

(1.1) The energy efficiency standards set out in column 3 of Table 2 to this section apply to three-phase split-system central air conditioners described in column 1 that are manufactured during the periods set out in column 4.

(2) The heading of the table to section 134 is replaced by the following:

TABLE 2

(3) Section 134 is amended by adding the following before Table 2:

TABLE 1

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1	Split-system central air conditioners, other than those that are small-duct and high-velocity	CSA C656-05	Seasonal energy efficiency ratio ≥ 13.0	On or after February 3, 1995 and before January 1, 2017
2	Split-system central air conditioners, other than those that are small-duct and high-velocity	CSA C656-14 for seasonal energy efficiency ratio 10 C.F.R. Appendix M for off mode power consumption	Seasonal energy efficiency ratio ≥ 13.0 Off mode power consumption ≤ 30 W	On or after January 1, 2017
3	Split-system central air conditioners that are small-duct and high-velocity	CSA C656-05	Seasonal energy efficiency ratio ≥ 11.0	On or after February 3, 1995 and before January 1, 2017
4	Split-system central air conditioners that are small-duct and high-velocity	CSA C656-14 for seasonal energy efficiency ratio 10 C.F.R. Appendix M for off mode power consumption	Seasonal energy efficiency ratio ≥ 12.0 Off mode power consumption ≤ 30 W	On or after January 1, 2017

24 (1) The portion of section 135 of the Regulations before the table is replaced by the following:

Information

135 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected and provided to the Minister in respect of a split-system central air conditioner described in column 1 and, if applicable, the information must be collected in accordance with the standard set out in column 2.

(2) The portion of item 1 of the table to section 135 of the Regulations in column 3 is replaced by the following:

Item	Column 3 Information
1	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); and **(c)** seasonal energy efficiency ratio.

(3) Item 2 of the table to section 135 of the Regulations is replaced by the following:

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
2	Split-system central air conditioners that are single-phase and manufactured on or after January 1, 2017	CSA C656-14 for information set out in paragraphs (a) to (c) 10 C.F.R. Appendix M for off mode power consumption	**(a)** product classification set out in column II of Table 1 to CSA C656-14; **(b)** cooling capacity, in kW (Btu/h); **(c)** seasonal energy efficiency ratio; **(d)** off mode power consumption; and **(e)** phase of electric current.
3			**(a)** product classification set out in column II of

Split-system central air conditioners that are three-phase and manufactured on or after January 1, 2017	CSA C656-14 for information set out in paragraphs (a) to (c)	Table 1 to CSA C656-14; **(b)** cooling capacity, in kW (Btu/h); **(c)** seasonal energy efficiency ratio; and **(d)** phase of electric current.

25 Section 140 of the Regulations is amended by adding the following in alphabetical order:

ASHRAE 90.1-16 means ANSI/ASHRAE/IES Standard 90.1-2016, entitled *Energy Standard for Buildings Except Low-Rise Residential Buildings*. (*ASHRAE 90.1-16*)

26 (1) The portion of item 2 of the table to section 142 of the Regulations in column 3 is replaced by the following:

	Column 3
Item	**Period of Manufacture**
2	On or after January 1, 2017 and before December 31, 2019

(2) The table to section 142 of the Regulations is amended by adding the following after item 2:

	Column 1	Column 2	Column 3
Item	**Standard**	**Energy Efficiency Standard**	**Period of Manufacture**
3	ASHRAE 90.1-16, Table 6.8.1-3, column 6	Product's coefficient of performance and integrated part-load value must meet those applicable to the product in ASHRAE 90.1-16, Path A or Path B, Table 6.8.1-3	On or after December 31, 2019

27 The table to section 143 of the Regulations is replaced by the following:

TABLE

	Column 1	Column 2	Column 3
Item	Energy-using Product	Standard	Information
1	Chillers manufactured on or after October 28, 2004 and before January 1, 2017	CSA C743-02	**(a)** type; **(b)** net cooling/heating capacity, in kW (tons); **(c)** coefficient of performance; and **(d)** integrated part-load value or non-standard part-load value and a list of non-standard conditions.
2	Chillers manufactured on or after January 1, 2017 and before December 31, 2019	CSA C743-09	**(a)** type; **(b)** net cooling/heating capacity, in kW (tons); **(c)** coefficient of performance; **(d)** compliance Path for the energy-efficiency standard, namely, Path A or Path B of Table 10 to CSA C743-09; and **(e)** integrated part-load value or non-standard part-load value and a list of non-standard conditions.
3	Chillers manufactured on or after December 31, 2019	ASHRAE 90.1-16, Table 6.8.1-3, column 6	**(a)** type; **(b)** net cooling/heating capacity, in kW (tons); **(c)** full-load coefficient of performance; **(d)** compliance Path for the energy-efficiency standard, namely, Path A or Path B of Table 6.8.1-3 of ASHRAE 90.1-16; **(e)** part-load coefficient of performance; and

(f) list of non-standard conditions for centrifugal chillers designed for non-standard operation.

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28 The Regulations are amended by adding the following after section 143:

SUBDIVISION I

Portable Air Conditioners

Definitions

144 The following definitions apply in this Subdivision.

10 C.F.R. Appendix CC means Appendix CC to Subpart B, Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners*, as amended from time to time. (*appendice CC 10 C.F.R.*)

dual-duct portable air conditioner means a portable air conditioner that draws some or all of the condenser inlet air from outside the conditioned space through a duct attached to an adjustable window bracket and discharges the condenser outlet air outside the conditioned space by means of a separate duct attached to an adjustable window bracket. (*climatiseur portatif à deux conduits*)

portable air conditioner means a single package air conditioner, other than a packaged terminal air conditioner, room air conditioner or dehumidifier, with or without mounted wheels, that is portable and that

(a) is designed to deliver cooled and conditioned air to an enclosed space;
(b) is powered by single-phase electric current; and
(c) has a cooling capacity of less than 19 kW (65,000 Btu/h). (*climatiseur portatif*)

single-duct portable air conditioner means a portable air conditioner that draws all of the condenser inlet air from the conditioned space without the means of a duct and discharges the condenser outlet air outside the conditioned space through a single duct attached to an adjustable window bracket. (*climatiseur portatif à conduit unique*)

Energy-using product

145 (1) A portable air conditioner is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4 and 5, a portable air conditioner is not considered to be an energy-using product unless it is manufactured on or after October 1, 2017.

Information

146 (1) For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with 10 C.F.R. Appendix CC and provided to the Minister in respect of a portable air conditioner:

(a) its seasonally adjusted cooling capacity;
(b) its combined energy efficiency ratio; and
(c) information that indicates whether it is a single-duct portable air conditioner or a dual-duct portable air conditioner.

Additional information

(2) For a product with multiple duct configuration options, the information required by paragraphs 1(a) and (b) must be provided for both applicable duct configurations.

29 Section 186 of the Regulations is amended by adding the following in alphabetical order:

10 C.F.R. Appendix M means Appendix M to Subpart B, Part 430 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps*, as amended from time to time. (*appendice M 10 C.F.R.*)

30 The definition *CSA C744-14* in section 199 of the Regulations is replaced by the following:

CSA C744-17 means the joint CSA and AHRI standard ANSI/AHRI 310/380-2017/CSA-C744-17 entitled *Packaged terminal air conditioners and heat pumps*. (*CSA C744-17*)

31 The portion of item 2 of the table to section 201 of the Regulations in columns 1 and 2 is replaced by the following:

	Column 1	Column 2
Item	Standard	Energy Efficiency Standard
2	CSA C744-17	CSA C744-17, Table 2

32 Paragraph 202(2)(b) of the Regulations is replaced by the following:

(b) CSA C744-17, if the product is manufactured on or after September 30, 2012.

33 Section 203 of the Regulations is amended by adding the following in alphabetical order:

off mode power consumption means the power consumption when the unit is connected to mains power but is not providing cooling or heating. (*consommation d'énergie en mode arrêt*)

34 (1) Subsection 205(1) of the Regulations is replaced by the following:

Energy efficiency standards — single-phase

205 (1) The energy efficiency standards set out in column 3 of Table 1 to this section apply to single-phase package heat pumps described in column 1 that are manufactured during the periods set out in column 4.

Energy efficiency standards — three-phase

(1.1) The energy efficiency standards set out in column 3 of Table 2 to this section apply to three-phase single package heat pumps described in column 1 that are manufactured during the periods set out in column 4.

(2) The heading of the table to section 205 is replaced by the following:

TABLE 2

(3) Section 205 is amended by adding the following before Table 2:

TABLE 1

	Column 1	Column 2	Column 3	Column 4
Item	Energy-using Product	Standard	Energy Efficiency Standard	Period of Manufacture
1	Single package heat pumps, other than those that are through-the-wall or small-duct and high-velocity	CSA C656-05	Seasonal energy efficiency ratio ≥ 13.0 Heating seasonal performance factor (Region V) ≥ 6.7	On or after February 3, 1995 and before January 1, 2017
2	Single package heat pumps, other than those that are through-the-wall or small-duct and high-velocity	CSA C656-14 for seasonal energy efficiency ratio and heating seasonal performance factor 10 C.F.R. Appendix M for off mode power consumption	Seasonal energy efficiency ratio ≥ 14.0 Heating seasonal performance factor (Region V) ≥ 7.0 Off mode power consumption ≤ 33 W	On or after January 1, 2017
3	Single package heat pumps that are through-the-wall	CSA C656-05	Seasonal energy efficiency ratio ≥ 10.6	

			Heating seasonal performance factor (Region V) ≥ 6.1	On or after February 3, 1995 and before January 23, 2010
4	Single package heat pumps that are through-the-wall	CSA C656-05	Seasonal energy efficiency ratio ≥ 12.0 Heating seasonal performance factor (Region V) ≥ 6.4	On or after January 23, 2010 and before January 1, 2017
5	Single package heat pumps that are through-the-wall	CSA C656-05 for seasonal energy efficiency ratio and heating seasonal performance factor 10 C.F.R. Appendix M for off mode power consumption	Seasonal energy efficiency ratio ≥ 12.0 Heating seasonal performance factor (Region V) ≥ 6.4 Off mode power consumption ≤ 33 W	On or after January 1, 2017
6	Single package heat pumps that are small-duct and high-velocity	CSA C656-05	Seasonal energy efficiency ratio ≥ 13.0 Heating seasonal performance factor (Region V) ≥ 6.7	On or after February 3, 1995 and before January 1, 2017
7	Single package heat pumps that are small-duct and high-velocity	CSA C656-14 for seasonal energy efficiency ratio and heating seasonal performance factor 10 C.F.R. Appendix M for off mode power consumption	Seasonal energy efficiency ratio ≥ 12.0 Heating seasonal performance factor (Region V) ≥ 6.3 Off mode power consumption ≤ 30 W	On or after January 1, 2017

35 Section 206 of the Regulations is replaced by the following:

Information

206 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected and provided to the Minister in respect of a single package heat pump described in column 1 and, if applicable, the information must be collected in accordance with the standard set out in column 2.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
1	Single package heat pumps, other than those that are through-the-wall, manufactured on or after February 3, 1995 and before January 1, 2017	CSA C656-05	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; and

			(e) heating seasonal performance factor and the region for the factor.
2	Single package heat pumps that are single-phase, other than those that are through-the-wall, manufactured on or after January 1, 2017	CSA C656-14 for information set out in paragraphs (a) to (e) 10 C.F.R. Appendix M for off mode power consumption	**(a)** product classification set out in column II of Table 1 to CSA C656-14; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; **(e)** heating seasonal performance factor and the region for the factor; **(f)** off mode power consumption; and **(g)** phase of electric current.
3	Single package heat pumps that are three-phase, other than those that are through-the-wall, manufactured on or after January 1, 2017	CSA C656-14 for information set out in paragraphs (a) to (e)	**(a)** product classification set out in column II of Table 1 to CSA C656-14; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; **(e)** heating seasonal performance factor and the region for the factor; and **(f)** phase of electric current.
4	Single package heat pumps that are through-the-wall and manufactured on or after February 3, 1995 and before January 1, 2017	CSA C656-05	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; and **(e)** heating seasonal performance factor and the region for the factor.
5	Single package heat pumps that are single-phase, through-the-wall and manufactured on or after January 1, 2017	CSA C656-05 for information set out in paragraphs (a) to (e) 10 C.F.R. Appendix M for off mode power consumption	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; **(e)** heating seasonal performance factor and the region for the factor; **(f)** off mode power consumption; and **(g)** phase of electric current.

6	Single package heat pumps that are three-phase, through-the-wall and manufactured on or after January 1, 2017	CSA C656-05 for information set out in paragraphs (a) to (e)	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; **(e)** heating seasonal performance factor and the region for the factor; and **(f)** phase of electric current.

36 Subsection 208(2) of the Regulations is replaced by the following:

Limit

(2) However, for the purposes of sections 4, 5 and 209, a single package vertical heat pump is not considered to be an energy-using product unless it is manufactured on or after January 1, 2011 and has a cooling capacity of less than 70 kW (240,000 Btu/h).

37 Section 209 of the Regulations is replaced by the following:

Energy efficiency standards

209 (1) The energy efficiency standards set out in column 2 of the table to this section apply to single package vertical heat pumps described in column 1 that are manufactured during the periods set out in column 3.

Testing standard

(2) A single package vertical heat pump complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by CSA C746-17 that are applicable to a *single package vertical heat pump* as defined in section 207.

TABLE

Item	Column 1 Energy-using Product	Column 2 Energy Efficiency Standard	Column 3 Period of manufacture
1	Single package vertical heat pumps that have a cooling capacity of < 19 kW (65,000 Btu/h)	Energy efficiency ratio ≥ 9.0 Heating coefficient of performance ≥ 3.0	On or after January 1, 2011 and before September 23, 2019
2	Single package vertical heat pumps that have a cooling capacity of < 19 kW (65,000 Btu/h)	Energy efficiency ratio ≥ 11.0 Heating coefficient of performance ≥ 3.3	On or after September 23, 2019
3	Single package vertical heat pumps that have a cooling capacity of ≥ 19 kW (65,000 Btu/h) and < 39.5 kW (135,000 Btu/h)	Energy efficiency ratio ≥ 8.9 Heating coefficient of performance ≥ 3.0	On or after January 1, 2011 and before October 9, 2015
4			On or after October 9, 2015

	Single package vertical heat pumps that have a cooling capacity of ≥ 19 kW (65,000 Btu/h) and < 39.5 kW (135,000 Btu/h)	Energy efficiency ratio ≥ 10.0 Heating coefficient of performance ≥ 3.0	
5	Single package vertical heat pumps that have a cooling capacity of ≥ 39.5 kW (135,000 Btu/h) and < 70 kW (240,000 Btu/h)	Energy efficiency ratio ≥ 8.6 Heating coefficient of performance ≥ 2.9	On or after January 1, 2011 and before October 9, 2016
6	Single package vertical heat pumps that have a cooling capacity of ≥ 39.5 kW (135,000 Btu/h) and < 70 kW (240,000 Btu/h)	Energy efficiency ratio ≥ 10.0 Heating coefficient of performance ≥ 3.0	On or after October 9, 2016

38 The portion of section 210 of the Regulations before paragraph (b) is replaced by the following:

Information

210 For the purpose of subsection 5(1) of the Act, the following information must be collected in accordance with CSA C746-17 and provided to the Minister in respect of a single package vertical heat pump:

(a) its classification set out in columns II and III of Table 2 to CSA C746-17;

39 Section 211 of the Regulations is replaced by the following:

Definitions

211 The following definitions apply in this Subdivision.

off mode power consumption means the power consumption when the unit is connected to mains power but is not providing cooling or heating. (*consommation d'énergie en mode arrêt*)

split-system heat pump means a single-phase or three-phase air-to-air heat pump that is a centrally ducted split-system and that has a cooling or heating capacity of less than 19 kW (65,000 Btu/h). (*thermopompe bibloc*)

40 (1) Subsection 213(1) of the Regulations is replaced by the following:

Energy efficiency standards — single-phase

213 (1) The energy efficiency standards set out in column 3 of Table 1 to this section apply to single-phase split-system heat pumps described in column 1 that are manufactured during the periods set out in column 4.

Energy efficiency standards — three-phase

(1.1) The energy efficiency standards set out in column 3 of Table 2 to this section apply to three-phase split-system heat pumps described in column 1 that are manufactured during the periods set out in column 4.

(2) The heading of the table to section 213 is replaced by the following:

TABLE 2

(3) Section 213 is amended by adding the following before Table 2:

TABLE 1

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Energy Efficiency Standard	Column 4 Period of Manufacture
1		CSA C656-05		

	Split-system heat pumps, other than those that are small-duct and high-velocity		Seasonal energy efficiency ratio ≥ 13.0 Heating seasonal performance factor (Region V) ≥ 6.7	On or after December 31, 1998 and before January 1, 2017
2	Split-system heat pumps, other than those that are small-duct and high-velocity	CSA C656-14 for seasonal energy efficiency ratio and heating seasonal performance factor 10 C.F.R. Appendix M for off mode power consumption	Seasonal energy efficiency ratio ≥ 14.0 Heating seasonal performance factor (Region V) ≥ 7.1 Off mode power consumption ≤ 33 W	On or after January 1, 2017
3	Split-system heat pumps that are small-duct and high-velocity	CSA C656-05	Seasonal energy efficiency ratio ≥ 11.0 Heating seasonal performance factor (Region V) ≥ 5.9	On or after December 31, 1998 and before January 1, 2017
4	Split-system heat pumps that are small-duct and high-velocity	CSA C656-14 for seasonal energy efficiency ratio and Heating seasonal performance factor 10 C.F.R. Appendix M for off mode power consumption	Seasonal energy efficiency ratio ≥ 12.0 Heating seasonal performance factor (Region V) ≥ 6.3 Off mode power consumption ≤ 30 W	On or after January 1, 2017

41 Section 214 of the Regulations is replaced by the following:

Information

214 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected and provided to the Minister in respect of a split-system heat pump described in column 1 and, if applicable, the information must be collected in accordance with the standard set out in column 2.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
1	Split-system heat pumps manufactured on or after December 31, 1998 and before January 1, 2017	CSA C656-05	**(a)** product classification set out in column II of Table 1 to CSA C656-05; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; and **(e)** heating seasonal performance factor and the region for the factor.
2	Split-system heat pumps that are single-phase and manufactured on or after January 1, 2017	CSA C656-14 for information set out in paragraphs (a) to (e) 10 C.F.R. Appendix M for off mode power consumption	**(a)** product classification set out in column II of Table 1 to CSA C656-14; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; **(e)** heating seasonal performance

			factor and the region for the factor; **(f)** off mode power consumption; and **(g)** phase of electric current.
3	Split-system heat pumps that are three-phase and manufactured on or after January 1, 2017	CSA C656-14 for information set out in paragraphs (a) to (e)	**(a)** product classification set out in column II of Table 1 to CSA C656-14; **(b)** cooling capacity, in kW (Btu/h); **(c)** heating capacity, in kW (Btu/h); **(d)** seasonal energy efficiency ratio; **(e)** heating seasonal performance factor and the region for the factor; and **(f)** phase of electric current.

42 (1) The definition *refrigerated beverage vending machine* in section 646 of the Regulations is replaced by the following:

refrigerated beverage vending machine means a self-contained product that is designed to accept consumer payments and dispense bottled, canned or other sealed refrigerated beverages. (*distributeur automatique de boissons réfrigérées*)

(2) Section 646 of the Regulations is amended by adding the following in alphabetical order:

combination vending machine means a refrigerated beverage vending machine containing two or more compartments separated by a solid partition — whether or not they share a product delivery chute — in which at least one compartment is designed to be refrigerated and has temperature controls; and at least one compartment is not designed to be refrigerated and does not contain temperature controls. (*distributeur automatique combiné)*)

CSA C804 means the CSA standard CAN/CSA-C804-18 entitled *Energy performance of vending machines*. (*CSA C804*)

43 The Regulations are amended by adding the following before section 647:

646.1 For the purposes of these Regulations, the class of a refrigerated beverage vending machine is one of the following:

(a) Class A, if it is not a combination vending machine and 25% or more of the surface area on the front side of the refrigerated beverage vending machine is transparent;
(b) Class B, if it is not a combination vending machine and less than 25% of the surface area on the front side of the refrigerated beverage vending machine is transparent;
(c) Combination A, if it is a combination vending machine and 25% or more of the surface area on the front side of the combination vending machine is transparent; and
(d) Combination B, if it is a combination vending machine and less than 25% of the surface area on the front side of the combination vending machine is transparent.

44 (1) Subsection 648(2) of the Regulations is replaced by the following:

Testing standard

(2) The refrigerated beverage vending machine complies with the energy efficiency standard if it meets that standard in the following circumstances:

(a) subject to paragraph (b), it is manufactured before January 8, 2019 and tested in accordance with testing procedures established by sections 1 to 7.2 of ASHRAE 32.1 that are applicable to a *refrigerated beverage vending machine* as defined in section 646, except that the ambient temperature during the testing to determine E_{daily} must be 23.9°C ± 1°C;
(b) it is manufactured before August 31, 2012, is designed to display and dispense less than 20 discrete types of beverages, and is tested in accordance with testing procedures established by sections 1 to 7.2 of ASHRAE 32.1 that are applicable to a *refrigerated beverage vending machine* as defined in section 646, except that the ambient temperature during the testing to determine the E_{daily} must be 32.2°C ± 1°C; or
(c) it is manufactured on or after January 8, 2019 and tested in accordance with testing procedures established by CSA C804.

(2) Items 4 and 5 of the table to section 648 of the Regulations are replaced by the following:

Item	Column 1 Energy-using Product	Column 2 Energy Efficiency Standard	Column 3 Period of Manufacture
4	Class A refrigerated beverage vending machines	$E_{daily} \leq 0.00194 \times V + 2.56$ Must be capable of operating in standby mode	On or after August 31, 2012 and before January 8, 2019
5	Class B refrigerated beverage vending machines	$E_{daily} \leq 0.00258 \times V + 3.16$ Must be capable of operating in standby mode	On or after August 31, 2012 and before January 8, 2019
6	Class A refrigerated beverage vending machines	$E_{daily} \leq 0.00184 \times V + 2.43$	On or after January 8, 2019
7	Class B refrigerated beverage vending machines	$E_{daily} \leq 0.00184 \times V + 2.20$	On or after January 8, 2019
8	Combination A combination vending machines	$E_{daily} \leq 0.00304 \times V + 2.66$	On or after January 8, 2019
9	Combination B combination vending machines	$E_{daily} \leq 0.00392 \times V + 2.04$	On or after January 8, 2019

45 Section 649 of the Regulations is replaced by the following:

Information

649 For the purpose of subsection 5(1) of the Act, the information set out in column 3 of the table to this section must be collected in accordance with the standard set out in column 2, with the testing procedure adjusted in accordance with paragraphs 648(2)(a) and (b), and be provided to the Minister in respect of a refrigerated beverage vending machine described in column 1.

TABLE

Item	Column 1 Energy-using Product	Column 2 Standard	Column 3 Information
1	Refrigerated beverage vending machines manufactured on or after January 1, 2007 and before August 31, 2012	Sections 1 to 7.2 of ASHRAE 32.1	**(a)** E_{daily}; **(b)** vendible capacity; and **(c)** number of discrete types of beverages that it can display and dispense.
2	Refrigerated beverage vending machines manufactured on or after August 31, 2012 and before January 8, 2019	Sections 1 to 7.2 of ASHRAE 32.1	**(a)** E_{daily}; **(b)** if the product is Class A or Class B; and **(c)** V.
3	Refrigerated beverage vending machines manufactured on or after January 8, 2019	CSA C804	**(a)** E_{daily}; **(b)** if the product is Class A, Class B, Combination A, or Combination B; **(c)** if E_{daily} was calculated based on the presence of a refrigeration low power mode; **(d)** if applicable, the lowest application product temperature in degrees Celsius (°C); **(e)** V; and **(f)** the percentage of the surface area on the front side that is transparent.

46 Subsection 650(2) of the Regulations is replaced by the following:

(2) However, for the purposes of sections 4, 5 and 651, a snack and refrigerated beverage vending machine is not considered to be an energy-using product unless it is manufactured on or after January 1, 2007 and before January 8, 2019.

47 (1) The definitions *walk-in process cooling refrigeration system* and *walk-in refrigeration system* in section 657 of the Regulations are replaced by the following:

walk-in process cooling refrigeration system means a refrigeration system that

(a) is sold as a set with an insulated enclosure and, when assembled with the enclosure, has a cooling capacity of at least 1.035 kW/m3 (100 Btu/h/ft3) of enclosed internal volume;
(b) is a unit cooler — or a dedicated condensing unit exclusively sold as a set that has a dedicated condensing unit and a unit cooler — that has an evaporator coil with a means of forced air circulation and a height that is
(i) at least 1.37 metres (4.5 feet), as measured perpendicular to the tubes, and
(ii) at least one and a half times the width, as measured parallel to the tubes; or
(c) is sold as a set that has a dedicated condensing unit and an evaporator coil that does not have a means of forced air circulation. (*système de réfrigération de type chambre pour refroidissement industriel*)

walk-in refrigeration system means a refrigeration system that is installed, or that is designed to be installed, in a walk-in cooler or walk-in freezer for the purpose of cooling its refrigerated compartment and has a unit cooler or a dedicated condensing refrigeration system. It includes all controls and other components that are integral to its operation but does not include a walk-in process cooling refrigeration system. (*système de réfrigération de chambre froide*)

(2) Paragraphs (a) to (c) of the definition *dedicated condensing unit* in section 657 of the Regulations are replaced by the following:

(a) has one or more compressors, a condenser and one refrigeration circuit; and
(b) is designed to serve one refrigerated load. (*unité de condensation dédiée*)

(3) Section 657 of the Regulations is amended by adding the following in alphabetical order:

dedicated condensing refrigeration system means a dedicated condensing unit, a single-package dedicated system or a matched refrigeration system. (*système de réfrigération à condensation dédiée*)

matched refrigeration system means a refrigeration system including a dedicated condensing unit and one or more unit coolers with which it is sold. (*système de réfrigération apparié*)

unit cooler means an assembly, including means for forced air circulation and elements by which heat is transferred from air to refrigerant without any element external to the cooler imposing air resistance. (*refroidisseur d'air*)

48 Section 658 of the Regulations is renumbered as subsection 658(1) and is amended by adding the following:

Additional requirements

(2) Every walk-in cooler dedicated condensing refrigeration system that is manufactured on or after January 1, 2020 and every walk-in refrigeration system that is manufactured on or after July 10, 2020, must be labelled with a nameplate that is attached to the outside of the product in a location that is readily visible prior to assembly of the walk-in cooler or the walk-in freezer and that sets out the following information in English and French:

(a) the brand name or manufacturer of the product;
(b) a statement indicating whether the product is intended for use in a walk-in cooler, walk-in freezer or both;
(c) the model number;
(d) the product's date of manufacture, if it is not included in the model number; and
(e) a statement indicating that the product is for indoor use only, if applicable.

Idem

(3) For matched refrigeration systems, the statement referred to in paragraph (2)(e) must appear on the dedicated condensing unit.

49 Subsection 665(2) of the Regulations is replaced by the following:

(2) However, a walk-in refrigeration system is not considered to be an energy-using product for the purposes of sections 4, 5 and 666 unless

(a) it is a walk-in cooler dedicated condensing refrigeration system manufactured on or after January 1, 2020;
(b) it is a walk-in freezer dedicated condensing refrigeration system manufactured on or after July 10, 2020; or
(c) it is a walk-in cooler or walk-in freezer unit cooler manufactured on or after July 10, 2020.

50 (1) Subsection 666(1) of the Regulations is replaced by the following:

(1) The energy efficiency standards set out in column 2 of the table to this section apply to walk-in refrigeration systems described in column 1 that are manufactured during the periods set out in column 3.

(2) Section 666 of the Regulations is amended by adding the following after subsection (2):

TABLE

Item	Column 1 Energy-using Product	Column 2 Energy Efficiency Standard	Column 3 Period of Manufacture
1	Walk-in cooler dedicated condensing refrigeration systems for use indoors	Annual walk-in energy factor ≥ 1.644	On or after January 1, 2020
2	Walk-in cooler dedicated condensing refrigeration systems for use outdoors	Annual walk-in energy factor ≥ 2.227	On or after January 1, 2020
3	Walk-in freezer dedicated condensing refrigeration systems for use indoors with a net refrigeration capacity of <1900 W (6,500 Btu/h)	Annual walk-in energy factor ≥ $9.091 \times 10^{-5} \times q_{net} + 0.530$	On or after July 10, 2020
4	Walk-in freezer dedicated condensing refrigeration systems for use indoors with a net refrigeration capacity of ≥1900 W (6,500 Btu/h)	Annual walk-in energy factor ≥ 0.703	On or after July 10, 2020
5	Walk-in freezer dedicated condensing refrigeration system for use outdoors with a net refrigeration capacity of <1900 W (6,500 Btu/h)	Annual walk-in energy factor ≥ $6.522 \times 10^{-5} \times q_{net} + 0.800$	On or after July 10, 2020
6	Walk-in freezer dedicated condensing refrigeration systems for use outdoors with a net refrigeration capacity of ≥1900 kW (6,500 Btu/h)	Annual walk-in energy factor ≥ 0.923	On or after July 10, 2020
7	Walk-in cooler unit coolers	Annual walk-in energy factor ≥ 2.638	On or after July 10, 2020
8	Walk-in freezer unit coolers with a net refrigeration capacity of <4540 W (15,500 Btu/h)	Annual walk-in energy factor ≥ $1.575 \times 10^{-5} \times q_{net} + 1.146$	On or after July 10, 2020
9	Walk-in freezer unit coolers with a net refrigeration capacity of ≥4540 W (15,500 Btu/h)	Annual walk-in energy factor ≥ 1.216	On or after July 10, 2020

51 Section 667 of the Regulations is amended by striking out “and” at the end of paragraph (a) and by adding the following after paragraph (b):

(c) information that indicates if it is for use in a walk-in cooler or walk-in freezer;
(d) information that indicates if it has a unit cooler or a dedicated condensing refrigeration system; and

(e) if it is a walk-in freezer unit cooler or dedicated condensing refrigeration system, its net refrigeration capacity, expressed in watts.

52 The Regulations are amended by adding the following after section 803:

DIVISION 14

Pumps

SUBDIVISION A

Clean Water Pumps

Definitions

804 The following definitions apply in this subdivision.

10 C.F.R. Appendix A means Appendix A to Subpart Y, Part 431 of Title 10 to the United States *Code of Federal Regulations*, entitled *Uniform Test Method for the Measurement of Energy Consumption of Pumps*, as amended from time to time. (*appendice A 10 C.F.R.*)

10 C.F.R. §431.465(b)(4) means the table to paragraph 431.465(b)(4) of Subpart Y, Part 431 of Title 10 to the United States *Code of Federal Regulations*, as amended from time to time. (*10 C.F.R. §431.465(b)(4)*)

best efficiency point means the pump hydraulic power operating point that results in a maximum efficiency. (*point de rendement maximal*)

clean water means water with a maximum non-absorbent solid content of 0.25 kg/m^3 (0.016 lb/ft^3), a maximum dissolved solid content of 50 kg/m^3 (3.1 lb/ft^3), a total gas content of the water that does not exceed the saturation volume and may include additives necessary to prevent the water from freezing at a minimum of -10°C (14°F). (*eau propre*)

clean water pump means a pump, with or without mechanical equipment, driver and controls, that is designed for pumping clean water and that

(a) is one of the following types:
- **(i)** an end suction close-coupled pump with a specific speed not more than 5 000 RPM,
- **(ii)** an end suction frame mounted pump with its own bearings and with a specific speed not more than 5 000 RPM,
- **(iii)** an in-line pump,
- **(iv)** a radially split, multi-stage, vertical, in-line diffuser casing pump, or
- **(v)** a submersible turbine pump with a bowl diameter not greater than 152 mm (6 in);

(b) has a shaft input power not less than 0.75 kW (1 horsepower) and not greater than 150 kW (200 horsepower) at best efficiency point and full impeller diameter;
(c) has a flow rate of 5.68 m^3/h (25 US gallons/min) or greater at best efficiency point and full impeller diameter;
(d) has a maximum head of 139.9 m (459 ft) at best efficiency point, full impeller diameter;
(e) has a design temperature range that lies within -10 and 120°C (14 and 248°F); and
(f) is designed to operate with either a 2-pole or 4-pole induction motor or a non-induction motor with a nominal speed of rotation of either 1 800 RPM or 3 600 RPM, as determined in accordance with 10 C.F.R. Appendix A, and in which the driver and impeller rotate at the same speed.

It does not include any of the following:

(g) a fire pump;
(h) a self-priming pump;
(i) a prime-assist pump;
(j) a magnet-driven pump;
(k) a pump designed to be used in a nuclear facility;
(l) a pump designed to Canadian or United States military specifications; or
(m) a pump designed and marketed for use as a pool pump. (*pompe à eau propre*)

Energy-using product

805 (1) A clean water pump is prescribed as an energy-using product.

Limit

(2) However, for the purposes of sections 4, 5 and 806, a clean water pump is not considered to be an energy-using product unless it is manufactured on or after January 27, 2020.

Energy efficiency standard

806 (1) The energy efficiency standard that applies to a clean water pump is the maximum pump energy index set out for the applicable equipment class in 10 C.F.R. 431.465(b)(4).

Testing standard

(2) A clean water pump complies with the energy efficiency standard if it meets that standard when tested in accordance with testing procedures established by 10 C.F.R. Appendix A that apply to a *clean water pump* as defined in section 804.

Information

807 For the purpose of subsection 5(1) of the Act, the following information must be provided to the Minister in respect of a clean water pump:

(a) its nominal power, in kilowatts;
(b) the impeller diameter, in millimetres;
(c) its type, namely, end suction close-coupled pump, end suction frame mounted with own bearings pump, in-line pump; radially split multi-stage, vertical, in-line diffuser casing pump or submersible turbine pump;
(d) its nominal speed of rotation, collected in accordance with 10 C.F.R. Appendix A;
(e) its mode of operation, namely, constant load or variable load; and
(f) its pump energy index value, collected in accordance with 10 C.F.R. Appendix A.

Coming into Force

53 These Regulations come into force on the day that, in the sixth month after the month in which they are published in the *Canada Gazette*, Part II, has the same calendar number as the day on which they are published or, if that sixth month has no day with that number, the last day of that sixth month.

Footnotes

1 The use of the term “minimum energy performance standard” or “MEPS” throughout this document is in reference to the “energy efficiency standard” as defined in the *Energy Efficiency Act*.

2 https://webstore.iea.org/achievements-of-appliance-energy-efficiency-standards-and-labelling-programs (https://webstore.iea.org/achievements-of-appliance-energy-efficiency-standards-and-labelling-programs)

3 https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-forward-plan-august-2014.html (https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-forward-plan-august-2014.html)

4 Homes, commercial and institutional buildings.

5 https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/CoucilReport_june27_English_Web.pdf (https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/CoucilReport_june27_English_Web.pdf)

6 https://www.efficiencycanada.org/wp-content/uploads/2018/04/Economic-Impact-of-Pan-Canadian-Framework-Energy-Effciency.pdf (https://www.efficiencycanada.org/wp-content/uploads/2018/04/Economic-Impact-of-Pan-Canadian-Framework-Energy-Effciency.pdf)

7 Canada's 7th National Communication and 3rd Biennial Report (http://unfccc.int/files/national_reports/national_communications_and_biennial_reports/application/pdf/4623051_canada-br3-nc7-1-5108_eccc_can7thncomm3rdbi-report_en_04_web.pdf)to the United Nations Framework Convention on Climate Change, p. 145.

8 https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-action-plan.html (https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-action-plan.html)

9 http://www.gazette.gc.ca/rp-pr/p1/2018/2018-10-20/html/reg3-eng.html (http://www.gazette.gc.ca/rp-pr/p1/2018/2018-10-20/html/reg3-eng.html)

10 International Energy Agency, 2015. *Achievements of appliance energy efficiency standards and labelling programs: A GLOBAL ASSESSMENT*, p. 3.

11 Ibid., p. 1.

12 Ibid., p. 3.

13 Calculated as the value of avoided damages from GHG emission reductions.

14 Cost captured by Treasury Board of Canada Secretariat's administrative burden calculator.

15 *Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* (SOR/2014-207) and other regulations made under the *Canadian Environmental Protection Act, 1999*.

16 Environment and Climate Change Canada, 2016. *Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates*.

17 U.S. Government, U.S. Interagency Working Group on the Social Cost of Carbon (IWGSCC), 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866.

18 Vary by manufacturer and are based on a number of elements, such as the number of programs the manufacturer engages in with the certification body, e.g. safety certification, energy efficiency verification, as well as the number of products and models they have.

19 Marginal fuels represent the last power plant that is needed to meet the electricity demand at a given time. The costs and emissions from that power plant are used to calculate the reduced emissions owing to the Regulations.

20 Consistent with the discount rate used by the Pan-Canadian Framework on Clean Growth and Climate Change and in accordance with Treasury Board Secretariat recommendations for environmental and health regulations.

21 Available upon request from Environment and Climate Change Canada.

22 IEA, 2015. Achievements of appliance energy efficiency standards and labelling programs: A GLOBAL ASSESSMENT, p. 6.

23 Cosmos Energy Consulting Inc., 2018. Experience Curves of Residential Gas-fired Furnaces in Canada.

24 Costs for technology and installation.

25 Benefits from energy savings and GHG emission reductions.

26 The administrative burden reported in Table 3 was estimated applying a 3% discount rate, from 2019 to 2030, to determine the value in 2018 dollars. This method was used to be consistent with the calculation of other costs and benefits presented in this table. Administrative burden estimates produced for the “One-for-One” Rule, discussed later in this RIAS, were calculated using the Treasury Board of Canada Secretariat’s Regulatory Cost Calculator. This tool used a 7% discount rate, over 10 years (2019–2028), to determine the value in 2012 dollars, resulting in an estimated annualized increase in total administrative burden to all businesses subject to the Amendment of approximately $55,508.

27 http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845 (http://www.nrcan.gc.ca/energy/regulations-codes-standards/6845)

28 Stakeholders that were informed include all organizations and individuals with an interest in the proposed Amendment. Groups that provided input include, but are not limited to, manufacturers, industry associations, provincial governments, energy utilities, contractors, and builders.

29 This absence of an existing third-party verification service is not unusual when initially proposing to regulate new product categories.

30 ANSI/ASHRAE/IES Standard 90.1-2016 — Energy Standard for Buildings Except Low-Rise Residential Buildings.

31 ANSI/AHRI Standard 551/591-2011 (SI) — Performance Rating Of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle.

32 https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation- council/joint-forward-plan-august-2014.html (https://www.canada.ca/en/treasury-board-secretariat/corporate/transparency/acts-regulations/canada-us-regulatory-cooperation-council/joint-forward-plan-august-2014.html)

33 IEA/OECD, 2011. *Summing up the Parts — Combining Policy Instruments for Least-Cost Climate Mitigation Strategies*, p. 8.

34 GHG emissions are quantified by applying the appropriate emission factors to the changes in energy, by fuel. Consumer savings are quantified by applying the appropriate energy prices to the changes in energy, by fuel.

35 SOR/2016-311

a S.C. 2009, c. 8, s. 5

b S.C. 1992, c. 36

Government of Canada activities and initiatives

#YourBudget2018 – Advancement



(https://www.budget.gc.ca/2018/docs/themes/advancement-advancement-en.html?utm_source=CanCa&utm_medium=Activities_e&utm_content=Advancement&utm_campaign=CAbdgt18)
Advancing our shared values

#YourBudget2018 – Reconciliation



(https://www.budget.gc.ca/2018/docs/themes/reconciliation-reconciliation-en.html?utm_source=CanCa&utm_medium=%20Activities_e&utm_content=Reconciliation&utm_campaign=CAbdgt18)
Advancing reconciliation with Indigenous Peoples

#YourBudget2018 – Progress



(https://www.budget.gc.ca/2018/docs/themes/progress-progres-en.html?utm_source=CanCa&utm_medium=Activities_e&utm_content=Progress&utm_campaign=CAbdgt18)
Supporting Canada's researchers to build a more innovative economy

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Request IR-29:

Reference: Appendix A, 2020-2022 DSM Plan, pages 86-87.

(a) Please describe any proposed changes made to EfficiencyOne's evaluation methodology/activities compared to 2016-2018.

(b) Please provide copies of any internal reviews, studies, assessments, report or audits or other analyses with respect to EfficiencyOne's existing evaluation methodology/activities.

Response IR-29:

a) Proposed changes made to EfficiencyOne's 2020-2022 evaluation methodology/activities compared to the 2016-2018 evaluation methodology/activities include the following:

- The 2020, 2021 and 2022 evaluation scopes for impact evaluations will be determined in collaboration with the evaluator after the completion of EfficiencyOne's previous years' evaluation activities. In the 2016-2018 evaluation scope, 2016 included full impact evaluations for all program components. In 2020-2022, EfficiencyOne will collaborate with the evaluator to determine which programs require a full or condensed impact evaluation based on the following criteria: new program components; program components with recent changes; and program components with variable savings parameters. The Evaluator will design and conduct a full scope of evaluation activities for program components that require a full impact evaluation.
- The 2020, 2021 and 2022 evaluation scopes for process evaluations will remain similar to the 2016, 2017 and 2018 evaluation scopes with the exception of adding the following criteria to be used to determine when a process evaluation should occur:

- program components should have a process evaluation performed at least every three years (no more than two years between process evaluations).

- The 2020, 2021 and 2022 evaluation scopes for organizational process evaluations have not yet been determined by EfficiencyOne. EfficiencyOne will consider conducting organizational process evaluations if recommended by the Nova Scotia Utility and Review Board (NSUARB) verification consultant in the annual Savings Verification Reports filed with the NSUARB.

b) EfficiencyOne does not conduct internal reviews, studies, assessments, reports, audits or other analyses with respect to existing evaluation methodology/activities. EfficiencyOne relies on the NSUARB appointed verification consultant to provide annual reviews of evaluation activities.

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Request IR-30:

Appendix A, Attachment 1 provides measure-by-measure details of cost and savings for the Preferred Plan.

(a) Provide Attachment 1 to Appendix A as an Excel file with all formulas and links intact.

(b) Please provide a version of Attachment 1 in Excel with formulas and links intact showing the dollar value translated to a percentage.

(c) Please provide a version of Attachment 1 in Excel for the Alternate scenario and include formulas showing the dollar value translated to a percentage.

Response IR-30:

a) The measure level technical tables are an output of the ProCESS model. Most calculations are performed in the ProCESS model with the results being exported to Excel, as opposed to being calculated in Excel with formulas. Please refer to Attachment 1 of this IR response (filed electronically) for an update to the technical tables which includes formulas in the header to describe each calculation. For more complex calculations, annotations are provided to describe the methodology.

b) Columns AN, BA, and BN provide the costs expressed as a percentage of total annual investment. Please refer to Attachment 1of this IR response, filed electronically.

c) Columns AN, BA, and BN provide the costs expressed as a percentage of total annual investment. Please refer to Attachment 2 of this IR response, filed electronically.

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Request IR-31:

Please provide:

(a) The initial optimized Preferred Plan model output, prior to the application of constraints from EfficiencyOne's review/iteration;

(b) Itemized list of constraints applied in the final Preferred Plan model, including:

(i) name of constraint;
(ii) value of constraint;
(iii) tolerance applied to constraint; and
(iv) justification/explanation of reason for applying the constraint

(c) Explanation of the model's objective function factors and their priority/weighting for derivation of solution (e.g. total program spend, benefit distribution among rate classes, etc.), outside of specified/altered constraints)

(d) Model Input, including all model input variables (e.g. the excel input template).

(e) Provide an itemized narrative of all the model modifications (to equations and/or parameter values) that resulted from the model output vetting process (Appendix A, 2020-2022 DSM Plan, section 2.5).

Response IR-31:

a) Please refer to Attachment 1 of this IR response, filed electronically.

b) Please refer to EfficiencyOne's response to NS Power IR-52, Attachment 1 for the nominal constraint parameters used in early development of the Preferred Plan. There were no further optimizer constraints applied since the optimizer tool was only used initially to create a model structure (seeking to maximize utility and ratepayer benefits) upon which EfficiencyOne applied its expertise and program delivery experience to develop the final DSM Pan.

c) Please refer to EfficiencyOne's response to NS Power IR-52, Attachment 1 for a description of the optimizer tool's objective function in mathematical notation. The objective function seeks to maximize utility and ratepayer benefits and does not apply priority or weighting to factors such as total program expenditure, benefit distribution among rate classes, etc.

d) Please refer to Attachment 2 of this IR response, filed electronically.

e) There were no modifications made to equations in the ProCESS model. Below is a narrative of the 2020-2022 DSM Plan development process, including the steps, considerations, and examples of decisions involved in the vetting process.

Measure characterization and model configuration

The 2020-2022 DSM Plan uses a bottom-up model, aggregating measures up to higher-levels like end-uses, programs, program components, and sectors. As such, before modelling can begin, EfficiencyOne built comprehensive measure profiles containing information such as first year energy savings, coincident peak demand savings, measure life, multiple baseline considerations (if applicable), incremental costs, rebate costs, direct install cost, administrative costs, etc. This information is contained in the model input file (Attachment 1 of this IR response, filed electronically). Measure characterization was largely informed by program evaluation results and historical cost data.

Global variables (e.g., line losses, avoided costs, and discount rate) were compiled by EfficiencyOne using the most up-to-date data available. Indices that form the reporting schema (e.g., definitions of program and program components) were also created in order to give structure to the measure aggregation procedures explained above. Once inputs were defined, the model was tested to ensure proper functioning. Please refer to EfficiencyOne's response to NS Power IR-51 for more details on this process.

Produce machine-generated model outputs

Once the model was configured, the optimizer tool was used to select initial measure quantities. An entirely unconstrained model will choose a single measure for the entire portfolio, according to the measure's attributes and the selected objective function. This is not a desirable or meaningful result, so EfficiencyOne applied constraints to ensure results are more realistic and achievable. This process was iterative, with constraints being added as needed. For example, the output generated in Attachment 1 of this IR response produced a solution with high first-year energy savings for the Residential Efficient Products Installation program, which EfficiencyOne knows is a program that is declining due to market saturation. EfficiencyOne responded by introducing a program-component level constraint which would produce results more in line with what can be expected from existing programs given historical and forward-looking trends.

As more constraints are added, finding a solution with the optimizer tool becomes increasingly difficult (i.e., the model becomes over-constrained). As more constraints are added, tolerances must be loosened to achieve a solution. This diminishes individual constraints' influence on results and becomes an inefficient, time-consuming process as more constraints are added. Further, there is the danger of introducing false-precision due to data limitations populating constraints. Instead of requiring that every design decision be introduced as a new constraint, once EfficiencyOne found a solution with the optimizer tool that broadly aligns with EfficiencyOne's objectives, a detailed review was conducted to assess:

1. Whether the machine-generated portfolio is deliverable, and if not, what changes must be made; and
2. If other intelligence, not captured within the model, can be incorporated into the Plan.

It's important to note that at the conclusion of this stage, the optimizer tool was no longer used in development of the 2020-2022 DSM Plan.

EfficiencyOne's vetting

EfficiencyOne's vetting of the model results aimed to, but was not limited to, answering the following questions:

- Do the machine-generated model results align with historical and forward-looking trends? (e.g., is a program or measure growing or being phased out?)
- Are the measure characterizations appropriate and accurate?
- Are individual measure quantities realistic and achievable?
- Are there new measures planned for deployment in the future that are not in the model?
- Are there plans to retire existing measures?
- Are there plans to modify incentive levels?

EfficiencyOne did not maintain a comprehensive list of all design decisions made during the plan design and vetting process. However, below is a list of examples:

<u>Revise measure mixes to reflect anticipated uptake:</u>

- Machine-generated solutions produced a measure mix in the Appliance Retirement program component with high measure quantities for air conditioner retirement and no freezer retirements. Nova Scotia is a predominantly heating climate and there are limited numbers of room air conditioners to retire; this is supported by historical uptake of this measure. Conversely, there are relatively high number of opportunities for freezer retirements. EfficiencyOne updated the measure mix to reflect this insight, informed by historical trends in the Appliance Retirement program component.

- Some lighting measures in the Instant Savings program component (e.g., R, BR and Decorative LEDs) are anticipated to be phased out over time. Machine-generated solutions maintained relatively constant uptake of these measures over the 2020-2022 period. EfficiencyOne adjusted measure quantities to reflect a gradual phase out.
- Large Air-Source Heat Pumps incentives and uptake were reviewed by Business Energy Rebates program staff. Staff commented that operational plans were underway to shift support for this measure to the Custom program component. Expected participation for this measure was modified from 20 units per year, down to zero within Business Energy Rebates.
- Luminaire Level Lighting Control (LLLC) measures, which are new to the Business Energy Rebates portfolio, were adjusted to reflect a lower level of anticipated participation which increases over the three-year plan period. These adjustments reflect the delayed nature of market response to new incentives and measures being introduced.
- The expected level of uptake for small (24-48 kBTU/hr) heat pumps within Small Business Energy Solutions was adjusted upward to reflect continued strong market demand anticipated by program staff. The machine-generated version of the model had not anticipated any uptake for these measures within Small Business Energy Solutions.

<u>Corrections or improvements to measure characterization assumptions:</u>

- Because the First Nations Home Energy Efficiency program component is new and no projects have been completed to date in the pilot, there are no historical program costs that can help form assumptions for this program's costs. Instead, program costs were based on historical upgrade costs for the HomeWarming program. The program manager flagged during their review that these costs were too low since the First Nations Pilot as it is currently designed offers more upgrades than the HomeWarming program (i.e., space heating systems, water heating systems, and appliances). The measure characterization was revised to a more accurate cost estimate.

- In the New Residential program, the program manager identified two updates. First, in their next service delivery contract, delivery agent costs will increase for the high-performance home measures (shown as measures *Whole Home – Tier 2* and *Whole Home – Tier 3* in the submitted technical tables) so that delivery agents may provide the additional support needed to enable builders to reach these tiers. As a result, the measure mix was also modified to reflect growth in participation in these tiers over the 2020-2022 period.
- In the Green Heat Program component, the program manager provided updated unitary savings estimates based on year-to-date tracked results for measures in this program. Because the measures in the Green Heat program are quasi-prescriptive (i.e., they are not deemed savings, but dependent project-specific variables), this update reflects the most current program performance.
- The expected incentive unit cost within Energy Management Information Systems (EMIS) was updated based on an analysis of existing participant performance conducted by EMIS program staff, which led to more accurate future forecast for these costs.

<u>Develop new initiatives:</u>

- EfficiencyOne identified gaps and opportunities in its program offerings and developed enhancements to the portfolio that addressed those items. These enhancements are discussed in detail in sections 4.1.2, 4.2.2, and 5.2.2 of Appendix A. Please note, this process excludes development of demand reduction initiatives, the Affordable Multifamily Housing program component, and the First Nations program component, which were already accounted for at this stage.

Integrating review feedback and new initiatives

Much of the feedback received through the review process required measure-level changes (e.g., a reviewer identifies that measure uptake is declining and the measure quantity should be reduced over time). Since at this stage, the optimizer tool is already over-constrained,

transforming review feedback into new, measure-level constraints to find a solution with the optimizer tool is not practical. For this reason, the revised measure quantities developed during the organization review were input directly into the model as opposed to being determined by the optimizer tool.

New initiatives were integrated into the model input file either in the form of new measures or modifications to existing measures.

Quality Assurance

Finally, model inputs were reviewed before finalizing the Preferred Plan. This process served to verify measure-level assumptions were free of methodological or typographical/data entry errors.

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Request IR-32:

For Appendix A, please provide full year hourly load shapes (8760) for all measures listed and indicate how both the kWh and kW savings (column AC and AD) amounts are calculated including a fully functional spreadsheet.

Response IR-32:

EfficiencyOne did not use the full year hourly (8760) load shapes in the savings calculations. The savings associated with each measure were calculated using the per-unit savings for energy and coincident demand from the 2017 program evaluation. Calculations for first-year savings (column AC and AD in Appendix A – 2020-2022 DSM Resource Plan, Attachment 1: Measure Level Technical Tables) are performed in the ProCESS Model, not Excel. These have been replicated in Excel (please refer to Attachment 1 of this IR response, which has been filed electronically), which includes participation values for the 2020-2022 Preferred DSM Plan for demonstration purposes.

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Request IR-33:

For each measure listed in Appendix A please indicate the level of free ridership expected, all documentation and information supporting such expectation, and how the free ridership is taken into account in the estimated costs.

Response IR-33:

Free ridership by measure is not separately broken out in the ProCESS model. Appendix A – 2020-2022 DSM Resource Plan, Attachment 1 – Measure Level Technical Tables, Column T contains measure-level net-to-gross ratios (NTG). NTG ratios reflect free-ridership and spillover effects and are based on the most recent (2017) evaluated and verified program results. Supporting documentation on free-ridership and spillover levels and their associated methodologies are contained in the annual Evaluation Reports, in each program's impact evaluation section.[1]

Free-ridership does not affect program costs; however, its impact is factored into all net savings, and resulting first-year energy savings unit-cost calculations ($/kWh). For example, the three-year average unit-cost of $0.31/kWh reflects net savings at the generator, i.e. after adjustments for NTG (free-ridership and spillover) and line losses are applied.

[1] M08604, EfficiencyOne – 2019 Demand Side Management (DSM) Plan Application, 2017 Annual Progress report and 2017 Evaluation Reports

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Request IR-34:

Please provide in electronic format the following data from your DSM Data Tracking System for those customers that participated in DSM Programs in 2016 to 2018, inclusive:

(a) Customer Name or Customer Identifier (Name, EfficiencyOne identification code for individual customer, or other like identification)

(b) Rate Class (and any other identifiers available to distinguish customers in a rate class)

(c) Customer Location including postal code

(d) Annual energy and demand consumption (to the extent available)

(e) Business type (if applicable)

(f) Measure(s) installed

(g) kWh savings tracked

(h) kWh evaluated, if available

(i) $ amounts of incentive provided (or financing, if applicable)

(j) $ amounts of total project costs (Program administrator and customer costs separately)

Response IR-34:

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EfficiencyOne asserts this IR, which is requesting individual, customer-specific information, engages issues of relevance and confidentiality.

The individualized information sought by NS Power in this IR is not relevant to determination of the matter before the Nova Scotia Utility and Review Board (NSURB), which, has as its primary purpose, the conclusion and approval of a DSM supply agreement between EfficiencyOne and NS Power, involving the establishment of a DSM Resource Plan for the 2020-2022 period.

All information sought pursuant to parts b), f), g), h) and i) of this IR has been provided in aggregate through EfficiencyOne's Rate and Bill Impact Analysis Model, EfficiencyOne's evaluation reports to be filed with the Board, and EfficiencyOne's annual financial statements.

EfficiencyOne is under an ongoing legal requirement to ensure protection of customers' personal information. While NS Power's request allows for use of an identifying number, the combination of remaining requests would allow for the identification of individual customers which may, in certain circumstances, violate EfficiencyOne's privacy policy.

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Request IR-35:

Reference: Evidence, page 42, lines 2-3. 6

EfficiencyOne states: "DSM investment must be increased as a result of the evolution and maturity of energy efficiency in Nova Scotia over the last number of years."

Please explain how the Preferred Plan is designed to be responsive to:

(a) changes in Nova Scotia's wholesale and retail markets;

(b) ongoing research in Nova Scotia and the Maritime provinces regarding DSM program efficacy, technology, and performance; and,

(c) ongoing access to DSM programs for the residential and BNI customer classes.

Response IR-35:

a) EfficiencyOne will continue to support distributor and retail partners, who play an essential role in helping Nova Scotians purchase the more energy efficient product. EfficiencyOne intends on monitoring the prices of energy efficient products at both distributor and retail locations to respond to changing prices in an effort to increase participation in programs or reduce the spending levels where appropriate.

Furthermore, EfficiencyOne will continue to consider new energy efficient products to add to its portfolio. These may be identified by potential customers, jurisdictional scans, general research, distributors / retailers, or from other avenues.

b) The Preferred Plan continues to rely on an evidence-based approach to monitor and respond to program efficacy and performance, and changes in technology. Sections 5.1 and 5.2 in the Evidence Section describes how the Preferred Plan has responded to ongoing research into these trends. Enabling Strategies includes research and outreach to monitor customer sentiment and behaviours with respect to conservation and efficiency, and to understand specific market segments of similar characteristics. Such research, combined with analytics to identify relevant patterns in customer electricity usage and other data, informs decisions around program design and delivery, and how best to engage specific customer segments. Technology trends, including assessment of appropriate program measures, will be based on a combination of 3rd party evaluation and expertise, market research, and jurisdictional scans. As in the past, EfficiencyOne will use pilots to test the efficacy of proposed changes to program design and delivery prior to launching at a larger scale.

c) The Preferred Plan has a balanced portfolio focus, which helps ensure broad customer access. In addition to the well-established broad portfolio of programs the 2020-2022 DSM Plan expands access for Nova Scotians in affordable rental housing and for First Nations communities and also provides new demand-reduction incentives for Residential as well as BNI sectors.

Helping Nova Scotians overcome barriers to becoming more energy-efficient is a key role of EfficiencyOne. Examples of barriers and mitigation strategies for Residential and BNI customers can be found in Table 6 and Table 7, in the Evidence section of the 2020-2022 DSM Plan.

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Request IR-36:

Reference: Appendix A, 2020-2022 DSM Plan, page 1, lines 16-17.

EfficiencyOne states: "In the Preferred Plan, EfficiencyOne is proposing an investment of $129.1 million…"

(a) How did EfficiencyOne account for the uncertainties underlying the potential benefits of the Preferred Plan? Please explain the extent to which EfficiencyOne varied the lifetime benefits, first-year energy savings, lifetime energy savings, weighted average measure life and peak demand savings in supporting the Preferred Plan performance metrics.

(b) If your answer to (a) above for each of the columns in Table 1, page 6, is that uncertainties were not accounted for, please explain why uncertainties were not explicitly incorporated in the Preferred Plan.

(c) Had EfficiencyOne tested the impact of uncertainty on the potential benefits of the Preferred Plan, would the recommended investment be significantly reduced? If no, why not?

Response IR-36:

a) EfficiencyOne did not perform sensitivity analyses with respect to benefits or savings. This is consistent with the approach taken in the DSM Resource Plan modelling since 2008. EfficiencyOne has confirmed that application of such sensitivity analysis as suggested in this IR is not an industry standard practice performed for short-term DSM planning.

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b) Sensitivity analyses with respect to DSM are conducted within Integrated Resource Plans. EfficiencyOne has consistently been achieving its Nova Scotia Utility and Review Board (NSUARB)-Approved cost-effective energy and demand savings Performance Targets, within approved budgets, undergoing in-depth annual Impact and Process Evaluations, Savings Verification Reports, and Annual Financial Audits. The DSM Resource Plan modelling and planning processes rely upon learnings from these past evaluations along with the best available information from which to produce forward-looking estimates of expected plan performance.

c) No. The Preferred DSM Resource Plan is based upon expert modelling and planning and is informed by over a decade of experience in achieving proven results and benefits for Nova Scotians. Over its 8 full years (2011-2018) of developing and administering DSM Programs, Efficiency Nova Scotia has achieved independently-verified annual energy savings of 1,171.9 GWh against its NSUARB-Approved Target of 1,082.8 GWh (or 108.2%).

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Request IR-37:

Reference: Appendix A, 2020-2022 DSM Plan, page 5 of 95, lines18-19.

In EfficiencyOne's decision to use the 2014 IRP Mid-level DSM Case energy savings targets to prepare the Preferred Plan, how were the following factors addressed?

(a) Saturation due to accelerated adoption of measures whose cost-effectiveness is in the grey zone;

(b) The natural occurrence of DSM penetration without additional investment;

(c) Other non-EfficiencyOne sponsored forms of DSM penetration and load reduction (distributed energy generation).

Response IR-37:

EfficiencyOne did not use the 2014 Integrated Resource Plan (IRP) Mid-level DSM Case energy savings targets for its 2020-2022 Preferred DSM Plan. The 2020-2022 Preferred DSM Plan proposes to move directionally toward, rather than continuing to move away from, the achievement of annual energy savings in NS Power's Preferred Resource Plan of its 2014 IRP.

a) EfficiencyOne's 2020-2022 Preferred DSM Plan was developed to only include cost-effective DSM programming. It addresses the accelerated adoption of measures (lighting measures in particular) by diversifying its portfolio away from lighting savings. This strategy is consistent with industry trends and is discussed in section 4.3 of Evidence and in David Hill's Direct Testimony in Appendix D of the Application.

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b) EfficiencyOne's 2020-2022 Preferred DSM Plan was developed to only include achievable energy savings that are directly attributable to its actions as the energy efficiency utility administering DSM in Nova Scotia. To the extent of free-ridership determined by the independent Evaluator and verified by the Savings Verification Consultant, these energy savings are not included in the achievement of EfficiencyOne's Performance Targets. Although savings from Codes and Standards are estimated by the Evaluator, they also are not included in the achievement of EfficiencyOne's Performance Targets. EfficiencyOne has not addressed other non-EfficiencyOne forms of load reduction (distributed energy generation) or conversely, load increases (electrification).

c) Please refer to part b).

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Request IR-38:

Reference: Evidence, page 13, lines 7-10.

EfficiencyOne states: "Nova Scotia has been falling behind and is left to "catch up" in order to realize the significant benefits associated with [the] optimal level of energy savings through DSM identified by the IRP." In regard to the 181 GWh/year in energy savings for each year from now until 2040 for customers to fully achieve the Mid-Level DSM benefits, did EfficiencyOne compute the additional cost associated with the higher energy savings associated with the 'catch up' scenario referenced above? If yes, what are the annual changes in cost borne by customers?

Response IR-38:

In preparation of its 2020-2022 Preferred DSM Plan, EfficiencyOne did not model the cost associated with the Mid-Level DSM scenario, nor the 181 GWh/year scenario to catch up to acquire all Mid-Level DSM savings by 2040.

NS Power's analysis within the 2014 IRP, however, which considered the annual costs and energy savings of various levels of DSM investment, revealed that the Mid-Level DSM scenario produced the lowest long-term revenue requirements, thereby lowering costs borne by customers.

EfficiencyOne recognizes that the further we move away from Mid-Level DSM savings targets, the more likely concerns over short-term step increases in cost to catch up will prevent Nova Scotians from having a reasonable opportunity to realize the long-term benefits afforded by the Mid-Level DSM scenario.

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Request IR-39:

Reference: Evidence, page 31, lines 22-27.

EfficiencyOne states: "The Preferred Plan recognizes the long-term benefits that demand reduction will provide to ratepayers. To be clear, there are no direct energy savings associated with demand reduction, and an increased investment in demand reduction results in a higher first-year energy savings unit cost of the Preferred Plan. However, this investment avoids mid and long-term capacity issues, mitigating long-term rate impacts, which is a real benefit to ratepayers."

(a) Did EfficiencyOne calculate capacity savings for 2020, 2021, and 2022? If yes, please specify the capacity savings, in MW/year, attributed to the demand reduction DSM.

(b) What capacity price, in $/MW-year, was used to calculate the avoided capacity cost?

(c) What are the generation, transmission, and distribution capacity costs avoided through demand reduction DSM?

(d) If the investment in demand reduction "avoids mid and long-term capacity issues, mitigating long-term rate impacts" how did EfficiencyOne convert those long-term effects into the short-term demand savings?

Response IR-39:

a) Incremental demand reductions attributable to demand reduction activities in each of the plan years are shown in the table below.

Year	2020	2021	2022
Incremental Demand Reduction (MW)	5.9	6.9	7.9

b) Please note that EfficiencyOne has inadvertently underestimated capacity-related avoided costs in its modelling for the Business, Not-for-Profit and Institutional (BNI) sector only. Updated avoided costs of transmission and distribution of $14.88/kW (real dollars) were used for the Residential sector. The previous avoided costs of transmission and distribution of $11.89/kW (real dollars) were used for the BNI sector, as well as an older version of extrapolation in outer years of the analysis (from the Generation Utilization and Optimization Potential Analysis). This underestimate is immaterial and conservative – its effects are estimated to underreport total benefits within the BNI sector by less than 0.6%. The annual nominal per unit avoided costs of capacity, transmission and distribution (in sum), as used in the model, are presented in Attachment 1 to this IR response. In addition, Attachment 1 of this IR response displays the correct BNI avoided costs of capacity, and the percentage difference between the annual values used in the model and the correct values.

c) The total Net Present Value (NPV) capacity-related avoided costs (i.e. generation, transmission and distribution) through demand reduction initiatives, excluding the demand-focused portion of Custom Incentives is $23,783,667. The Custom program component was modelled as one discrete measure having both energy and capacity related avoided costs with a NPV of $140, 663,694.

d) No such conversion was necessary – the demand focused measures and activities proposed to be introduced will begin to provide capacity savings as they are installed, beginning in 2020. These measures will continue to provide capacity savings until the expiration of their Effective Useful Lives. In this way, the demand savings from the proposed demand reduction activities will provide both short-term and mid-to-long term demand savings.

Sector	Avoided Cost Savings Types	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Residential	Coinc. Demand Savings (kW) - As Modelled	211.24	194.32	206.58	223.29	217.32	232.25	219.58	216.15	212.84	213.51
BNI	Coinc. Demand Savings (kW) - Correct	211.24	194.32	206.58	223.29	217.32	232.25	219.58	216.15	212.84	213.51
BNI	Coinc. Demand Savings (kW) - As Modelled	208.48	191.46	203.63	220.24	214.17	229.00	216.22	212.68	209.26	209.81
BNI	Deviation From Correct - % - Coinc. Demand Savings (kW)	-1.3%	-1.5%	-1.4%	-1.4%	-1.4%	-1.4%	-1.5%	-1.6%	-1.7%	-1.7%

Sector	Avoided Cost Savings Types	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Residential	Coinc. Demand Savings (kW) - As Modelled	212.31	208.56	207.54	212.69	212.43	216.74	213.34	217.88	218.72	195.74
BNI	Coinc. Demand Savings (kW) - Correct	212.31	208.56	207.54	212.69	212.43	216.74	213.34	217.88	218.72	195.74
BNI	Coinc. Demand Savings (kW) - As Modelled	208.49	204.62	203.48	208.50	208.11	212.29	208.74	213.14	213.84	190.71
BNI	Deviation From Correct - % - Coinc. Demand Savings (kW)	-1.8%	-1.9%	-2.0%	-2.0%	-2.0%	-2.1%	-2.2%	-2.2%	-2.2%	-2.6%

Sector	Avoided Cost Savings Types	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Residential	Coinc. Demand Savings (kW) - As Modelled	196.19	196.65	197.12	197.60	198.09	198.58	199.09	199.61	200.14	200.68
BNI	Coinc. Demand Savings (kW) - Correct	196.19	196.65	197.12	197.60	198.09	198.58	199.09	199.61	200.14	200.68
BNI	Coinc. Demand Savings (kW) - As Modelled	187.72	184.80	181.95	185.59	189.30	193.09	196.95	200.89	204.91	209.00
BNI	Deviation From Correct - % - Coinc. Demand Savings (kW)	-4.3%	-6.0%	-7.7%	-6.1%	-4.4%	-2.8%	-1.1%	0.6%	2.4%	4.1%

Sector	Avoided Cost Savings Types	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
Residential	Coinc. Demand Savings (kW) - As Modelled	201.23	201.79	202.36	202.94	203.54	204.15	204.76	205.40	206.04	206.70
BNI	Coinc. Demand Savings (kW) - Correct	201.23	201.79	202.36	202.94	203.54	204.15	204.76	205.40	206.04	206.70
BNI	Coinc. Demand Savings (kW) - As Modelled	213.18	217.45	221.80	226.23	230.76	235.37	240.08	244.88	249.78	254.78
BNI	Deviation From Correct - % - Coinc. Demand Savings (kW)	5.9%	7.8%	9.6%	11.5%	13.4%	15.3%	17.2%	19.2%	21.2%	23.3%

Sector	Avoided Cost Savings Types	2060
Residential	Coinc. Demand Savings (kW) - As Modelled	207.37
BNI	Coinc. Demand Savings (kW) - Correct	207.37
BNI	Coinc. Demand Savings (kW) - As Modelled	259.87
BNI	Deviation From Correct - % - Coinc. Demand Savings (kW)	25.3%

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Request IR-40:

Reference: Evidence, from page 31, line 28, to page 32, line 2.

EfficiencyOne states: "The Preferred Plan appropriately balances the dual priorities of achieving energy savings and demand savings by increasing investment in demand reduction initiatives from $1 million in the 2019 pilot to $3.3 million per year over the term of the Preferred Plan. This investment is expected to reduce demand by 20.7 MW over the term of the 2020-2022 DSM Plan."

(a) Provide all documentation, workpapers, assumptions, and analyses that EfficiencyOne used to calculate the annual investment amount of $3.3 million in the demand reduction measures.

(b) Provide an explanation of how the expected 20.7 MW demand reduction of the Preferred Plan was calculated and all documentation, workpapers, assumptions and analyses used by EfficiencyOne in this calculation.

(c) Please explain how EfficiencyOne determined the proposed demand reducing measures met the affordability test.

Response IR-40:

a) The design of demand reduction initiatives considered two areas of application (prescriptive and custom). The first established parameters relating to prescriptive demand reduction measures, specifically those offerings within the proposed Home Energy Assessment, Green Heat, Business Energy Rebates and Small Business Energy Solutions program components. The second established parameters relating to the Custom program component.

Prescriptive demand reduction activities were conceptualized early in the development process of the 2020-2022 DSM Resource Plan as a continuation of planned 2019 Pilot activities. These activities are highly cost-effective, given the current profile of avoided capacity costs. However, there may be risks identified through the pilot with the introduction of these prescriptive demand reduction measures. These may include:

- Uncertainties regarding levels of customer uptake, given the lack of EfficiencyOne's experience in offering these measures;
- Timing interdependencies associated with the 2019 Locational DSM Pilot and 2020-2022 prescriptive demand reduction activities; and
- Unforeseen challenges with particular products and/or technologies.

As EfficiencyOne balanced the considerations of being highly cost-effective yet having potential risks, two design characteristics were determined:

- A ramped approach to investment in prescriptive demand reductions, whereby 2019 investment levels could be gradually increased; and
- A limit to total annual investment to manage risk.

The design process therefore considered prescriptive annual investment amounts of $1.2, $1.6, and $2.0 Million in 2020, 2021, and 2022, respectively.

The investment amounts associated with demand reduction activities within the Custom program component were prepared by modification of the original Custom measure characterization. This characterization is unique in that it consists of one modelled "measure" within Navigant's ProCESS modelling tool, consistent with past treatment within the ELRAM modelling tool. The source characterization for the Custom measure was then modified to accommodate EfficiencyOne's planned level of focus on demand reduction projects within the Custom program component, as provided in Attachment 1 to this IR response. Through the internal vetting process later in the overall DSM Plan

development process, the final amount of Custom activity (e.g., investment and savings), inclusive of demand response activity, was determined.

Note that the actual calculation of total investment for a measure occurs within Navigant's ProCESS model and is not readily produced in Excel format. However, it takes the following form:

$$Annual\ Investment = Annual\ Measure\ Quantity * (Per\ Unit\ Incentive + Per\ Unit\ Adminstrative\ Cost)$$

The source characterizations for prescriptive demand reduction measures are detailed in EfficiencyOne's IR response to NS Power IR-41 and NS Power IR-42.

b) The total demand savings for all prescriptive demand reduction measures were calculated within Navigant's ProCESS model using the following formula (for measures without dual baseline treatment). These values were then summed between measures and Plan years.

$$Incremental\ Demand\ Savings = Annual\ measure\ quantity * pre - RUL\ Demand\ Savings * [\frac{1}{1 - Line\ Losses}] * Net - to - Gross\ Factor$$

Since the Custom program component was modelled as a single measure, EfficiencyOne analyzed ProCESS output data in the context of input characterization to produce the demand savings attributable to the demand reduction portion of Custom. That analysis is provided in Attachment 1 to this IR response.

c) EfficiencyOne considers affordability at the DSM Plan investment level, given the portfolio of cost-effective programs. Attachment 1 to Appendix A of the Application, provides the Total Resource Cost screening tests for demand reduction measures, which are relatively high, providing an indication of their affordability.

Key Assumptions:	25% of Custom Retrofit investment is repurposed for demand related projects
	50% first-year demand unit cost for demand-focused projects, relative to energy-focused projects
	All other cost information identical in both cases

	Incremental Energy Savings (kWh)	Demand Savings (kW)	Incremental Cost ($)	Admin Cost ($)	Incentives ($)
Custom Retrofit Base Characterization (Based on 2017 Evaluated Results)	1,000,000.00	166.76	459,665.00	$73,439.64	$91,933.00
Removal For Demand-Focused Efforts	250000	41.69	114,916.25	$18,359.91	$22,983.25
Remaining Base Characterization	750,000.00	125.07	344,748.75	$55,079.73	$68,949.75
Demand Focused Efforts	0	83.382	114,916.25	$18,360.00	$22,983.00
Revised Characterization - Custom Retrofit w/ Demand Focused Efforts	750,000.00	208.45	459,665.00	$73,439.73	$91,932.75
Revised Characterization (per GWh)	1000000	277.94	612,886.67	$97,919.64	$122,577.00
Per Single Measure Quantity - Demand Focused Efforts	0	111.18	153,221.67	$24,480.00	$30,644.00

	2020	2021	2022	Total
ProCESS measure quantity (Preferred Plan)	30.16	31.16	32.17	93.49
Custom Demand from Demand Focused Efforts (Preferred Plan) (MW)	3.36	3.47	3.58	10.40
Investment for Custom Demand Focused Efforts (Preferred Plan)	$1,662,370.90	$1,717,783.26	$1,773,195.62	$5,153,349.78

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Request IR-41:

Attachment 1 to Appendix A, lines 157-159, and lines 164-165, includes the data for the Residential Demand Reduction Green Heat and Home Energy Assessment measures, respectively.

(a) Provide the source and supporting documentation of the measure life data.

(b) Provide the source and supporting documentation of the Gross Peak Demand Savings per Unit at Meter (Watts) Pre-RUL.

(c) Define abbreviation "pre-RUL" and all other abbreviations used in Attachment 1.

(d) Provide the source and supporting documentation of the per Unit Present Value Avoided Cost Benefits ($).

(e) Provide the source and supporting documentation of all other data specified for the Residential Demand Reduction measures.

Response IR-41:

a) Consistent with 2017 Evaluation practices, all Electrical Thermal Storage (ETS) measures, for both Residential and Business, Non-Profit and Institutional (BNI), rely on an Effective Useful Life (EUL) value of 18 years. This value comes from the "Heating and Cooling System – replacement/retrofit" recommended value as provided on page 1-3 of Attachment 1 to this IR response.

For domestic hot water (DHW) Timers, an EUL value of 9 years was selected, consistent with the mid-point of the expected lifetime for storage-type hot water storage tanks, as provided on page 2 of Attachment 2 to this IR response.

b) For all ETS measures, both Residential and BNI, EfficiencyOne based its measure characterizations on a review of available units within the marketplace. Please refer to Attachments 3-6 of this IR response for the documents relied upon for this review.

Key conclusions from this technical review were:

- A large number of ETS products are available in the Nova Scotia marketplace, capable of charging currents between 985 W (Ecombi – ECO158) and 46.5 kW (Steffes - Model 6140). A wide variety of systems are available at intermediate capacities between these two systems.
- Maintainable heat rate outputs are highly dependent on the ratio of charge vs. discharge hours.

With knowledge that a variety of ETS systems and charging patterns are possible and technically suited to a given heating requirement, EfficiencyOne sought to define representative power outputs for consideration in the Plan.

These power outputs were designated as provided in the Table below:

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System	Description of Heat Source Replaced	Heat Load Moved Off-Peak (kW)
Residential ETS System (Room)	1 x 2.5 kW Electric Baseboard	2.5 kW
Residential ETS System (Central)	Small home – Electric Furnace – 5 kW	5.0 kW
Small Commercial ETS System	Small business – Electric Furnace – 5 kW (e.g. convenience store)	5.0 kW
Medium Commercial ETS System	Medium Business – Electric Baseboard (e.g. small restaurant) – 10 kW	10.0 kW
Large Commercial ETS System	Medium-Large Business – Electric Furnace (e.g. medium/large office) – 20 kW	20.0 kW

Since Residential and BNI ETS measures were estimated to provide conservative savings by design, a coincidence factor of 100% was estimated for demand savings. EfficiencyOne expects evaluated coincidence of these loads to be close to this value, since system peak is expected to occur relatively close to building design temperature.

For DHW Timers, EfficiencyOne relied assumed upon a coincident peak demand savings value of 0.50 kW. Coincidence of demand savings for this measure has not been evaluated, so 0.5 kW was chosen as a conservative estimate, consistent with estimates from NS Power of 0.57 kW for total electric DHW coincident unit load, from the 2018 Load Forecast.[1]

All of the values estimated by EfficiencyOne are expected to be updated through independent evaluation and verification, prior to EfficiencyOne claiming system coincident peak demand savings.

[1] M08670, N-1, 2018 Load Forecast – Redacted, Filed April 30, 2018, at pages 24-25.

c) Please see below for definitions:

ASHP – Refers to an air-source heat pump, regardless of what medium it provides/removes energy to.

AWHP – Refers to an air-source heat pump that transfers heat to a water (or glycol) based heat distribution system.

CEE – Refers to the Consortium for Energy Efficiency.

CFL – Refers to a Compact Fluorescent Lamp.

CFM – Refers to Cubic Feet per Minute.

DHW – Refers to Domestic Hot Water.

ECM – Refers to an electronically-commutated, or brushless DC, motor.

ETS – Refers to Electric Thermal Storage.

GPM – Refers to Gallons per Minute.

GSHP – Refers to a ground-source heat pump.

HID – Refers to a High-Intensity Discharge [Lamp].

LED – Refers to Light-Emitting Diode.

MSHP – Refers to a mini-split, or ductless, heat pump.

MURB – Refers to a Multi-Unit Residential Building.

PAC – Refers to the Program Administrator Cost [Test].

pre-RUL – This abbreviation refers to pre-Remaining Useful Life (RUL). This term, when used as a prefix, refers to savings values that occur in the years prior to the end of the in-situ baseline equipment's useful life. For dual-baseline early replacement measures, this refers to savings in that period, as opposed to the post-RUL period, which uses standard market-available equipment as the baseline (since the original baseline equipment would have been no longer operational). For all other measures, this term may be disregarded, as annual savings values remain constant throughout the Effective Useful Life of the efficient measure.

R and BR Lamps – Refer to reflector lamps, and bulged reflector lamps, respectively.

RET – Refers to "Retirement" or "Early-Retirement". This is a decision type in energy efficiency program design, which refers to the replacement of a baseline measure prior to the end of its Remaining Useful Life (RUL) (i.e. the replacement of a 5-year old electric furnace while it remains functional). Typically, in-situ baselines are used for these scenarios, or a combination of in-situ and market baselines (i.e. a dual baseline approach).

ROB – Refers to Replace-on-Burnout. This is a decision type in energy efficiency program design, which refers to the replacement of a baseline measure at the end of its Remaining Useful Life (RUL) (i.e. the replacement of a 20-year old electric furnace once it has stopped functioning). Typically, market-based baselines are used for the calculation of energy and demand savings in this scenario.

TRC – Refers to the Total Resource Cost [Test].

VFD – Refers to a Variable Frequency Drive.

Please note that standard SI unit abbreviations have not been defined here.

d) These values were calculated within Navigant's ProCESS modelling tool, using the approach of multiplying the annual energy and demand savings streams from a given measure by the annual energy and capacity-related avoided costs, respectively. These values were then converted to a Net-Present Value amount using NS Power's 2018 weighted average cost of capital.

e) Navigant's ProCESS model calculates administrative costs for measures using a per-kWh allocation methodology. This methodology does not function for solely demand-based measures, so EfficiencyOne conducted an analysis to allocate average administrative costs, on a per-measure basis, from the given program component "hosting" each demand reduction measure, to determine administrative costs on a per unit basis. That analysis is provided as Attachment 7 of this IR response.

Incremental cost information for ETS systems are based on internal technical estimates generated within EfficiencyOne. EfficiencyOne notes the incremental costs for ETS measures are representative and expects these values to be refined using operational data from the 2019 demand reduction pilots.

Incremental cost information for DHW Timers was based on an informal online pricing review, and assumes $100 for material costs, and $100 for installation.

Incentives were informed by actual incentive levels offered by Efficiency PEI, as provided in Attachment 8. Incentive levels for Business Energy Rebates ETS systems were linearly

extrapolated, in terms of system size, from this data as well. For Small Business Energy Solutions, incentive levels 4/3 those of BER were assumed.

Incentives for DHW Timers was assumed to be 25% of incremental cost for this measure.

All other information contained within Appendix A, Attachment 1 for these measures was calculated by Navigant's ProCESS model, using the data described in this IR response, augmented with global assumption data such as discount rate and avoided cost information.

Measure Life Report

Residential and Commercial/Industrial Lighting and HVAC Measures

Prepared for

The New England State Program Working Group (SPWG)

For use as an

Energy Efficiency Measures/Programs Reference Document for the ISO Forward Capacity Market (FCM)

June 2007

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Table of Contents

I. INTRODUCTION AND RESULTS I-1

A. Measure Life Definition I-2

B. Recommended Measure Life Values – Residential and C&I Lighting and HVAC Measures I-2

II. METHODOLOGY II-1

A. Data Collection II-1

B. Data Review and Analysis, and Propose Draft and Final Default Measure Life Values II-2

APPENDIX A – Background Detail Considered in Development of Common Measure Life Values

APPENDIX B – Relevant Data Sources

APPENDIX C – Additional Documentation on Targeted Measures and Preliminary Measure Life Value Data for Other Residential and C&I End Use Equipment

Acknowledgement: Key individuals from the New England State Program Working Group (SPWG) and associated energy efficiency program administrators were involved in the provision of important data and reviews leading to the drafting and finalization of this report. We would like to specifically acknowledge the contributions and support of Elizabeth Titus and Julie Michals (NEEP), Carol White, Bill Blake, Dave Jacobson and Angela Li (National Grid), Carole Welch (VT PSB), Chris Neme (VEIC), Tom Belair (PSNH), Joe Swift (WMECO), Dave Bebrin and Don Flynn (CL&P), Tom Buffa and Paul Gray (UI), Phil Mosenthal (Optimal Energy – for the MA DOER), David Weber (NStar), Deborah Jarvis (Unitil), Kevin Galligan (Cape Light Compact), Denis Bergeron (Maine PUC), Cindy Jacobs (CT DPUC), Doug Hartley (RI PUC), and Paul Horowitz (PAH Associates – consultant to the SPWG).

I. INTRODUCTION AND RESULTS

The New England State Program Working Group (SPWG)[1] contracted with GDS Associates, Inc. (GDS) to research current practices and develop and document a set of measure life values for selected measures that could be consistently applied to energy efficiency programs in any of the New England states for use by the SPWG members in the ISO-NE's Forward Capacity Market (FCM) and for any other relevant contexts. As directed by the SPWG, the focus of this effort was on residential and commercial/industrial (C&I) lighting measures and heating, ventilation and air conditioning (HVAC) measures.

Resulting measure life values presented in this report were developed to meet the following conditions:

- Satisfy any ISO-NE requirements (e.g. for definition and documentation sources);
- Work as common values, accepted by all New England states for the FCM; and
- Accurately reflect conditions for measures installed by energy efficiency programs in the New England states that have supported this research effort.

Key SPWG members reviewed previous and proposed measure life definitions and provided information and supporting documentation regarding HVAC and lighting measure life values currently being used for their residential and C&I programs. GDS then compiled this New England state program administrator-specific information and provided supplemental values and supporting documentation from multiple other relevant data and reporting sources. Preliminary recommendations were distributed to all SPWG members for vetting and refinement. Following multiple review sessions and feedback calls, a final definition and set of common measure life values were developed. This report is structured as follows:

Section I (the Introduction) – provides a brief overview of the project. It presents the definition of measure life that was developed and tables of results that show the common measure life values for all residential and C&I lighting and HVAC measures currently addressed in SPWG members' energy efficiency programs.

Section II (Methodology) – provides more information regarding data sources and collection approaches.

Appendix A (Background Detail) – presents a compilation of data tables and documentation sources for all targeted residential and C&I measures by program administrator and other potentially relevant data sources. More information on the data sources used is included in Appendix B. Although not the focus of this current effort, during the project, measure life values for a number of non-lighting or HVAC measures were also collected and are presented in table format as Appendix C of this report.

[1] Represented by the state regulatory agencies (CT DPUC, Maine PUC, MA DOER, NH PUC, RI PUC, and VT PSB) and associated energy efficiency program administrators (Cape Light Compact, Efficiency Maine, Efficiency Vermont, National Grid – MA, NH & RI, Northeast Utilities – CT & MA, NStar, PSNH, United Illuminating, and Unitil – MA & NH).

A. Measure Life Definition

Based on a critical review of previous definitions[2] by GDS and discussion with the SPWG, the following measure life definition was agreed on for use in this report:

For programs delivered by program administrators in New England, Measure Life includes equipment life and measure persistence (not savings persistence).

- Equipment Life means the number of years that a measure is installed and will operate until failure, and
- Measure Persistence takes into account business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued.

For retrofit/early retirement programs, the measure life will take into account both the expected remaining life of the measure being replaced and the expected changes in baselines over time.

B. Recommended Measure Life Values – Residential and C&I Lighting and HVAC Measures

Based on a critical review of all state program administrator-specific values, values from other sources compiled in the course of this study, , and discussion with the SPWG, final measure life values for residential and C&I lighting and HVAC measures were developed and are summarized in the following tables:

Table 1 – Residential Measures

- Lighting
- Lighting Controls
- Heating and Cooling
- Ventilation
- HVAC Controls

Table 2 – Commercial and Industrial (C&I) Measures

- Lighting
- Lighting Controls
- HVAC
- HVAC Controls
- Motors

[2] One key source for the SPWG's measure life definition came from the October 10, 2005 *Measure Life Study Report prepared for The Massachusetts Joint Utilities*, by ERS (energy & resource solutions). Pgs 2-5 through 2-7.

Table 1 - Residential Measures [Note 1]	
Measure	Measure Life
Lighting	
Bulb (CFL screw base) - Retail	6 years or product specific
Bulb (CFL screw base) - Direct Install	Site specific values to be used where known
Exit Sign - LED (multifamily installations)	13 years - retrofit 15 years - new construction
Interior Fixture - CFL hardwired	20 years
Exterior Fixture - CFL hardwired	15 years
Fixture - CFL table lamp	8 years
Fixture - CFL Torchiere	8 years
Lighting Controls	
Occupancy Sensors	10 years
Heating and Cooling	
Heating & Cooling System	18 years - replacement/retrofit 25 years - new construction (ESTAR Homes)
Air Conditioner or Heat Pump Commisioning Air Conditioner or Heat Pump ECM Refrigerant Charge - at time of installation	18 years
Heating & Cooling System repair/tune-up/recharge	5 years
Room/Window AC replacement	12 years
Ventilation	
Fans - whole house	25 years
Attic Ventilation Fan (thermostatically controlled)	19 years
Duct Sealing	20 years
Air Sealing	15 years
Insulation	25 years
Weatherization (includes combination of duct sealing, air sealing, and insulation)	20 years
Duct Insulation - heating/cooling; heating; cooling; oil heat	20 years
Windows - low SHGC, or high performance	25 years
Dehumidifier	12 years
Pipe Wrap	15 years
Tank Temperature Turn-Down	4 years [Note 2]
HVAC Controls	
AC Timers	5 years
Programmable Thermostat	10 years

Note 1: For measures shown in Table 1 where there is a single value specified, the value applies to both new and retrofit program situations

Note 2: Candidate for further research/study

Table 2 - Commercial & Industrial Measures		
Measure*	Measure Life**	
	Retrofit	New
Lighting		
Bulb - CFL screw base [Note 1]	5 years [Note 2]	N/A
Fluorescent Fixture	13 years	15 years
Hardwired CFL	13 years	15 years
LED Exit Signs	13 years	15 years
HID (interior and exterior)	13 years	15 years
Lighting Controls		
Occupancy Sensors	9 years	10 years
Daylight Dimming	9 years	10 years
HVAC		
Packaged AC/HP	N/A	15 years
Chillers	N/A	23 years [Note 3]
Enthalpy Economizer	7 years [Note 4]	10 years
HVAC Controls		
Programmable Thermostat	8 years	N/A
Energy Management Systems (EMS)	10 years	15 years
Motors		
Motors	15 years	20 years

* Also applies for installation in common areas of multifamily buildings

** Primary Source: Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 10/10/05

Note 1: Measure not included in the ERS 10/10/05 Measure Life Study

Note 2: Candidate for further research/study

Note 3: Value = 20 years in ERS 10/10/05 Measure Life Study

Note 4: Value = "N/A" in ERS 10/10/05 Measure Life Study

As noted previously, although not the focus of this current effort, during the project, measure life values for a number of non-lighting/HVAC measures were compiled along with associated source documentation. For reference and potential future consideration, this additional measure life information is included and summarized in table format as Appendix C of this report.

II. METHODOLOGY

The measure life values presented in this report were developed to meet the following conditions:

- Satisfy any ISO-NE requirements (e.g. for definition and documentation sources);
- Work as common values, accepted by all New England states for the FCM; and
- Accurately reflect conditions for measures installed by energy efficiency programs in the New England states that have supported this research effort.

The following activities were performed in the development of these measure life values:

- Data Collection
- Review and Analysis
- Development of Proposed Draft and Final Default Measure Life Values

More information regarding the approach for conducting each of these activities is presented below.

A. Data Collection

GDS identified and assembled reference measure life values for a broad array of residential and C&I lighting, HVAC, and other measures currently delivered to customers through the energy efficiency programs of each SPWG member, using a variety of local and nationally recognized data sources including:

- Measure Life Study for the Massachusetts Joint Utilities – ERS, October 10, 2005
- Vermont Electric Energy Efficiency Potential Study – GDS Associates
- Efficiency Vermont Technical Reference User Manual (RTM) No. 2006-41, June 14, 2006
- Efficiency Maine Technical Reference User Manual (TRM) No. 2006-1
- UI and CL&P Program Savings Documentation for 2006 Program Year
- California Measurement Advisory Council (CALMAC) database
- Database for Energy Efficient Resources (DEER), sponsored by the CA Energy Commission and the CPUC
- Revised/Update EULs Based on Retention and Persistence Studies Results, Revised Report – SERA July 8, 2005
- A more complete list of relevant data sources is itemized and presented in Appendix B

B. Data Review and Analysis, and Propose Draft and Final Default Measure Life Values

GDS reviewed all secondary data collected and developed a preliminary list of potentially applicable residential and C&I measures. This list was then distributed to program administrator staff within the SPWG for review and to obtain additional program-specific measure life values and associated documentation sources. GDS compiled all responses and developed initial measure life recommendations for SPWG member consideration.

Written feedback from the SPWG regarding these draft measure life value recommendations was provided along with verbal input during two scheduled measure life document review teleconferences. Following receipt of all feedback, and SPWG confirmation regarding the appropriateness of all recommended values, GDS prepared final default measure lives in annotated summary tables, by sector and end use. A summary of these tables was presented in the Introduction and Results section of this report. Appendix A provides the background detail from these tables showing the individual states' initial values and source documentation. Where applicable, all tables include notes to identify specific measures that might be good candidates for further research or a targeted measure life/persistence study.

Appendix B provides more comprehensive reference information for the documented data sources for each of the residential and C&I lighting and HVAC measures that are the subject of this report. In addition, Appendix C provides background detail and documentation on a number of other residential and C&I measures collected and compiled during the course of this project. The information in Appendix C should provide SBWG members with an excellent starting point for development of common default measure life values for measures other than HVAC and lighting end uses, in the expectation that common values may be of interest or importance to the region's electric energy efficiency program administrators in the future.

APPENDIX A

Background Detail Considered in Development of Common Measure Life Values

The following tables provide the source information on the residential and C&I lighting and HVAC measures that were the subject of this report. As described above, the source information was reviewed and discussed by members of the SPWG and GDS, to establish the measure life value for each measure (or two values if there was a basis for separate values for new construction and retrofit situations). In each case the source data were considered, along with the underlying information that supported the values (eg., daily hours of use, location), to arrive at a set of measure life values that reflected the most reasonable circumstances under which the measures would be installed.

1. Residential Lighting and Lighting Controls

Table A-1 Residential Lighting		
Measure	Measure Life	Comments
Bulb - CFL screw base - Retail	6 years or product specific	6 years - MA, VT, RI 2003 Residential Lighting Impact Study (based on 3.2 hours/day & 7000 hour bulb life) 6.4 years - 3.4 hours/day 8000 hours (NH Retail Sales) 8.1 years - 3.4 hours/day 10,000 hours (NH Retail Catalog)
Bulb - CFL screw base - Direct Install (site specific)	Site specific values to be used where known	This measure life requires knowledge of the rated bulb life and site specific daily burn time, and consideration of measure persistance and should be calculated as follows: (rated bulb life / annual burn time) * measure persistence 5 years - CT: 2.6 hours/day is default includes 20% reduction for cycling. Full range of values is 5 years thru 13 years 6.4 years - VT: 3 hours/day 7000 hours 7.6 years - ME: 2.7 hours/day 7500 hours 8.6 years - NH: Energy Star Homes Program) 9 years - MA, RI
Exit Sign - LED (multifamily installations)	13 years - retrofit 15 years - new construction	Per commercial/industrial sector values documentation
Interior Fixture - CFL hardwired	20 years	20 years - CT, NH 15 years - MA, RI
Exterior Fixture - CFL hardwired	15 years	15 years - MA, RI 20 years - CT, NH 16, 20 years - CALMAC
Fixture - CFL table lamp	8 years	5 years (MA, RI) EL&MP 8 years - 3.2 hours/day (CT) 10 years (NH, VT) - 16 years DEER
Fixture - CFL Torchiere	8 years	8 years - CT 5 years - MA, RI 10 years - NH, VT, ME 9 years - DEER; 9.4 years - CALMAC
Residential Lighting Controls		
Occupancy Sensors	10 years	10 years - consistent with C/I sector Retrofit value 15 years - VT

2. Residential Heating and Cooling and HVAC Controls

Table A-2 Residential Heating and Cooling		
Measure	Measure Life	Comments
Heating & Cooling System Replacement	18 years	18 years - MA, RI: Heat Pump Retrofit, Central AC 18 years - NH, VT: Retrofit Central AC 19 years - CT: Heat Pump, Central AC 20 years - MA, RI, VT: Furnace, Burner Replacement 25 years - VT: Central AC 15 years - Skumatz, 16,18 years CALMAC Heat Pump 15, 18 years - Skumatz, 18 years CALMAC, VT TPS Central AC
Heating, Cooling and Hot Water Savings in the ES Homes Program New Construction	25 years	Heating: 25 years - MA, RI, NH, VT, CT Cooling: 25 years - MA, RI, NH, VT Cooling: 19 years - CT Hot Water: 25 years - MA, RI, NH, VT Hot Water: 15 years - CT
AC or HP Commisioning AC or HP ECM Refrigerant Charge - at time of installation	18 years	18 years - MA, RI 19 years - CT
Heating & Cooling System repair/tune-up/recharge	5 years	5 years - MA, RI: reflects estimate of remaining life 5 years - NH: for weatherization program
Room/Window AC replacement	12 years	12 years - MA, RI, NH 13 years - VT, CT, NH - Energy Star Program 12 years - VT TRM, 11,15 years CALMAC
Residential HVAC Controls		
AC Timers	5 years	5 years - MA, RI, NH
Programmable Thermostat	10 years	10 years - MA, RI, CT 12 years - NH 10 years - VT TPS, 12 years CALMAC, DEER

3. Residential Ventilation and Other Measures

Table A-3 Residential Ventilation and Other Measures		
Measure	Measure Life	Comments
Fans - whole house	25 years	25 years - MA, RI
Attic Ventilation Fan (thermostatically controlled)	19 years	19 years - CT, NH (New Construction)
Duct Sealing	20 years	20 years - CT (Low Income) 15 years - MA, RI, VT 25 years - CT (Single Family, Multi Family)
Air Sealing	15 years	15 years - MA, RI, NH 20 years - VT (Retrofit)
Insulation	25 years	25 years - MA, RI, CT, NH (Retrofit) 20 years - VT (Retrofit) 25 years - CALMAC, VT TRM, 20 years DEER
Weatherization (includes combination of duct sealing, air sealing, and insulation)	20 years	20 years - CT (Low Income) 25 years - MA, RI 20 years - VT TPS, 13 years DEER
Duct Insulation - heating/cooling; heating; cooling; oil heat	20 years	20 years - MA, RI, CT
Windows - low SHGC, or high performance	25 years	25 years - NH 20 years - MA, RI 25 years - CALMAC, 35 years VT TPS Retrofit, 20 yrs DEER Retrofit
Dehumidifier	12 years	12 years - MA, RI, CT-07
Pipe Wrap	15 years	15 years - CALMAC, DEER 20 years - CT - Low Income 25 years - MA, RI 10, 13 years - VT TRM
Tank Temperature Turn-Down	4 years [Note 1]	4 years - VT (Single Family) 5 years - CT (Low Income Retrofit) 7 years - VT (Low Income New)

Note 1: Candidate for further research/study

4. Commercial and Industrial Lighting

Table A-4 Commercial & Industrial Lighting			
Measure*	Measure Life**		Comments
	Retrofit	New	
Bulb - CFL screw base [Note 1]	5 years [Note 2]	N/A	5 years - CT 3.4 years - VT (based on 9.6 hours/day 12,000 hours where higher bulb life is due to less cycling for a commercial application) 6 years - MA, RI, NH (mostly small business applications)
Fluorescent Fixture	13 years	15 years	13 years (retrofit), 15 years (new) - MA, RI, NH 11,16 years - Skumatz, 16 years CALMAC
Hardwired CFL	13 years	15 years	13 years (retrofit), 15 years (new) - MA, RI, NH 15 years (retrofit and new) - VT and VT TPS 10, 16 years - CALMAC
LED Exit Signs	13 years	15 years	13 years (retrofit), 15 years (new) - MA, RI, NH 10 years (retrofit) - VT and VT TPS 15,16 years - CALMAC, 16 years - DEER
HID (interior and exterior)	13 years	15 years	Retrofit: 13 years (MA, RI, NH) Retrofit: 15 years (VT) New: 15 years (MA, RI, NH, VT)
Commercial & Industrial Lighting Controls			
Occupancy Sensors	9 years	10 years	9 years (retrofit) - MA, RI, NH 10 years (new) - MA, RI, NH 10 years (retrofit and new) - VT 15 years (new) - CT 8, 10 years - CALMAC
Daylight Dimming	9 years	10 years	9 years (retrofit), 10 years (new) - MA, RI, NH 10 years (retrofit) - VT 16 years - DEER

* Also applies for installation in common areas of multifamily buildings

** Primary Source: Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 10/10/05

Note 1: Measure not included in the ERS 10/10/05 Measure Life Study

Note 2: Candidate for further research/study

5. Commercial and Industrial HVAC and Motors

Table A-5 Commercial & Industrial HVAC			
Measure	Measure Life *		Comments
	Retrofit	New	
Packaged AC/HP	N/A	15 years	15 years - MA, RI, NH, CT (new - water and ground source heat pump, CT-07) 12 years - CT (new - air source heat pump) 15 years - ASHRAE, CALMAC, VT TRM
Chillers	N/A	23 years [Note 1]	23 years - CT (new - water cooled) 18 years - CT (new - air cooled) 20 years (new) - MA, RI, NH, CT-07 23 years - ASHRAE 20 years - CALMAC, DEER (new)
Enthalpy Economizer	7 years [Note 2]	10 years	7 years - CT-07 (retrofit) 7 years - VT TPS 9.8 years (new) - adj from 14 years engineering life VT TRM, 14 years VEIC 15 years - DEER
Commercial & Industrial HVAC Controls			
Programmable Thermostat	8 years	N/A	8 years - MA, RI, NH (retrofit) 10 years - VT (retrofit) 5 years - VT TPS
Energy Management Systems (EMS)	10 years	15 years	10 years - MA, RI, NH, VT (retrofit) 15 years - CT-07 (retrofit) 15 years - MA, RI, NH, CT-07 (new) 15 years - CALMAC, 14, 15 years Skumatz
Commercial & Industrial Motors			
Motors	15 years	20 years	15 years - MA, RI, NH (retrofit) 13 years - CT-07 (retrofit) 20 years - VT (retrofit) 20 years - MA, RI, NH, CT-07 (new) 17 years - CT (new) 15 years - CALMAC, DEER (new)

* Primary Source: Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 10/10/05
Note 1: Value = 20 years in ERS 10/10/05 Measure Life Study
Note 2: Value = "N/A" in ERS 10/10/05 Measure Life Study

APPENDIX B – Relevant Data Sources

Residential Sources

Utility	Primary Source
National Grid	Extended Residential Logging Results Memo from RLW and Nexus Market Research to National Grid, May 2, 2005.
Vermont Energy Investment Corporation	EVT TRM User Manual #41, dated 6/14/06
Connecticut - UI and CLP	Connecticut - UI and CLP Programs Savings Documentation - 2006
Efficiency Maine	Efficiency Maine TRM 2006-1
PSNH	Extended Residential Logging Results Memo from RLW and Nexus Market Research to National Grid, May 2, 2005.
Connecticut - UI and CLP -2007	Connecticut - UI and CLP Programs Savings Documentation - 2007 Table 1.4 Commercial and Industrial Lifetimes Page 222
Study	**Primary Source**
CALMAC Public Workshops	CALMAC Public Workshops on PY Energy Efficiency Programs, Appendix C2, "Proposed Effective Useful Life for Measures for PY2001 Program Elements" by PG&E, Edison, SDG&E, and SoCalGas, September 2000
Vermont Technical Potential Study	GDS Associates, Inc., "Vermont Electric Energy Efficiency Potential Study, Final Report", prepared for the VT DPS, May 10, 2006
California Public Utilities Commission (CPUC) and California Energy Commission	Database Energy Efficient Resource Database
Skumatz and Gardner	Skumatz, Woods, and Dimetrosky, "Review of Retention and Persistence Studies for the California Public Utilities Commission (CPUC)", October 2004, prepared for California Public Utilities Commission, San Francisco, CA.
Efficiency Vermont	Efficiency Vermont TRM Users Manual 2006-41

Commercial & Industrial Sources

Utility	Primary Source
National Grid	Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 11/17/05, p. 1-4.
Vermont Energy Investment Corporation	EVT TRM User Manual #41, dated 6/14/06
Connecticut - UI and CLP	UI/CL&P C&LM Program Savings Documentation -2006
Public Service of New Hampshire	Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 11/17/05, p. 1-4.
Connecticut - UI and CLP -2007	Connecticut - UI and CLP Programs Savings Documentation - 2007 Table 1.4 Commercial and Industrial Lifetimes Page 222
Study	**Primary Source**
CALMAC Public Workshops	CALMAC Public Workshops on PY Energy Efficiency Programs, Appendix C2, "Proposed Effective Useful Life for Measures for PY2001 Program Elements"
Vermont Technical Potential Study	GDS Associates, Inc., "Vermont Electric Energy Efficiency Potential Study, Final Report", prepared for the VT DPS, May 10, 2006
California Public Utilities Commission (CPUC) and California Energy Commission	Database Energy Efficient Resource Database
Skumatz and Gardner	Skumatz, Woods, and Dimetrosky, "Review of Retention and Persistence Studies for the California Public Utilities Commission (CPUC)", October 2004, prepared for California Public Utilities Commission, San Francisco, CA.
Efficiency Vermont	Efficiency Vermont TRM Users Manual 2006-41

APPENDIX C – Additional Documentation on Targeted Measures and Preliminary Measure Life Value Data for Other Residential and C&I End Use Equipment

Residential Measures	Current Value (in Years, or Hours if indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low-Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Interior Lighting				
Bulb - CFL screw base	NG	9		EL and Measure Persistence
	VEIC	6.4		Retrofit: EL(most CFL's have a rated lifetime of 10,000 hrs but actual operating hrs based on site-specific data; daily burn time presented in "CFL Life by Daily Burn Time" table on p. 384 of VT TRM allows for variation in lifetime hours from 3,000 to 12,000) & MP(assumed to be 1.0) New Construction: EL(=6.4; based on 1,102 operating hrs/yr) & MP(assumed to be 1.0), no source listed LI SF MF: EL(daily burn time presented in "CFL Life by Daily Burn Time" table on p. 203 of VT TRM allows for variation in lifetime hours from 3,000 to 12,000) & MP(assumed to be 1.0), no source listed
	CT	5 - 13 LI, SF, MF		EL (=5 - 13 years based on rated hours with 20% reduction based on effects of cycling, In a situation where the bulb life for an Energy Star bulb is unknown, assume the minimum average life of 5 years; operating hours 2.6 hours/day [5,6]) & MP (assumed to be 1.0); no source listed
	ME	7.6 years		EL(=7.6 years or 7500 hours [9]; based on 986 operating hrs/yr) & MP(assumed to be 1.0)
	PSNH	RC 8.1; RS 6.4; 8.6 ES Homes		RC EL=8.1 10,000 hours at 3.4 hours/day; RS EL=6.4 8,000 hours at 3.4 hours/day; New Const EL=8.6 for Energy Star Homes Program
	CALMAC	6; 7.2; 9		EL(=6 [22]; 7.2 [19]; 9 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	7.6		EL, manufacturer data and stipulated values [23]
	Sku	9.4; 9.4-16		EL(=9.4 based on 8,000 hr manufacturer rated life and average operating hrs of 2.34/day [40]; 9.4-16 [38])
Exit Sign - LED	VEIC		10	EL(=10; based on 8,760 operating hrs/yr) & MP(assumed to be 1.0)
Fixture - CFL	NG	20		EL and Measure Persistence
	PSNH	20		Home Energy Solutions/Home Energy Assistance Programs [17]
	CT-07	20		[16]
	VT TPS		10.87 - 12.08	EL, manufacturer data and stipulated values, 10.87 for homes withouth CFL installation, 12.08 for homes with partial CFL installation [23]
	Sku	16		EL(=16) [37] [38] & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - CFL hardwired	NG	20		EL and Measure Persistence
	CT	20 LI, SF, MF		EL (=20 years; operating hours 3.2 hours/day [7]) & MP(assumed to be 1.0); no source listed
	PSNH	20		Home Energy Solutions/Home Energy Assistance Programs [17]
	CALMAC	16; 20		EL(=16 [18]; 20 [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - CFL integral	NG	20		EL and Measure Persistence
	CALMAC	6; 7.2; 9		EL(=6 [22]; 7.2 [19]; 9 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	9.4		EL(=9.4) [6] [32]
Fixture - CFL modular	NG	20		EL and Measure Persistence
	CALMAC	16; 20		EL(=16 [18]; 20 [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	16	-	EL(=16) [6] [29] [30] [34]
Fixture - CFL table lamp	NG	5		EL and Measure Persistence
	VEIC	10		
	CT	8 LI, SF, MF		EL (=8 years; operating hours 3.2 hours/day [7]) & MP(assumed to be 1.0); no source listed
	PSNH	10		Energy Star Lighting Program [17]
	DEER	16		EL(=16) [6] [29] [34]
Fixture - CFL unspecified	NG	5		EL and Measure Persistence
	Sku	16		EL(=16 [37] [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TRM	LI MF: 20		EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0)
Fixture - CFL Torchiere	NG	5		EL and Measure Persistence
	VEIC	10		EL(=10, based on lamp life of 6.26 yrs and ballast life of 32.88 yrs from "Component Costs and Lifetimes Used in Computing O&M Savings Residential Applications" table on p. 306 of VT TRM, and annual usage of 3.4 hrs/day) & MP(assumed to be 1.0), no source listed
	CT	8 LI, SF, MF		EL (=8 years; operating hours 3.2 hours/day [7]) & MP(assumed to be 1.0); no source listed
	ME	10 years		EL(=10 years [13]; based on 912.5 operating hrs/yr [14]) & MP(assumed to be 1.0)
	PSNH	10		[17]
	CALMAC	9.4		EL(=9.4 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	9	-	EL(=9) [6] [29] [34]

Residential Measures	**Current Value (in Years, or Hours if indicated)*** May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low-Income (LI)			**Basis and Documentation Source(s)** Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Fixture - Circline	NG	20		EL and Measure Persistence
	ME	10 years		EL(=10 years [15]; based on 1,460 operating hrs/yr [12]) & MP(assumed to be 1.0)
	VT TRM	LI MF: 20		EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0)
Fixture - Common Area	NG	20		EL and Measure Persistence
Fixture - Flood	NG	20		EL and Measure Persistence
Fixture - Fluorescent	NG	20		EL and Measure Persistence
	VEIC	20		New Construction: EL(=20; operating hrs are 1,102/yr) & MP(assumed to be 1.0), no source listed LI MF: EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0) LI SF: EL(=20, based on lamp life of 6.26 yrs and ballast life of 25.05 yrs from "Component Costs and Lifetimes Used in Computing O&M Savings Residential Applications" table on p. 304 of VT TRM, and annual usage of 3.4 hrs/day) & MP(assumed to be 1.0), no source listed
	ME	20 years		EL(=20 years [10]; based on 766.5 operating hrs/yr [11]) & MP(assumed to be 1.0) [10]
	CALMAC	17		EL(=17 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	11; 15; 16		EL(=11 [39]; 15 [37]; 16 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - HID High Pressure Sodium (HPS)	NG	20		EL and Measure Persistence
	DEER	16	-	EL(=16) [33]
Fixture - HID Metal Halide (MH)	NG	20		EL and Measure Persistence
	DEER	16	-	EL(=16) [33]
	VT TRM	LI MF: 20		EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0)
Fixture - Med Cabinet	NG	20		EL and Measure Persistence
Fixture - Sconce	NG	20		EL and Measure Persistence
Floor Lamp	VEIC	10		
Ceiling Fan w/ Energy Star Light Fixture	VEIC	20		
Generic Linear Fluorescent Tube Fixture	VEIC		20	
Indoor Fixture Unspecified	CALMAC	14; 20		EL(=14 [19]; 20 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
CFL Lighting Package Reinstall	VT TRM	LI MF: 6.2		EL(=6.2, based on life of standard CFL, 10,000 hrs and annual operating hours of 1,372; varying daily hours of usage from 1 to 24 changes the lifetime hours from 3,000 to 12,000, and this information is presented in Table A on page 211 of VT TRM) & MP(assumed to be 1.0), no source listed

Residential Measures	Current Value (in Years, or Hours if indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low-Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Exterior Lighting				
Bulb - CFL	NG	9		EL and Measure Persistence
	PSNH	8.1		EL=8.1 10,000 hours at 3.4 hours/day
	VEIC		3.9	Retrofit: New Construction: EL(=3.9; based on 2,190 operating hrs/yr or 6 hrs/day assumed usage [52]) & MP(assumed to be 1.0) LI SF MF: EL(daily burn time presented in "CFL Life by Daily Burn Time" table on p. 202 of VT TRM allows for variation in lifetime hours from 3,000 to 12,000) & MP(assumed to be 1.0), no source listed
	CALMAC	6; 7.2; 9		EL(=6 [22]; 7.2 [19]; 9 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	9.4; 9.4-16		EL(=9.4 based on 8,000 hr manufacturer rated life & average operating hrs of 2.34/day [40]; 9.4-16 [38])
Fixture - CFL hardwired	NG	15		EL and Measure Persistence
	CT	20 LI		EL (=20 years; operating hours 3.2 hours/day [7] for general exterior lighting and 12 hour/day for security exterior lighting) & MP(assumed to be 1.0); no source listed
	PSNH	20		
	CALMAC	16; 20		EL(=16 [18]; 20 [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - CFL integral	NG	15		EL and Measure Persistence
	CALMAC	6; 7.2; 9		EL(=6 [22]; 7.2 [19]; 9 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	7.1		EL(=7.1) [6] [32]
Fixture - CFL modular	NG	15		EL and Measure Persistence
	CALMAC	16; 20		EL(=16 [18]; 20 [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	16	-	EL(=16) [6] [29] [30] [34]
Fixture - CFL unspecified	NG	15		EL and Measure Persistence
	PSNH	16		Energy Star Lighting Program [17]
	Sku	16		EL(=16 [37] [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TRM	LI MF: 20		EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0)
Fixture - Flood	NG	15		EL and Measure Persistence
Fixture - Fluorescent	NG	15		EL and Measure Persistence
	VEIC	20		
	CALMAC	17		EL(=17 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	11; 15; 16		EL(=11 [39]; 15 [37]; 16 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - HID HPS; HID MH	NG	15		EL and Measure Persistence
	VEIC		20	EL(=20; operating hrs are 2,920/yr) & MP(assumed to be 1.0), no source listed
	DEER	16	-	EL(=16) [33]
Fixture - Sconce	NG	15		EL and Measure Persistence
Outdoor Fixture - unspecified	CALMAC	20		EL(=20 [19] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Other/Unspecified				
Electronic Ballast (non-dimming or dimming)	DEER	11		EL(=11) [34]
	Sku	10; 11; 16		EL(=10 [39]; 11 [37]; 16 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Lighting - RCP	CALMAC	16		EL(=16 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Ballast - Fluorescent	Sku	11; 15; 16		EL(=11 [39]; 15 [37]; 16 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Lighting Controls				
Daylighting				
Occupancy Sensor - plug loads	DEER	10		EL(=10) [33]
Occupancy Sensor - wall box	DEER	8		EL(=8) [33]
Occupancy Sensors	VEIC		15	
Photocell w/timeclock				
Timeclock				
Controls - unspecified	VT TRM	LI SF: 10		EL(=10 [42]) & MP(assumed to be 1.0)
Exterior Motion Sensor	VT TRM	-	15	EL(=15 [51]; based on 650 reduced operating hrs/yr) & MP(assumed to be 1.0)

Residential Measures	Current Value (in Years, or Hours if indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low-Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Heating				
Burner replacement	NG	20		EL and Measure Persistence [1]
ECM Air Furnace	NG	18		EL and Measure Persistence [2]
	VEIC	18		
	CT-07	19		[16]
Furnace replacement	NG	20		EL and Measure Persistence [1]
	VEIC	20		
	DEER	18		EL(=18) [34]
	Sku	18; 20	18; 20	EL(=18 [37] [39]; 20 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Heat Pump replacement	NG	18		EL and Measure Persistence [2]
	CT	19		EL (=19 years 8.5 or higher HSPF; operating hours 1500) & MP(assumed to be 1.0); no source listed
	CALMAC	16; 18		EL(=16 [18]; 18 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	15		EL(=15 [37] [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Heating System replacement	NG	20		EL and Measure Persistence [1]
Heating System repair/service	NG	5		
HP flow/charge	NG	18		EL and Measure Persistence [2]
Pipe Wrap	NG	25		EL and Measure Persistence [3]
	VEIC	6		
	CT	20 LI		EL (=20 years) & MP(assumed to be 1.0); no source listed
	CALMAC	15		EL(=15 [18] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	13		EL, stipulated values [24]
	DEER	15		EL(=15) no source listed
	VT TRM	10 LI SF: 10	13 LI SF: 10	Retrofit: EL(=10 [41]) & MP(assumed to be 1.0) New Construction: EL(=13, average life of water heater) & MP(assumed to be 1.0), no source listed LI SF: EL(=10) & MP(assumed to be 1.0), no source listed
Tank Wrap	VEIC	6		EL(=6 [41]) & MP(assumed to be 1.0)
	VT TPS	7	-	EL, market driven [4]
Tank Temperature Turn-Down	VEIC	4	7 LI SF: 4	Retrofit: EL(=4) & MP(assumed to be 1.0), no source listed New Construction: EL(=7, average life of water heater) & MP(assumed to be 1.0), no source listed LI SF: EL(=4) & MP(assumed to be 1.0), no source listed
	CT	5 LI		EL (=5 years since the water heater is not a new one and it will have a limited life, page 181 [1])
Shell Heating Savings	VEIC		25	
Efficient Space Heating - Oil, LP Boilers	VEIC	25		EL(=25 [49]) & MP(assumed to be 1.0) LI MF: EL(=25) & MP(assumed to be 1.0), no sources listed
Efficient Space Heating - Space Heaters (Oil, LP, Kero)	VEIC	15		EL(=15 [49]) & MP(assumed to be 1.0)
Fossil Fuel Water Heater	VEIC		25	
Hot Water Fuel Switch-Oil-Water Heater	VEIC	10		EL(=10 [48]) & MP(assumed to be 1.0)
Hot Water Fuel Switch-Oil-(or NG or LP or Kero) Storage Tank & Instantaneous	VEIC	15		EL(=15 [48]) & MP(assumed to be 1.0)
Hot Water Fuel Switch-NG-(or LP) Water Heater	VEIC	13		EL(=13 [48]) & MP(assumed to be 1.0)
Waterbed Insulation	NH	10		[17]
Water Heater (gas)	CALMAC	12.2; 13; 15		EL(=12.2 [18]; 13 [21] [22]; 15 [20]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	-	13	EL(=13) [31] [34] [35]
Water Heater (point of use)	DEER	20		EL(=20) [36]
Water Heater (electric)	DEER	-	15	EL(=15) [31] [34] [35]
Water Heater (heat pump)	DEER	-	10	EL(=10) [31] [34] [35]
Solar Water Heating	VT TPS	20	-	EL [27]
Water Heater	PSNH		13	Energy Star Homes Progam [17]
	VT TPS	13		EL [27]
Furnace Fan Motor	VT TPS	18		EL, stipulated values [24]
	VT TRM	18	18	EL(=18 [45]; operating hrs are 375/yr [44] [46]) & MP(assumed to be 1.0)
Furnace Replacement	VT TRM	20	-	EL(=20 [49]) & MP(assumed to be 1.0)

Residential Measures	**Current Value (in Years, or Hours if indicated)*** May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low-Income (LI)			**Basis and Documentation Source(s)** Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Cooling				
Central AC replacement	NG	18		EL and Measure Persistence [2]
	VEIC	18	25	Retrofit: EF(=18; based on operating hrs of 375/yr [50]) & MP(assumed to be 1.0) New Construction: EF(=25; based on operating hrs of 200 hrs/yr [47]) & MP(assumed to be 1.0)
	CT	19 LI, SF, MF		EL (=19 years SEER 14; operating hours 500) & MP(assumed to be 1.0); no source listed
	PSNH	18		EL and Measure Persistence [2]
	CALMAC	18		EL(=18 [18] [19] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	18		EL, market driven [4]
	Sku	15; 18		EL(=15 [38]; 18 [37] [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Cooling System	NG	18		EL and Measure Persistence [2]
	PSNH	18		EL and Measure Persistence [2]
Evaporative Cooler	CALMAC	7		EL(=7 [18] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	15		EL(=15) [34]
	Sku	15		EL(=15 [37] [38] [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Refrigerant Charge	NG	18		EL and Measure Persistence [2]
	CT-07	5		AC System Tune-up [16]
	PSNH	18		EL and Measure Persistence [2]
	DEER	10		EL(=10) [29]
Room AC replacement	NG	12		EL and Measure Persistence [4]
	VEIC	13		
	CT	13 LI, SF, MF		EL (=13 years; operating hours 500) & MP(assumed to be 1.0); no source listed
	PSNH	12; 13		EL and Measure Persistence [4]; EL=13 for Energy Star Appliance Program
	CALMAC	11; 15		EL(=11 [20]; 15 [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	12		EL, market driven [4]
	VT TRM	LI MF: 10		EL(=10, based on 500 operating hrs/yr [44]) & MP(assumed to be 1.0), no sources listed
Shell Cooling Savings	VEIC		25	
AC (gas)	CALMAC	25		EL(=25 [21] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Split System AC	DEER	18		EL(=18) [34]
AC (unspecified)	Sku	15; 18		EL(=15 [38]; 18 [37] [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Ventilation				
Fans - whole house	NG	25		EL and Measure Persistence [3]
	VT TRM	- LI MF: 10	10 LI MF: 10	EL(=10; based on operating hrs of 2,817/yr [43]) & MP(assumed to be 1.0)
Insulation	NG	25		EL and Measure Persistence [3]
	VEIC	20		EL(=20) & MP(assumed to be 1.0), no source listed
	CT	25 LI, SF, MF		EL (=25 years) & MP(assumed to be 1.0); no source listed
	PSNH	25		Home Energy Solutions; Home Energy Assistance Programs [17]
	CALMAC	25		EL(=25 [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	20	-	EL, studies [26]
	DEER	20		EL(=20) [33]
	VT TRM	LI MF: 25		EL(=25) & MP(assumed to be 1.0), no sources listed
Ventilation Fan	PSNH		19	Energy Star Homes Progam [17]
	VEIC		10	
Insulation (ceiling/floor)	CALMAC	25		EL(=25 [18] [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Insulation (walls)	CALMAC	20; 25		EL(=20 [20]; 25 [18] [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HVAC Controls				
AC Timers	NG	5		
	PSNH	5		Home Energy Solutions; Home Energy Assistance Programs [17]
Programmable Thermostat	NG	10		EL and Measure Persistence [1]
	CT	10 LI, SF, MF		EL (=10 years) & MP(assumed to be 1.0); no source listed
	PSNH	12		[17]
	CALMAC	12		EL(=12 [18] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	10		EL [28]
	DEER	12		EL(=12) [33]
Water Heater Controls	CALMAC	15		EL(=15 [21] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)

Residential Measures	Current Value (in Years, or Hours if indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low-Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Other				
AC or HP Commisioning AC or HP ECM	NG	18		EL and Measure Persistence [2]
	CT	19		EL (=19 years; operating hours 500 cooling, 1500 heating) & MP(assumed to be 1.0); no source listed
AC/Heat Pump	NG	18		EL and Measure Persistence [2]
	CT-07	19		[16]
	DEER	15		EL(=15) [34]
Air Sealing	NG	15		EL and Measure Persistence [3]
	VEIC	20		EL(=20) & MP(assumed to be 1.0), no source listed
	PSNH	15		
Dehumidifier	NG	12		EL and Measure Persistence [4]
	CT-07	12		[16]
Duct Insulation - heating/cooling; heating; cooling; oil heat	NG	20		EL and Measure Persistence [3]
	CT	20 LI		EL (=20 years) & MP(assumed to be 1.0); no source listed
Duct Sealing - heating/cooling	NG	15		EL and Measure Persistence [3]
	VEIC	15		
	DEER	18		EL(=18) [34]
Duct Sealing - heating	NG	15		EL and Measure Persistence [3]
	CT	25 SF, MF; 20 LI		LI EL (=20 years) SF, MF EL (=25 years) & MP(assumed to be 1.0); no source listed
	VT TRM	15	-	EL(=15) & MP(assumed to be 1.0), no source listed
Duct Sealing - cooling	NG	15		EL and Measure Persistence [3]
Refrigerant Charge w/duct sealing	NG	18		EL and Measure Persistence [2]
	DEER	15		EL(=15) [29]
Weatherization	NG	25		EL and Measure Persistence [3]
	CT	5 LI; 20 LI		EL (=5 year) - Weatherstrip window, door sweep or kit; EL (=20 year) - default custom weatherization measure; & MP(assumed to be 1.0); no source listed
	VT TPS	20	-	EL, studies [26]
	DEER	LI: 13		EL(=13) [35]
Windows - low SHGC, or high performance	NG	20		EL and Measure Persistence [1] shows measure life of 35 adjusted to 20 for MA common assumptions.
	PSNH	25		
	CALMAC	20; 25		EL(=20 [20]; 25 [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	35	-	EL [25]
	DEER	20		EL(=20) [33]
Windows - single pane clear	DEER	10	-	EL(=20) [33]
AC Tuneup	CT	5		EL (=5 years; operating hours 500) & MP(assumed to be 1.0); no source listed
Waterbed Cover	CT	3 LI		EL (=3 years) & MP(assumed to be 1.0); [8]
Caulking & Sealing	CT	10 LI		EL (=10 year) & MP(assumed to be 1.0); no source listed
AC (w/integrated water heating)	CALMAC	15		EL(=15 [18] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Advanced HVAC tune-up	CALMAC	18		EL(=18 [18] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Advanced HVAC diagnostic tune-up	CALMAC	15		EL(=15 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Basic HVAC diagnostic tune-up	CALMAC	10		EL(=10 [18] [19] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Duct Testing (and sealing)	CALMAC	20; 25		EL(=20 [20]; 25 [18] [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	-	15; 18; 25	EL(=15 [38]; 18 [37]; 25 [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HVAC/Refrigeration - RCP	CALMAC	20		EL(=20 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Low Flow Showerhead	CALMAC	10		EL(=10 [18] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	10	-	EL(=10) [31] [34] [35]
	VT TRM	9 LI SF MF: 9	9 LI SF MF: 9	EL(=9 [41]) & MP(assumed to be 1.0)
Room AC (turn-in)	VT TPS	6		EL, turn-in measure so measure life divided by two [4]
Windows - default w/sunscreen	DEER	10		EL(=20) [33]
High Efficiency Ducts	Sku	-	15; 18; 25	EL(=15 [38]; 18 [37]; 25 [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)

* Measure life values may vary by type of installation (i.e., retrofit/early replacement, new construction/replace on burnout)

Residential Data Sources

Utility/Study	Detail
NG	[1] B/C Screening Results for Regional Natural Gas Energy Efficiency Programs prepared by GDS for Gas Networks, March 25, 2004, page C-17.
NG	[2] Harvey Sachs study, Jan. 2003, p. 11.
NG	[3] Directive of MA NUP consultants.
NG, VT TPS	[4] Measure Life from Energy Star.gov Savings Calculator.
CT	[5] UI/CL&P C&LM Program Savings Documentation -2006
CT, DEER	[6] "CFL Metering Study", prepared for Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison by Kema Inc, February 25, 2005
CT	[7] Northeast Utilities and United Illuminating Retail/Point of Purchase Lightin gProgram Impact Evaluation, RLW Analytics, April 2003
CT	[8] Home Energy Magazine online September/October 1994
ME	[9] Impact evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs. Nexus Market Research & RLW Analytics. October 1, 2004. Pages 11-12.
ME	[10] Assumptions for Residential Lighting Fixtures, EPA Savings Calculator – Lighting Fixtures
ME	[11] Massachusetts, Rhode Island and Vermont Impact Evaluation Report, 2004
ME	[12] Assumptions for Residential Lighting Fixtures, EPA Savings Calculator – Lighting Fixtures; Massachusetts, Rhode Island and Vermont Impact Evaluation Report
ME	[13] Residential Torchiere Assumptions, EPA Savings Calculator – Torchieres
ME	[14] Engineering estimate of wattage savings and annual hours use of 912.5 hours from October 1, 2004 Massachusetts, Rhode Island and Vermont Impact Evaluation Report
ME	[15] Assumptions for Ceiling Fans with Lighting, EPA Savings Calculator – Ceiling Fans, 2005
CT-07	[16] UI/CL&P C&LM Program Savings Documentation -2007 Table 1.4 Lifetimes Residential Program Measure Lives Page 22
PSNH	[17] PSNH Weatherization Program; Home Energy Solutions Program; Home Energy Assistance Program
CALMAC	[18] Original EUL: Pacific Gas & Electric Company (PG&E)
CALMAC	[19] Original EUL: Southern California Edison Company (SCE)
CALMAC	[20] Original EUL: San Diego Gas and Electric Company (SDG&E)
CALMAC	[21] Original EUL: Southern California Gas Company (SoCalGas)
CALMAC	[22] Proposed EUL
VT TPS	[23] manufacturer data: product package gave useful life in hours, and hourly usage is from Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs, October 2004, GDS Associates
VT TPS	[24] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37
VT TPS	[25] "Selecting Targets for Market Transformation Programs", August 1998, ACEEE report
VT TPS	[26] GDS calculation based on program incentive figures from KeySpan Weatherization program completed in
VT TPS	[27] "Consumer Guide to Home Energy Savings" 8th ed., 2003, ACEEE
VT TPS	[28] phone call with Honeywell by Dick Spellman in 2001
DEER	[29] engineering judgement
DEER	[30] “Evaluation of Pacific Gas & Electric Company's 1997 Commercial Energy Efficiency Incentives Program: Lighting Technologies”, prepared by Quantum Consulting, Inc., for Pacific Gas & Electric Company, March 1,
DEER	[31] “Evaluation of Pacific Gas & Electric Company’s 1995 Nonresidential Energy Efficiency Incentives Program for Commercial Sector Lighting Technologies”, prepared by Quantum Consulting, Inc., for Pacific Gas & Electric
DEER	[32] DEER
DEER	[33] CALMAC Effective Useful Life Report, September 2000
DEER	[34] "Revised/Updated EULs Based on Retention and Persistence Studies Results", July 2005, SERA Inc.
DEER	[35] DEER 4.0 1996
DEER	[36] US DOE Technical Brief: "Demand (Tankless or Instantaneous) Water Heaters", January, 2004
Sku	[37] DEER Newly Adopted EUL (2005)
Sku	[38] Interim/previous DEER EUL
Sku	[39] A Priori Protocols EUL
Sku	[40] CFL_EUL.xls from Gary Cullen, Itron, 5/12/05
VT TRM	[41] DPS screening of Efficiency Utility Core programs
VT TRM	[42] previous REEP program reporting and screening
VT TRM	[43] DPS screening of RNC program
VT TRM	[44] Air Conditioning and Refrigeration Institute data for Vermont, www.ari.org
VT TRM	[45] Sachs and Smith, 2003
VT TRM	[46] VEIC experience in other states suggest that ARI estimates for AC tend to be overstated; to compensate, EVT applied a 0.75 multiplier
VT TRM	[47] Vermont State Cost Effectiveness Screening Tool
VT TRM	[48] EVT estimate
VT TRM	[49] previous estimates used by EVT in the state screening tool
VT TRM	[50] U.S. Climate Cooling Region 2 Full Load Hours; EVT applied 25% adjustment factor
VT TRM	[51] DPS core program screening
VT TRM	[52] based on estimate developed through EVT communications with VT Department of Service and Residential

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Lighting				
Fluorescent	NG	13	15	EL and Measure Persistence [1]
	VEIC	3.4		
	PSNH	13	15	EL and Measure Persistence [1]
	CT-07	13	15	[48]
	CALMAC	16		EL(=16 [4] [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	11; 16		EL(=11 [17] [36]; 16 [18]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Hardwired CFL	NG	13	15	EL and Measure Persistence [1]
	VEIC	15		EL(=15; operating hours are collected from prescriptive application form or by using "interior lighting operating hours by building type" table on page 56 of VT TRM [44]) & MP(assumed to be 1.0)
	PSNH	13	15	EL and Measure Persistence [1]
	CT-07	13	15	[48]
	CALMAC	10; 16		EL(=10 [5]; 16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	15		EL&MP, manufacturer data, studies [9]
LED Exit Signs	NG	13	15	EL and Measure Persistence [1]
	VEIC	10		EL(=10, operating hours of 8,760/yr), no source listed
	PSNH	13	15	EL and Measure Persistence [1]
	CALMAC	15; 16		EL(=15 [5]; 16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	10		EL&MP, manufacturer data, studies [9]
	DEER	16		EL(=16) [19] [20]
HID	NG	13	15	EL and Measure Persistence [1]
	VEIC	15		EL(=15; operating hours are collected from prescriptive application form or default of 3,338 hrs is used [45])
	PSNH	13	15	EL and Measure Persistence [1]
	CT-07	13	15	[48]
	VT TPS	15		EL&MP, manufacturer data, studies [9]
T8 Fixture w/ electronic ballast	VEIC	15		EL(=15; operating hours are collected from prescriptive application form or by using "operating hours by building type" table on page 53 of VT TRM [44]) & MP(assumed to be 1.0)
Electronic Ballast (non-dimming or dimming)	CT-07	13		[48]
	CALMAC	10; 16		EL(=10 [5]; 16 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
LED Traffic/Pedestrian Signals	VEIC	10		EL(operating hrs based on type of signal from page 67 of VT TRM [46]) & MP(assumed to be 1.0); 100,000 hrs, capped at 10 yrs
Metal Hallide track	VEIC	15		EL(=15; operating hours are collected from prescriptive application form or from "operating hours by building type" table on page 73 of VT TRM [44]) & MP(assumed to be 1.0)
Metal Halide (MH)	DEER	16	-	EL(=16) [19] [20] [21]
Lighting Power Density	VEIC	15		EL(=15; operating hours determined on a site-specific basis, or by building type using "interior lighting operating hours by building type" table on page 108 of VT TRM [44]) & MP(assumed to be 1.0)
	CALMAC	10; 16		EL(=10 [5]; 16 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Lighting	CT	15	20	Retrofit: EL (=15 years, Operating hours are determined on a case by case basis or taken from Table 2.0.0 page 233 [3]) New: EL (=20 years, Operating Hours taken from Table 2.0.0 page 233 [3]), no source listed

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
CFL Lamp (screw-in replaceable)	CALMAC	7.7; 10		EL(=7.7 [4] [6] [8]; 10 [5]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
CFL Bulbs (integral)	VT TPS	3.4		EL&MP, manufacturer data, studies [9]
Delamping/fixture modification/remove lamps	CALMAC	16		EL(=16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Exit Signs (CFL hardwire kit, LED, or electroluminescent)	CALMAC	15; 16		EL(=15 [5]; 16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Halogen Lamp	CALMAC	0.6		EL(=0.6 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Halogen Bulbs (infra-red)	VT TRM	4,000 hrs (rated)		EL(most IR halogens have a rated lifetime of 4,000 hrs; depending on hrs of operation, lifetime can differ according to "operating hours by building type" table on page 112 of VT TRM [44]) & MP(assumed to be 1.0)
HID Fixture	CALMAC	10; 16		EL(=10 [5]; 16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HID Fixture (w/electronic ballast)	VT TRM	15		EL(=15; operating hours are collected from prescriptive application form or by using "operating hours by building type" table on page 121 of VT TRM [44]) & MP(assumed to be 1.0)
Induction Lamps	CALMAC	1.7		EL(=1.7 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Induction Fixture	CALMAC	16		EL(=16 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Indoor/Outdoor System Modification	CALMAC	15; 16		EL(=15 [5]; 16 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
SPC Lighting	CALMAC	16		EL(=16 [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Electronic Ballast (for display case)	CALMAC	16		EL(=16 [4] [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
CFL Fixture (vapor-proof)	VT TPS	10.05		EL(=15 without MP, 10.05 with MP) &MP(=0.67), manufacturer data, studies [9]
Fluorescent Fixture	VT TPS	15		EL&MP, manufacturer data, studies [9]
Ballast (integrated metal halide)	VT TPS	3.4		EL&MP, manufacturer data, studies [10]
Metal Halide Fixture	VT TPS	15		EL&MP, manufacturer data, studies [9]
Halogen Bulb (infrared)	VT TPS	1.3		EL&MP, manufacturer data, studies [10]
High Pressure Sodium (HPS)	DEER	16	-	EL(=16) [19] [20]
Low Pressure Sodium (LPS)	DEER	16	-	EL(=16) [19] [20]
Fluorescent Fixture (w/electronic ballast)	DEER	-	11	EL(=11) [19] [20] [21]
Fluorescent Fixture (w/dimming electronic ballast)	DEER	-	11	EL(=11) [19] [20] [21]
De-lamp (from fixture)	DEER	11	-	EL(=11) [19] [20] [21]
Electroluminescent Exit Signs	DEER	16		EL(=16) [19] [20]

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Integral CFL (Education - Primary School)	DEER	5.6		EL(=5.6) [33] [35]
Integral CFL (Education - Secondary School)	DEER	3.5		EL(=3.5) [33] [35]
Integral CFL (Education - Community College)	DEER	2.1		EL(=2.1) [33] [35]
Integral CFL (Education - University)	DEER	2.6		EL(=2.6) [33] [35]
Integral CFL (Grocery)	DEER	1.4		EL(=1.4) [33] [35]
Integral CFL (Health/Medical - Hospital)	DEER	0.9		EL(=0.9) [33] [35]
Integral CFL (Health/Medical - Nursing Home)	DEER	0.9		EL(=0.9) [33] [35]
Integral CFL (Lodging - Hotel)	DEER	0.9		EL(=0.9) [33] [35]
Integral CFL (Lodging - Motel)	DEER	0.9		EL(=0.9) [33] [35]
Integral CFL (Lodging - Guest Rooms)	DEER	7		EL(=7) [33] [35]
Integral CFL (Manufacturing - Light Industrial)	DEER	2.8		EL(=2.8) [33] [35]
Integral CFL (Office - Large)	DEER	2.9		EL(=2.9) [33] [35]
Integral CFL (Office - Small)	DEER	3.2		EL(=3.2) [33] [35]
Integral CFL (Restaurant - Sit-Down)	DEER	2.3		EL(=2.3) [33] [35]
Integral CFL (Restaurant - Fast-Food)	DEER	1.3		EL(=1.3) [33] [35]
Integral CFL (Retail - 3-Story Large)	DEER	1.9		EL(=1.9) [33] [35]
Integral CFL (Retail - Single-Story Large)	DEER	1.8		EL(=1.8) [33] [35]
Integral CFL (Retail - Small)	DEER	2.1		EL(=2.1) [33] [35]
Integral CFL (Storage - Conditioned)	DEER	2.8		EL(=2.8) [33] [35]
Integral CFL (Storage - Unconditioned)	DEER	2.8		EL(=2.8) [33] [35]
Integral CFL (Warehouse - Refrigerated)	DEER	3.1		EL(=3.1) [33] [35]
Modular CFL	DEER	12	-	EL(=12) [20] [23] [33] [34]
CFL Fixture	Sku	12;16		EL(=12 [17] [36]; 16 [18]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Electronic Ballast (non-dimming or dimming)	Sku	10; 11; 16		EL(=10 [36]; 11 [17]; 16 [18]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fluorescent Lamps	Sku	5		EL(=5 [17] [36]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Delamp/reflectors	Sku	11		EL(=11) [17] & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Optical Reflectors	Sku	10	12	Retrofit: EL(=10 [17]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies) New Construction: EL(=12 [17]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HID (interior)	Sku	16		EL(=16) [17] [18] [36] & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HID Fixture Upgrade (pulse start Metal Halide)	CT-07	13	15	[48]
	VT TRM	15		EL(=15; operating hours are collected from prescriptive application form or from "operating hours by building type" table on page 73 of VT TRM [44]) & MP(assumed to be 1.0)
CFL Bulb	Sku	5-9.4; 5.8-14		EL(=5-9.4 [18]; 5.8-14 [36]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TRM	10,000 hrs (rated)		EL(most CFL's have a rated lifetime of 10,000 hrs; depending on hrs of operation, lifetime can differ according to prescriptive application form or from reference tables on page 78 of VT TRM [44]) & MP(assumed to be 1.0)
CFL Bulb (Education - Primary School)	Sku	5.56		EL(=5.56 based on 1,440 operating hrs) [37]
CFL Bulb (Education - Secondary School)	Sku	3.47		EL(=3.47 based on 2,305 operating hrs) [37]
CFL Bulb (Education - Community College)	Sku	2.11		EL(=2.11 based on 3,792 operating hrs) [37]
CFL Bulb (Education - University)	Sku	2.6		EL(=2.6 based on 3,073 operating hrs) [37]
CFL Bulb (Grocery)	Sku	1.37		EL(=1.37 based on 5,824 operating hrs) [37]
CFL Bulb (Health/Medical - Hospital)	Sku	0.92		EL(=0.92 based on 8,736 operating hrs) [37]
CFL Bulb (Health/Medical - Nursing Home)	Sku	0.92		EL(=0.92 based on 8,736 operating hrs) [37]
CFL Bulb (Lodging - Hotel)	Sku	0.92		EL(=0.92 based on 8,736 operating hrs) [37]
CFL Bulb (Lodging - Motel)	Sku	0.92		EL(=0.92 based on 8,736 operating hrs) [37]
CFL Bulb (Lodging - Guest Rooms)	Sku	6.99		EL(=6.99 based on 1,145 operating hrs) [37]
CFL Bulb (Manufacturing - Light Industrial)	Sku	2.8		EL(=2.8 based on 2,860 operating hrs) [37]
CFL Bulb (Office - Large)	Sku	2.92		EL(=2.92 based on 2,739 operating hrs) [37]
CFL Bulb (Office - Small)	Sku	3.21		EL(=3.21 based on 2,492 operating hrs) [37]
CFL Bulb (Restaurant - Sit-Down)	Sku	2.32		EL(=2.32 based on 3,444 operating hrs) [37]
CFL Bulb (Restaurant - Fast-Food)	Sku	1.29		EL(=1.29 based on 6,188 operating hrs) [37]
CFL Bulb (Retail - 3-Story Large)	Sku	1.88		EL(=1.88 based on 4,259 operating hrs) [37]
CFL Bulb (Retail - Single-Story Large)	Sku	1.83		EL(=1.83 based on 4,368 operating hrs) [37]
CFL Bulb (Retail - Small)	Sku	2.15		EL(=2.15 based on 3,724 operating hrs) [37]
CFL Bulb (Storage - Conditioned)	Sku	2.8		EL(=2.8 based on 2,860 operating hrs) [37]
CFL Bulb (Storage - Unconditioned)	Sku	2.8		EL(=2.8 based on 2,860 operating hrs) [37]
CFL Bulb (Warehouse - Refrigerated)	Sku	3.08		EL(=3.08 based on 2,600 operating hrs) [37]
Dairy Farm Hard-wired Vapor-Proof CFL Fixture (w/electronic ballast)	VT TRM	10		EL(=10 adjusted for persistence from engineering measure life of 15 yrs; operating hours of 2,679 [38]) & MP(assumed to be 67%)
Dairy Farm Vapor-Proof Fluorescent Fixture (w/electronic ballast)	VT TRM	15		EL(=15; operating hrs of 2,679 [38]) & MP(assumed to be 1.0)
Fluorescent High-Bay Fixtures (T5)	VT TRM	15		EL(=15; operating hours are collected from prescriptive application form or by using "interior lighting operating hours by building type" table on page 97 of VT TRM [44]) & MP(assumed to be 1.0)
T5 Fixtures and Lamp/Ballast Systems	VT TRM	15		EL(=15; operating hours are collected from prescriptive application form or by using "interior lighting operating hours by building type" table on page 127 of VT TRM [44]) & MP(assumed to be 1.0)
Low-Voltage Tungsten Halogen Fixtures	CT-07	13	15	[48]

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Lighting Controls				
Occupancy Sensors	NG	9	10	EL and Measure Persistence [1]
	VEIC	10		EL(=10; operating hours are collected from prescriptive application formor by using "interior lighting operating hours by building type" table on page 66 of VT TRM [44]) & MP(assumed to be 1.0)
	CT		15	EL (=15 years Operating Hours taken from Table 2.0.0 page 233 [3]); no source listed
	CT-07	9	10	[48]
	PSNH	9	10	EL and Measure Persistence [1]
	CALMAC	8; 10		EL(=8 [4] [6] [8]; 10 [5]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	10		EL&MP, manufacturer data, studies [9]
Daylight Dimming	NG	9	10	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	10		EL(=10; operating hours are collected from prescriptive application formor by using "interior lighting operating hours by building type" table on page 66 of VT TRM [44]) & MP(assumed to be 1.0)
	PSNH	9	10	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07	9	10	[48]
	VT TPS	10		EL&MP, manufacturer data, studies [9]
	DEER	16		EL(=16) [32]
Photocell	CALMAC	8; 10		EL(=8 [4] [8]; 10 [5]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Timeclock	CALMAC	8		EL(=8 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	8		EL(=8) [20] [22]
Lighting Controls	CALMAC	15; 16		EL(=15 [5]; 16 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Other Lighting Controls	VT TPS	10		EL&MP, manufacturer data, studies [9]
Day Lighting Controls	CALMAC	10; 16		EL(=10 [5]; 16 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Plug Load Sensor	CALMAC	10		EL(=10 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Bi-level Switching	VT TPS	10		EL&MP, manufacturer data, studies [9]
More Efficient Lighting Design	VT TPS	20		EL&MP, manufacturer data, studies [11]
Occupancy Sensor (wall box)	DEER	8		EL(=8) [19] [20] [22]
Occupancy Sensor (plug loads)	DEER	10		EL(=10) [20] [22]
Photocell (w/timeclock)	DEER	8		EL(=8) [19] [20] [22]
Sweep Controls	CT-07	10	15	[48]

C&I Measures	Utility/Study	Current Value (in Years, or Hours if indicated)* Retrofit	New Construction	Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
HVAC				
Packaged AC/HP	NG		15	EL and Measure Persistence [1]
	VEIC	10		
	CT	12	12; 15	EL (=12 years Air source heat pump =15 years Water and Ground source heat pump; 6,000 Operating Hours for heat pump from Table 2.0.0 page 233 [3]); no source listed
	PSNH		15	EL and Measure Persistence [1]
	CT-07	13	15	[48]
	VT TRM	15		EL(=15; operating hours are 800 cooling full load hours and 1600-2200 heating full load hours according to page 37 in VT TRM) & MP(assumed to be 1.0), no source listed
Chillers	NG		20	EL and Measure Persistence [1]
	VEIC	25		EL(=25; operating hours are site-specific based on engineering estimates according to page 37 of VT TRM) & MP(assumed to be 1.0), no source listed
	CT	18; 23		EL (=23 years Water cooled, =18 years Air cooled; Operating Hours are custom based on Customer Load Profile); no source listed
	PSNH		20	EL and Measure Persistence [1]
	CT-07	9	10	[48]
	VT TPS	-	25	EL&MP, manufacturer data, studies [9]
	DEER	-	20	EL(=20) [32]
Enthalpy Economizer	CT-07	10	15	[48]
	VEIC	14		
	VT TPS	7		EL(=10 without MP, 7 with MP) &MP(=0.7), manufacturer data, studies [9]
	DEER	15		EL(=15) [30] [31]
	VT TRM	9.8		EL(=9.8, adjusted for persistence from 14 yrs engineering measure life; typical annual hours of savings is 4,438 [42]) & MP(assumed to be 70% [43])
Custom HVAC Equipment or Systems	NG	13		EL and Measure Persistence [1]
	PSNH	13		EL and Measure Persistence [1]
Unitary	VEIC	15		
	CT	14		EL (=14 years 6,000 Operating Hours for heat pump from Table 2.0.0 page 233 [3]); no source listed
Ventilation CO2 Controls	CT		14; 15	EL (=14 years Unitary HVAC, =15 Air Handling Units installation; Operating Hours are site specific); no source listed
Heat Exchangers (liquid suction)	CALMAC	16		EL(=16 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
AC	CALMAC	15; 15.4		EL(=15 [4] [6] [8]; 15.4 [5]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Boiler	CALMAC	19.5; 20		EL(=19.5 [4]; 20 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Cooling Tower/Evap Condenser	CT-07	13	15	[48]
	CALMAC	15		EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Furnace	CALMAC	25		EL(=25 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Window Glazing (high VLT and high shade coefficient)	CALMAC	24		EL(=24 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HVAC/Space Heating/Efficient Design (gas)	CALMAC	15		EL(=15 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Insulation	CALMAC	20		EL(=20 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Reflective Window Film/Window Treatment	CT-07	10		[48]
	CALMAC	10		EL(=10 [4] [5] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Heat Pump (split system or ground source or w/integrated water heating)	CALMAC	15		EL(=15 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Packaged HVAC Systems	CALMAC	15; 16		EL(=15 [5] [8]; 16 [4]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Chillers (water-cooled)	CALMAC	20		EL(=20 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Evaporative Coolers	CT-07	13	15	[48]
	CALMAC	15		EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HVAC/Refrigeration - SPC	CALMAC	20		EL(=20 [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
AC (gas)	CALMAC	20		EL(=20 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Water Heater (gas)	CALMAC	15		EL(=15 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	-	13 or 15	EL(=13 for lower efficiencies less than 70%, and 15 for higher efficiencies) [32]
DHW Boiler (gas)	CALMAC	24		EL(=24 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Central AC	VT TPS	15		EL&MP, manufacturer data, studies [9]
	Sku	15		EL(=15) [17] [18] [36] & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Chiller (tune-up/diagnostics)	VT TPS	10		EL&MP, manufacturer data, studies [11]
Heat Pump (air to air or ground source)	VT TPS	15		EL&MP, manufacturer data, studies [12]
Heat Pump (hydronic)	VT TPS	20		EL&MP, manufacturer data, studies [13]
Solar Water Heating System	CT-07	20		[48]
	VT TPS	15		EL&MP, manufacturer data, studies [14]
Heat Recovery	CT-07	15		[48]
	VT TPS	23		EL&MP, no source listed
Heat Recovery (rotary)	DEER	10		EL(=10) [23]
Kiln/Oven/Furnace (with or without heat recovery)	CALMAC	25		EL(=25 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Point of Use Water Heater	CT-07	12		[48]
	VT TPS	10		EL&MP, manufacturer data, studies [12]
Heat Pump Water Heater	CT-07	12		[48]
	VT TPS	14		EL&MP, manufacturer data, studies [12]
Demand Controlled Ventilation	VT TPS	10		EL&MP, manufacturer data, studies [9]
Water Heater (point of use)	DEER	20		EL(=20) [26] [27]
Water Heater (electric)	DEER	-	15	EL(=15) [20] [26]
Water Heater (heat pump)	DEER	-	10	EL(=10) [32]
Low Flow Aerators	DEER	9	-	EL(=9) [29]
Low Flow Showerheads	DEER	10	-	EL(=10) [32]
Pipe Wrap	DEER	15		EL(=15) [32]
VAV Variable Speed Drive VAV System Components	CT-07	13	15	[48]
Ventilation or Box Fans or High Volume Low Speed Fans	DEER	10		EL(=10) [28]
Variable Air Volume Box	DEER	10		EL(=10) [23]
Fans (high volume low speed)	VT TPS	12		EL&MP, manufacturer data, studies [11]
Insulation (ceiling/roof/floor)	CT-07	25		[48]
	DEER	20	-	EL(=20) [32]
Tank Wrap	DEER	10		EL(=10) [23]
Windows (low SHGC or high performance glass)	CT-07	20		[48]
	DEER	20		EL(=20) [32]
Windows (double pane low-e)	VT TPS	30		EL&MP, manufacturer data, studies [12]
Chilled or Hot Water Loop Pump (variable flow or w/VSD	DEER	10		EL(=10) [23]
Indirect Evap Cooling (central or packaged system)	DEER	15		EL(=15) [32]
Heat Exchanger (air to air)	DEER	10		EL(=10) [23]
Economizer (mainenance)	DEER	3		EL(=3) [23]
Split/Packaged AC/HP	DEER	15 or 20		EL(=15 for <760k, 20 for >=760k) [32]
Room AC	VT TRM	10		EL(=10; operating hours are 800 cooling full load hours) & MP(assumed to be 1.0), no source listed
Proper HVAC Sizing (comprehensive track)	VT TRM	15 ; 25		EL(=same measure life as HVAC equipment measures such as packaged AC/HP and chillers) & MP(assumed to be 1.0), no source listed
Hot Water Heater (stand-alone oil)	VT TRM	10		EL(=10) & MP(assumed to be 1.0), no source listed
Hot Water Heater (stand-alone gas)	VT TRM	13		EL(=13) & MP(assumed to be 1.0), no source listed
Hot Water Heater (stand-alone kerosene)	VT TRM	15		EL(=15) & MP(assumed to be 1.0), no source listed
Hot Water Heater (Indirect-fired Storage Tank)	VT TRM	15		EL(=15) & MP(assumed to be 1.0), no source listed
Hot Water Heater (Instantaneous)	VT TRM	13		EL(=13) & MP(assumed to be 1.0), no source listed
Boiler	VT TRM	25		EL(=25) & MP(assumed to be 1.0), no source listed
Furnace	VT TRM	20		EL(=20) & MP(assumed to be 1.0), no source listed
Room Space Heater	VT TRM	15		EL(=15) & MP(assumed to be 1.0), no source listed
Envelope Measures	VT TRM	30		EL(=30) & MP(assumed to be 1.0), no source listed
Chiller Strainer	CT-07	20		[48]
Movable Window Insulation	CT-07	10		[48]
Roof Spray Cooling	CT-07	15		[48]
Plenum/Attic Insulation	CT-07	14		[48]
Plate/Heat Pipe Type Heat Recovery System	CT-07	18		[48]
Rotary Type Heat Recovery System	CT-07	14		[48]
Economizer -Air/Water	CT-07	10	15	[48]
Low-Leakage Damper	CT-07	12		[48]

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
HVAC Controls				
Programmable Thermostat	NG	8		(Small Retrofit Only) EL and Measure Persistence [1]
	VEIC	10		
	PSNH	8		(Small Retrofit Only) EL and Measure Persistence [1]
	VT TPS	5		EL&MP, manufacturer data, studies [11]
EMS	NG	10	15	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	10		
	PSNH	10	15	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07	15		[48]
	CALMAC	15		EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	10		EL&MP, manufacturer data, studies [15]
	Sku	14; 15		EL(=14 [17] [36]; 15 [18]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Dual Enthalpy Economizer Controls	NG		10	EL and Measure Persistence [1]
	CT		14; 15	EL (=14 years rooftop DX, =15 years air handler); no source listed
	PSNH		10	EL and Measure Persistence [1]
Hotel Occupancy Sensors	NG	10		EL and Measure Persistence [2]
	PSNH	10		EL and Measure Persistence [2]
Bypass/Delay Timer	CALMAC	15; 16		EL(=15 [8]; 16 [4]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Set-Back Thermostat	CALMAC	10; 11		EL(=10 [5]; 11 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Timeclock	CT-07	10		[48]
	CALMAC	10		EL(=10 [4] [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Reduce Internal Load	CALMAC	15		EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Energy Reduction	CALMAC	10		EL(=10 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Water Heater Controls	CALMAC	15		EL(=15 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
EMS (optimization)	VT TPS	5		EL&MP, manufacturer data, studies [16]
Retrocommissioning	VT TPS	7		EL&MP, manufacturer data, studies [15]
Variable Speed Drive Control (VSD)	VT TPS	20		EL&MP, manufacturer data, studies [11]
Heat Pump Variable Speed Drive	CT-07	13	15	[48]

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Timeclock (for circulation pump, non weather-sensitive)	DEER	10		EL(=10) [23]
Timeclock (for circulation pump, weather-sensitive)	DEER	15		EL(=15) [32]
Chilled Water Reset	DEER	10	-	EL(=10) [23]
Hot Water Reset	DEER	10		EL(=10) [23]
Reducing Overventilation	DEER	10		EL(=10) [23]
2-Speed Motor Control in Rooftop Units	CT-07	15	20	[48]
Energy Efficient Packaged Terminal Units	CT-07	13	15	[48]
Dehumidifiers	CT-07	13	15	[48]
Induced Draft Cooling Towers	CT-07	13	15	[48]
Cooling Tower Fan Pony Motor	CT-07	13	15	[48]
Variable Frequency Pump Drive (Solid State)	CT-07	13	15	[48]
Zoned Circulator Pump System	CT-07	15	15	[48]
Make-up Air Unit for Exhaust Hood	CT-07	15	15	[48]
Pipe and Duct Systems	CT-07	20	20	[48]
Paddle Type Air Destratification Fan	CT-07	10	10	[48]
Duct Type Air Destratification System Air Curtain	CT-07	15	15	[48]
Electric Spot Radiant Heat	CT-07	10	10	[48]
Automatic Energy Management Controls	CT-07	10	15	[48]
Occupancy Sensor Ventilation Control	CT-07	10	15	[48]
Variable Inlet Vane Control	CT-07	10	15	[48]

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Other Measures				
Motors	NG	15	20	EL and Measure Persistence [1]
	VEIC	20		EL(=20 [39]; a more accurate lifetime can be found if customer provides annual operating hours or if not available then refer to "annual motor operating hours" table on p.17 of VT TRM to find operating hours by building type [47]; for all unlisted motors use 4,500 hrs [40]) & MP(assumed to be 1.0)
	CT		17	EL (=17 years, Operating Hours taken from Table 2.0.0 page 233 [3]), no source listed
	PSNH	15	20	EL and Measure Persistence [1]
	CT-07	15	20	[48]
	CALMAC	15; 15.3		EL(=15 [5] [6] [8]; 15.3 [4]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	-	15	EL(=15) [19] [26] [27]
VFD on HVAC Fans	NG	13	15	EL and Measure Persistence [1]
	VEIC	15		
	CT		15	EL (=15 years, Operating Hours taken from Table 2.0.0 page 233 [3]), no source listed
	PSNH	13	15	EL and Measure Persistence [1]
	CALMAC	15; 16		EL(=15 [5] [8]; 16 [6]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	16		EL(=16 [17] [36]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
VFD on non-HVAC Fans	NG	13	15	EL and Measure Persistence [1]
	VEIC	10		
	PSNH	13	15	EL and Measure Persistence [1]
	CALMAC	15; 16		EL(=15 [5] [8]; 16 [6]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
VFD on CT/Chilled Water Pump	NG	13		EL and Measure Persistence [1]
	VEIC	15 (HVAC) 10 (Process)		EL(=15 for non-process VFD; 10 for process) & MP(assumed to be 1.0; National Grid evaluated persistence and estimated a factor of 97% but given that the discounted value of a 3% degradation in 5 years is minimal, no persistence reduction has been applied; footnote 3 on page 22 in VT TRM [41])
	PSNH	13		EL and Measure Persistence [1]
	CALMAC	16; 20		EL(=16 [4]; 20 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fan Control	NG	10		(Small Retrofit Only) EL and Measure Persistence [1]
	VEIC	15		
	PSNH	10		(Small Retrofit Only) EL and Measure Persistence [1]
Door Heater Control	NG	10		(Small Retrofit Only) EL and Measure Persistence [1]
	VEIC	10		
	CT	15		EL (=15 years); no source listed
	PSNH	10		(Small Retrofit Only) EL and Measure Persistence [1]
Cooler Shut Off	NG	10		(Small Retrofit Only) EL and Measure Persistence [1]
	PSNH	10		(Small Retrofit Only) EL and Measure Persistence [1]
Vending Machine	NG	5		(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	15		
	PSNH	5		(Large Retrofit Only) EL and Measure Persistence [1]
	DEER	10		EL(=10) [24] [25]
Vending Machine (non-refrig)	NG	5		(Large Retrofit Only) EL and Measure Persistence [1]
	PSNH	5		(Large Retrofit Only) EL and Measure Persistence [1]
	DEER	10		EL(=10) [24] [25]

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Industrial Refrig Compressors	NG	18	20	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	13		
	PSNH	18	20	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07	20		[48]
Refrigeration Controls	NG	9	10	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07	10		[48]
	VEIC	10		
	CT	15		EL (=15 years evaporator fan); no source listed
	PSNH	9	10	(Large Retrofit Only) EL and Measure Persistence [1]
Commercial Refrig Compressors	NG	13	15	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	13		
	PSNH	13	15	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07	20		[48]
15-75 HP Efficient Compressor	NG	13	15	(Large Retrofit Only) EL and Measure Persistence [1]
	PSNH	13	15	(Large Retrofit Only) EL and Measure Persistence [1]
Dryer	NG		15	EL and Measure Persistence [1]
	VEIC	14		
	PSNH		15	EL and Measure Persistence [1]
Custom Process Cooling	NG	13	15	EL and Measure Persistence [1]
	PSNH	13	15	EL and Measure Persistence [1]
Custom Process Equipment	NG	5,10,13	5,10,15	EL and Measure Persistence [1]
	PSNH	5,10,13	5,10,15	EL and Measure Persistence [1]
VFD - process	VEIC	10		
Custom Compressed Air	NG	13	15	EL and Measure Persistence [1]
	PSNH	13	15	EL and Measure Persistence [1]
Custom Non-Lighting Measures	NG	13		EL and Measure Persistence [1]
	PSNH	13		EL and Measure Persistence [1]
Custom O&M Projects	NG	5		EL and Measure Persistence [1]
	PSNH	5		EL and Measure Persistence [1]
Custom Building Shell	NG		20	EL and Measure Persistence [1]
	PSNH		20	EL and Measure Persistence [1]
Custom Comprehensive Design Project	NG		11 - 20	EL and Measure Persistence [1]
	PSNH		11 - 20	EL and Measure Persistence [1]
Custom Comprehensive Chiller Project	NG		11 - 20	EL and Measure Persistence [1]
	PSNH		11 - 20	EL and Measure Persistence [1]
VFD - non process	VEIC	15		
Energy Star Transformers	VEIC	30		
Refrig Case Covers-strip curtains	VEIC	4		
Refrig Case Covers-continuous covers	VEIC	5		
Refrigeration Economizer	VEIC	15		
Commercial Reach-In Refrigerator	VEIC	9		
Commercial Reach-In Freezer	VEIC	9		

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Permanent Split Capacitor Motors & ECM	VEIC	15		
Vending Machine Occupancy Controls	CT		10	EL (=10 years); no source listed
Audit	CALMAC	3		EL(=3 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Pump Test	CALMAC	15		EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
ASD	CALMAC	15; 16		EL(=15 [5] [8]; 16 [4]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
VFD on Dairy Vacuum Pump	DEER	10	-	EL(=10), no source listed [23]
VSD on Supply Fan Motors	DEER	10		EL(=10) [23]
VFD (unspecified application)	Sku	10		EL(=10 [17] [36]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Pump Repair	Sku	9;11	-	EL(=9 [36]; 11 [17]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
VFD for Environmental Remediation Projects	VT TRM	12		EL(=12; each project's expected life is 4 yrs but VFD's will be used for multiple projects, expected engineering life of 15 yrs reduced for expected downtime between projects) & MP(assumed to be 1.0; National Grid evaluated persistence and estimated a factor of 97% but given that the discounted value of a 3% degradation in 5 years is minimal, no persistence reduction has been applied; footnote 7 on page 26 in VT TRM [41])
Heat Pump VSD	CT-07	13	15	[48]
Cool Thermal Storage	CT-07	15		[48]
Refrigeration - Central Air Cooled	CT-07	20		[48]
Refrigeration - Central Water Cooled	CT-07	20		[48]
Mechanical Subcooling	CT-07	15		[48]
Ambient Subcooling	CT-07	15		[48]
Auto Cleaning System for Condensor Tubes	CT-07	10		[48]
Hot Gas Bypass Defrost	CT-07	10		[48]
Defrost Control Optimization	CT-07	10		[48]
Open or Enclosed Display Cases	CT-07	10		[48]
Case Cover	CT-07	10		[48]
Polyethylene Strip Curtain	CT-07	3		[48]
Vertical Door Levelers	CT-07	15		[48]
High-Low Freezer/Cooler Dimmers	CT-07	10		[48]
Oversized Condensers	CT-07	15		[48]
Low Case HVAC Returns	CT-07	10		[48]
Demineralized Water for Ice	CT-07	10		[48]
Low Emissivity Ceiling Surface	CT-07	15		[48]
Ice Temp Sensor	CT-07	10		[48]
Hot Gas Regeneration	CT-07	10		[48]
Air Compressor	CT-07	13	15	[48]
Refrigerated Air Dryer	CT-07	13	15	[48]

* Measure life values may vary by type of installation (i.e., retrofit/early replacement, new construction/replace on burnout)

Commercial/Industrial Data Sources

Utility/Study	Detail
NG	[1] Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 11/17/05, p. 1-4.
NG	[2] Deemed value
CT	[3] UI/CL&P C&LM Program Savings Documentation -2006
CALMAC	[4] Original EUL: Pacific Gas & Electric Company (PG&E)
CALMAC	[5] Original EUL: Southern California Edison Company (SCE)
CALMAC	[6] Original EUL: San Diego Gas and Electric Company (SDG&E)
CALMAC	[7] Original EUL: Southern California Gas Company (SoCalGas)
CALMAC	[8] Proposed EUL
VT TPS	[9] Efficiency Vermont Technical Reference User Manual (TRM) No. 2004-31
VT TPS	[10] Efficiency Vermont Technical Reference User Manual (TRM) Update - Portfolio of New and Revised Measures - Portfolio Update No. 38
VT TPS	[11] Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, June 2004, GDS Associates
VT TPS	[12] Energy Efficiency and Renewable Energy Resource Development Potential in New York State - Final Report, Volume 5 Energy Efficiency Technical Appendices, August 2003
VT TPS	[13] Northeast Utilities, Action Program C&I Persistence Study, October 2001
VT TPS	[14] KeySpan Energy, 2005. Cost benefit analysis conducted for solar measures.
VT TPS	[15] The Maximum Achievable Cost Effective Potential for Natural Gas Energy Efficiency In the Service Territory of PNM, May 2005, GDS Associates
VT TPS	[16] CALIFORNIA STATEWIDE COMMERCIAL SECTOR NATURAL GAS ENERGY EFFICIENCY POTENTIAL STUDY, Study ID #SW061, May 2003, Prepared by Mike Rufo and Fred Coito KEMA-XENERGY Inc., Prepared
Sku	[17] DEER Newly Adopted EUL (2005)
Sku	[18] Interim/previous DEER EUL
DEER	[19] 2001 DEER Update, prepared for the California Energy Commission by Xenergy Inc., August 2001
DEER	[20] “Evaluation of Pacific Gas & Electric Company’s 1997 Commercial Energy Efficiency Incentives Program: Lighting Technologies”, prepared by Quantum Consulting, Inc., for Pacific Gas & Electric Company, March 1,
DEER	[21] "Energy Data Sourcebook for the US Residential Sector", Lawrence Berkeley Laboratory (LBL-40297 UC-1600), September, 1997
DEER	[22] "Review of Survey Data to Support Revisions to DOE's Dishwasher Test Procedure", Arthur D. Little Inc.,
DEER	[23] engineering judgement
DEER	[24] Memo from Gary Fernstrom, Pacific Gas & Electric, July, 2004
DEER	[25] "Final Report on Technology Energy Savings (DEER)", prepared by NEOS Corporation for the California Conservation Inventory Group, May 1994
DEER	[26] "Consortium for Energy Efficiency Residential Clothes Washer Initiative, 1996", revised 2002 by the Consortium for Energy Efficiency
DEER	[27] US DOE Technical Brief: "Demand (Tankless or Instantaneous) Water Heaters", January, 2004
DEER	[26] "Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program", prepared for Southern California Edison by Kema-Xenergy, February 13, 2004
DEER	[27] The Pacific Northwest’s Regional Technical Forum as of November, 2003 (http://rtf.nwppc.org/)
DEER	[28] Design of High Volume Low Speed Fan Supplemental Cooling System in free stall barns, Kammel, David, et al. 2003. Wisconsin: Wisconsin Public Service
DEER	[29] "Measure Savings Algorithms and Cost Assumptions: Technical Reference Manual", Efficiency Vermont, Jan.
DEER	[30] ASHRAE manuals
DEER	[31] DEER 4.0 1996
DEER	[32] CALMAC Effective Useful Life Report, September 2000
DEER	[33] "CFL Metering Study", prepared for Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison by Kema Inc, February 25, 2005
DEER	[34] "Revised/Updated EULs Based on Retention and Persistence Studies Results", July 2005, SERA Inc.
DEER	[35] DEER
Sku	[36] A Priori Protocols EUL
Sku	[37] CFL_EUL.xls from Gary Cullen, Itron, 5/12/05
VT TRM	[38] Vermont State Screening Tool
VT TRM	[39] BPA Measure Life Study II, Skumatz
VT TRM	[40] E Source Technology Atlas Series Volume IV, Drivepower, p.32
VT TRM	[41] Persistence Study by National Grid, 1999
VT TRM	[42] bin hours at Burlington, VT
VT TRM	[43] agreement between DPS and EVT
VT TRM	[44] Impact Evaluation of Orange & Rockland's Small Commercial Lighting Program, 1993
VT TRM	[45] 5 yrs of metering on 235 outdoor circuits in New Jersey
VT TRM	[46] A Market Transformation Opportunity Assessment for LED Traffic Signals, 1998, by American Council for an Energy-Efficient Economy (ACEEE)
VT TRM	[47] Southeastern NY audit data
CT-07	[48] Commercial UI/CL&P C&LM Program Savings Documentation -2007 Table 1.4 C&I Lifetimes, Pg 222-224

LEARN MORE AT energystar.gov

ENERGY STAR®, a U.S. Environmental Protection Agency program, helps us all save money and protect our environment through energy efficient products and practices. For more information, visit www.energystar.gov.

High Efficiency Water Heaters

Provide Hot Water for Less

Heating water accounts for approximately 15 percent of a home's energy use. High efficiency water heaters use 10 to 50 percent less energy than standard models, saving homeowners money on their utility bills. Actual energy savings from high efficiency water heaters depend on family size, heater location, and the size and placement of water pipes.

UNDERSTANDING HIGH EFFICIENCY WATER HEATER TECHNOLOGIES

- **Storage (Tank) Water Heaters.** Water is kept hot and ready for use at all times in insulated storage tanks with capacities ranging from 20 to 80 gallons. Many fuel options are available, including electricity, natural gas, oil, and propane. One drawback of these units is the energy used to keep the water hot at all times, otherwise known as "standby losses."

- **Demand (Tankless) Water Heaters.** Water circulated through a large coil is heated only on demand using gas or electricity; there is no storage tank continuously maintaining hot water. A possible concern with this technology is the limitation on the number of fixtures that can simultaneously use hot water. However, there is an endless supply of hot water and standby losses are eliminated.



Hot Water Usage
(based on national averages)
The typical U.S. homeowner's water consumption by place of use.

- **Heat Pump Water Heaters.** Heat pumps transfer energy from the surrounding air to water in a storage tank. These water heaters are much more efficient than electric resistance water heaters and most effective in warm climates with long cooling seasons.

- **Solar Water Heating.** While the initial purchase price of solar water heaters is high compared to standard models, they can be cost effective. That is because the sun's energy is harnessed to reduce operating costs up to 90 percent. Solar water heating systems require a conventional water heater as a backup water heating source to ensure hot water is available when solar energy is not.

Comparison of Water Heaters					
High Efficiency Water Heater Type	**Energy Savings vs. Minimum Standards**	**Best Climates**	**Expected Energy Savings Over Equipment Lifetime**	**Expected Lifetime**	**Major Advantages**
High Efficiency Storage (Tank) (Oil, Gas, Elec.)	10%–20%	Any	Up to $500	8–10 Years	Lowest first cost
Demand (Tankless) Using Gas or Elec.	45%–60%	Any	Up to $1,800	20 Years	Unlimited supply of hot water
Heat Pump	65% (Compared to electric resistance)	Mild-Hot	Up to $900	10 Years	Most efficient electric fuel option
Solar with Electric Back-Up	70%–90%	Mild-Hot	Up to $2,200	20 Years	Largest energy savings using a renewable energy source

IMPORTANT WATER HEATER METRICS

- **First-Hour Rating (FHR).** FHR measures how much hot water will be available during the busiest hour of the day. A large tank does not necessarily translate to a higher FHR. The recovery rating is important as it indicates the water heater's ability to replenish hot water as it is drawn from the tank.

- **Efficiency.** The water heater's efficiency is measured as an Energy Factor (EF), which is usually listed beside the EnergyGuide label. The higher the number, the more energy efficient the water heater.

A BETTER FUTURE

ENERGY STAR is a voluntary partnership between the government and more than 9,000 organizations, including more than 3,500 of the nation's home builders. Together with home buyers and their families, we are working to achieve a common goal—protecting the environment for future generations by changing to more energy-efficient practices and products today.

ENERGY STAR is the government-backed symbol for energy efficiency. It identifies new homes, buildings, and more than 50 types of products that are energy efficient and offer the features, quality, and performance that today's consumers expect. Products that can earn the ENERGY STAR include windows, heating and cooling equipment, lighting, and appliances. To learn more about ENERGY STAR, visit www.energystar.gov.

EPA United States Environmental Protection Agency

Ecombi

Maximum saving in running cost.
With Ecombi you make the numbers.



C US

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Manufacturing Excellence

ECOMBI



ELNUR HISTORY

ELNUR was founded in 1973 and since then, we have established ourselves as one of the leading European providers of the most efficient heating system in the world: electric heating.

With facilities spanning over 20,000 m^2, an extensive general and technical team and a complete range of products developed to meet the highest expectations of our customers, at Elnur we provide you with the most efficient solutions in an ever-changing world.

GABARRÓN products are uniquely designed and manufactured using the highest quality materials and components, which constitutes a significant advantage when it comes to providing an excellent level of performance and efficiency.

At ELNUR we provide you with the most efficient solutions in an ever-changing world.

40 years on, we maintain the same enthusiasm and commitment to offering a wide range of unique products which can cater to the varying needs of our customers, wherever in the world they may be.

With a commercial presence in more than 35 countries, and a strong exclusive distribution network in 15 of these, we have gained a presence in thousands of homes, always offering the best solution in electric heating.

QUALITY AND SUSTAINABILITY

ELNUR is totally committed to working and manufacturing in accordance with the appropriate certification under the Quality and Environmental Management System. Some of our international certifications are:

ISO 9001

ISO 9001: 2008 Quality Control Management System, which certifies the implementation and maintenance of the system through a cycle of continuous improvement in the performance of its procedures in all areas of the company, with the aim of achieving greater customer satisfaction..

ISO 14001

ISO 14001: 2004 Environmental Management System, which guarantees that our procedures are developed in accordance with environmental care and respect throughout the production process, from the initial design to the final stages of manufacturing.

"Let us invite you to meet ELNUR and expervience the values and benefits that our GABARRÓN products will bring to your life."

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Coldbrook Electric Supply

COLDBROOK ELECTRIC SUPPLY COMPANY LTD. is the ELNUR S.A. partner in North-America.

We have more than 20 years experience, offering high quality electric heating products and a specialized service focused on giving the best heating solutions.

CUSTOMER SERVICE

A product manufactured in accordance with the highest level of quality performance deserves to be complemented by excellent service. At COLDBROOK, all departments are customer-focused, offering quick and efficient solutions to any problems that may arise.

Our Customer Service Team will answer each and every query you may have. Any member of the team will be able to help you and deal with your request as quickly as possible.

Please email us at info@ecombi-northamerica.com or call us to the following telephone number 1-902-679-0535.

AFTER-SALES TECHNICAL SUPPORT

COLDBROOK´S job does not finish when the goods are dispatched. We are fully committed to customer service and this customer service includes a professional after-sales service. We have an Authorised Technical Services Network providing effective technical assistance all over the territory, irrespective of the location or the product.

Do contact us at technical@ecombi-northamerica.com

PROJECT MANAGEMENT

We know that many concerns may arise when it comes to evaluating your project requirements. Our Projects Department will advise you on each of the areas of your project and will offer you the best solution, taking into account potential options so that you can suggest a number of different alternatives to the end customer.

Please contact us at projects@ecombi-northamerica.com

PROFESSIONAL ADVICE

In this department you can get the assistance you need in order to solve any technical concerns you may have. We will provide direct and personalised assistance, offering the support necessary to resolve any issues with installing or setting up any of our products.

Email us at support@ecombi-northamerica.com

CONTINUOUS TRAINING

In line with our commitment to customers and end users, we cannot ignore the fact that professionals need support in order to gain a complete knowledge base with regard to GABARRÓN product ranges.

We have developed technical training for GABARRÓN products. These courses are taught by our best experts. Their ultimate aim is to help professionals in their daily work and for them to become more familiar with the significant advantages of installing these products.

If you are an installer, don't think twice. You can request information about these courses in the following email:

trainings@ecombi-northamerica.com

INNOVATION AT ITS FINEST

ECOMBI is a new efficient heating system that both controls electricity consumption and optimises heat management. Our system is the most economical of the electric storage heating solutions available on the market.

The ECOMBI smart system assesses energy consumption and heat loss in the room every day in order to establish the heat needs precisely and effectively adjusting the energy required.

The arrival of ECOMBI is a real revolution in traditional heating systems. ECOMBI optimises control of the energy running costs, while providing maximum comfort. This electric heating system adapts to your daily needs whatever the weather conditions.

Could you ask for more? Well you can with the ECOMBI smart system

Once autumn arrives, the temperatures and weather can be very unpredictable well into spring. The days can be cold, very cold or there may even be days when the temperatures are mild and pleasant. ECOMBI constantly monitors room temperature using its high-sensitivity thermostat to ensure that the room is always at the desired temperature. ECOMBI will guarantee you feel warm and comfortable all day long on the coldest days or it will adjust the amount of heat required on those warmer days by means of the ESICC (ECOMBI Smart Input Charge Control) module to adjust the amount of heat required on those warmer days. This will avoid any unnecessary extra energy consumption.

The best quality components available on the market and this exclusive ESICC electronic module, patented and designed by ELNUR, provide an outstanding level of performance and offer the user cheaper and customised heating. This is what the ECOMBI System, the most innovative and outstanding heating system and the only one of its kind on the market, is all about.

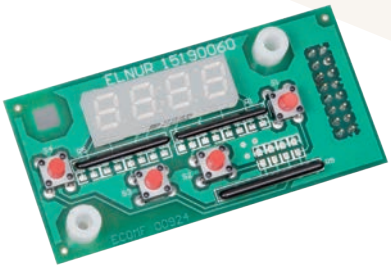
"The future is already present with ECOMBI System"



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EFFICIENCY IS ALL DOWN TO CONTROL

The cornerstone of ECOMBI technological innovation patented by ELNUR is the dynamic management of the energy charging.

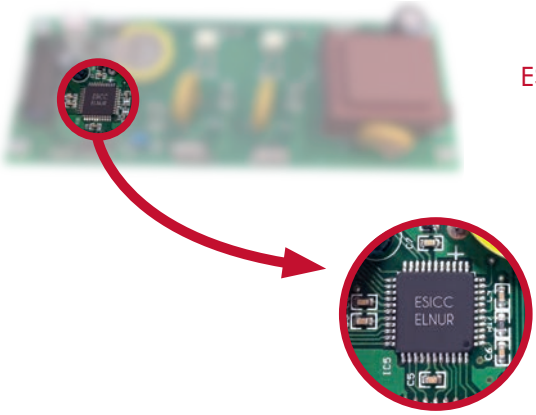


The use of highly accurate thermostats in electric heating is essential to ensure greater control of electricity consumption and to manage the temperature. ECOMBI incorporates this control system within its ESICC electronic management module.

The ESICC module includes a high sensitivity and precision thermostat with an accuracy of ± 0,1 ^{0}C, which continuously measures the temperature of the room and keeps the warmth at the comfort level desired by the customer.

Taking into account the temperature readings of the thermostat and the real heat needs in the room, the ESICC electronic management module assesses the energy consumption of the unit during the day and automatically adjusts energy charging to your comfort needs.

The automatic charge adjustment determines the amount of energy that the system forecasts that you will need and dynamically adjusts it each day, which will effectively reduce energy consumption.



ESICC (ECOMBI Smart Input Charge Control) electronic management module

OFF PEAK TARIFF

In the same way as any traditional storage heater, the ECOMBI system is designed to use the Time-Of-Use (TOU) or Time-Of-Day (TOD) low cost off-peak electricity.

How does Off Peak Electricity works

Most Utilities offer heavily discounted rates for electricity consumed during off peak electricity times, giving you the chance to save money on your energy bill. Off peak electricity is provided during set times of the day when homes and businesses use a lot less electricity. Off peak times are typically between 11pm and 7am, but they can vary depending on the area.

What are Off Peak Electricity times?

Electricity providers would prefer to provide a steady supply of electricity throughout the day and night, because the turbines that generate electricity cannot be easily turned on and off as we need power in our homes. People generally use most of their electricity during the morning and evening. To encourage people to use electricity during other times of the day, many providers offer cheaper electricity during periods known as off peak electricity times. In homes, off peak electricity is commonly used to heat water and can also be used to power other heating appliances that are able to store heat when not in use.

How do you access Off Peak Electricity rates?

You have to contact to your local Electricity Utility to get more details about Time-Of-Use (TOU) or Time-Of-Day (TOD) low cost Off Peak electricity rates availability in your area.

ECOMBI AND THE TRADITIONAL ELECTRIC STORAGE SYSTEMS

During the autumn, the cold winter and into spring, your heating system will have to deal with different temperatures. The operation of a traditional Electric Storage System is simple: storing all the heat possible while it is being charged, coinciding with the Time-Of-Use (TOU) or Time-Of-Day (TOD) low cost off-peak electricity tariff, and releasing it into the room during the rest of the day.

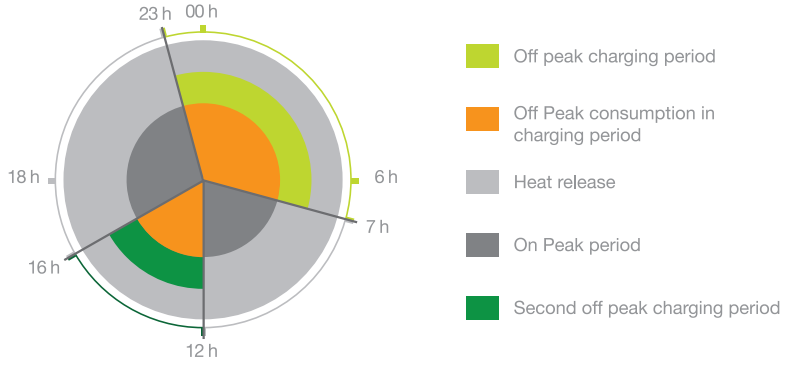
The greatest advantage of these traditional systems is their ability to provide a comfortable temperature at a really affordable price all day long.

STATIC ROOM STORAGE HEATER

In the case of Static Storage Heaters, the charge control is regulated by different sensors according to the temperature readings taken inside the equipment, inside the room and also outside the home.

By incorporating these different sensors, Static Storage Heaters can help to cut electricity consumption by 15% compared to other static storage heaters in the market which do not include these sensors.

A Static Storage Heater normally uses the complete off peak charging period to load its core of energy at 100%. It will release this stored heat during the release period.

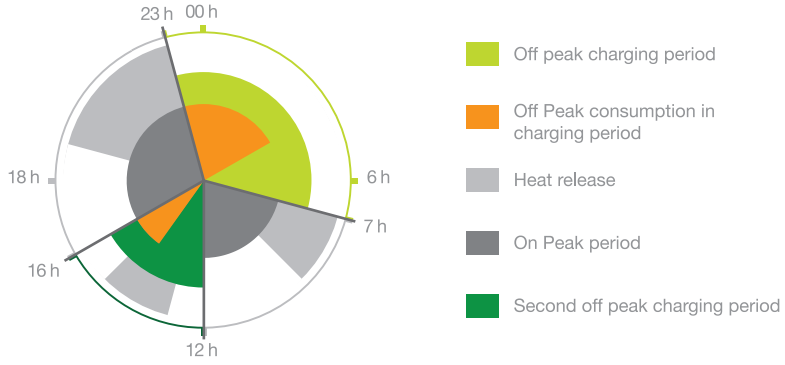


FAN-FORCED STORAGE HEATER (ETS)

In the case of Dynamic Storage Heaters (Fan Forced), the charging is performed in a similar way, but the main advantage of this system is how the release of the stored heat is controlled and the option of the stored heat being released when the customer really requires it. These storage heaters are ideal for large and open areas.

If the user manages the temperature optimally, storage heaters can result in an energy saving of 25%.

A Fan Forced Storage Heater will not use the complete off peak charging period because it will not discharge completely the heat during the release period. It will only release the heat when it is strictly needed and programmed by the user.



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HOW DOES ECOMBI SYSTEM WORK?

Ecombi is focused on the energy loading.

The CHARGING MANAGEMENT is, in fact, the CONSUMPTION CONTROL.

The target is to transfer all the loaded energy to the room.

Once autumn arrives, the temperatures and weather can be very unpredictable well into spring. The days can be cold, very cold or there may even be days when the temperatures are mild and pleasant. ECOMBI constantly monitors room temperature using its high-sensitivity thermostat to ensure that the room is always at the desired temperature.

Another of the major benefits of the ECOMBI system is that, in the case of a sharp change in temperature or unexpected heat loss in the room, it can provide additional heat using a back-up heater.

ECOMBI optimises control of the energy running costs, while providing maximum comfort.

Why spend more if I am going to need less?

The essence of ECOMBI System is the dynamic management of the energy charging and it is defined by our ESSIC technology.

ESICC (ECOMBI Smart Input Charge Control) electronic management module assesses the energy consumption and adjusts energy charging to cover the user's comfort needs.

Figure 1

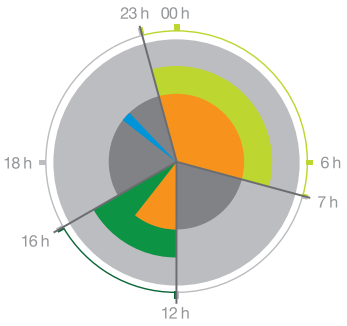


Figure 2

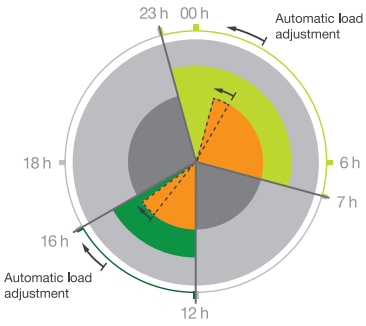
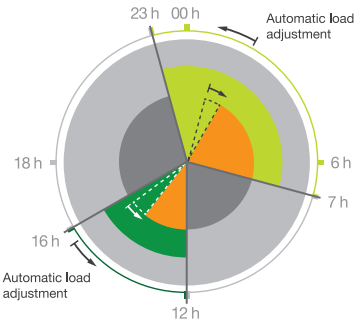
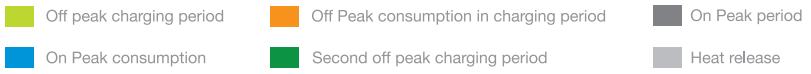


Figure 3





ECOMBI is programmed to store only the required energy to maintain a set up temperature in a room. It may be necessary to have extra heat in the release period, for a short time, to maintain the room set up temperature. (Figure 1). In this case during the next Off Peak charging period the energy load would increase. (Figure 2). But if extra heat is not necessary then ECOMBI will reduce the load in the next Off Peak charging period (Figure 3). By using ECOMBI System, savings can be increased by 35%.

ECOMBI will only charge the real required energy to heat up the room. No more and no less. It will only be charged during the off-peak tariff.

This assessment and management will happen every single day and every single night!

This will lead to significant energy savings. The innovative ECOMBI System can reduce energy consumption by 35%.

Besides this, with ECOMBI, room heat requirements can be programmed. Different periods of COMFORT TEMPERATURE AND ECO TEMPERATURE can be set up in a daily and weekly basis. Guarantying you a comfort time only when you need it.



This is efficiency, effectiveness at minimum cost!

GREAT BENEFITS, GREAT VIRTUES

EXTREMELY USER FRIENDLY WITH JUST THREE SIMPLE STEPS

The ECOMBI control panel is highly intuitive. Thanks to its user-friendly system, it will take you just three simple steps to set the mode and desired temperature.



To set it in the Automatic ECOMBI Mode, push the "mod." button until an "A" appears on the screen.



Use the "+" and "-" keys to select the desired temperature of the room.



And that is all it takes to enjoy the all day long comfort of the ECOMBI System.

INDIVIDUALIZED CONTROL

The ECOMBI units have an individual thermostat for constant and separate control of the room heat requirements where it is installed.

An ECOMBI installation does not require external charging control units or additional timers.
It is all included in each ECOMBI heater.

POSSIBILITY OF MANAGING DIFFERENT CHARGING PERIODS

ECOMBI allows different charging periods to be programmed during a single 24-hour interval. Each unit has its own digital timer to set the available Time Of Use (TOU) or Time Of Day (TOD) off-peak tariff periods.

The system is also pre-set up to be directly connected with digital meters in the future, which means that the electricity company itself could manage the energy charging of the system directly.

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DELAYED CHARGING

A very useful feature of the ECOMBI System that helps to optimize managing the energy is the delayed charging. If the off-peak tariff charging period is from 11.00 p.m. to 7.00 a.m. and ECOMBI has established that it needs to charge 50%, the charging will take place in the second part of the charging period. This means that the ECOMBI will be 100% ready at the start of the peak tariff period, thus making the most of cost-cutting potential.

This feature may be turned on or off using the unit parameters.

WEEKLY PROGRAMMING

The ECOMBI system has a weekly programme feature to meet your needs.

You can programme your ECOMBI unit to run on the days of the week that you choose. This option is very useful when used in weekend homes or in offices, where there are days of the week when the system does not need to be run.

COMFORT TEMPERATURE vs. ECO TEMPERATURE

Set up temperature can be programmed in a daily or weekly basis. The user can decide which periods of the day should be in COMFORT MODE and in ECO MODE (↓3 ^{0}C). On weekends this program can be override.

"With the ECOMBI System, everything is under control"



ECOMBI FITS PERFECTLY WITH OTHER HEAT SOURCES

ECOMBI is probably the best price sensitive heating solution on the market. ECOMBI is itself a complete heating system providing heat 24 hours but using energy at low rate prices. ECOMBI can also be installed in conjunction with other heating solutions or as an add-on to an existing heat source in the house.

ECOMBI AND AIR SOURCED HEAT PUMPS

ECOMBI and Heat Pumps are new concepts in the North American market. If you're looking for ways to decrease your electricity or oil bill, it is very much worth considering the benefits of ECOMBI units together with heat pumps for your comfort, as well as your pocketbook.

Most Utilities in North America, when you install ECOMBI, qualify homeowners for the special meter which allows them to use off-peak electrical rates for their entire home.

These programs encourage users to concentrate the energy usage load at a time when stress on the power system is light — in the evenings and overnight — and in so doing, users can save a lot of money over typical rates.

Heat pumps are a great complement to ECOMBI because they are not actually producing heat — rather, they are extracting existing heat from the outdoors and redistributing it into the home. They can reduce heat expenses in peak hours.

They are a very good complement for big and open areas when space for installing several ECOMBI heaters is limited.

Furthermore, Heat Pump functionality can be reversed in the summer months, cooling your house when it's warm.

Air Sourced Heat Pumps alone will not heat your house enough in winter time. They are a very good complement for existing heating systems.



Gabarrón

ECOMBI AND STANDARD ETS (FAN FORCED STORAGE HEATERS)

ETS units are not always ideal for heating your entire home. Larger units, which tend to be a bit bulky, serve best in recreation rooms and basements. You can think of these as a super-charged space heater; great for those big and open rooms that just don't ever feel warm enough.

ECOMBI is a smaller, slimmer and a sleeker unit that provides comfort in smaller areas in the house that have cold spots such as corridors, bathrooms or bedrooms. They can easily replace existing electric baseboard heaters, maintaining a constant or programmed set up temperature at a reduced energy cost.

The whole idea of using this combination of products is to provide heat around the clock in the whole house moving all the heat energy expenses to the off peak hours in order to reduce expenses.



ECOMBI AND GAS OR WOOD STOVES AND FIREPLACES

Stoves and Fireplaces are heating solutions used mainly in big open rooms as living, dining or recreation rooms. They are solutions that are limited to certain hours per day and only to the room where they are installed.

ECOMBI can help to provide heat to the rest of the house and also to that room when the fireplace is off, by compensating the temperature decrease and balance the heat in the entire house by programming and setting the desired temperature in each room.

ECOMBI BEHAVIOR IN COMBINATION WITH OTHER HEAT SOURCES

ECOMBI is not a standard STORAGE SYSTEM. These ETS devices are designed to discharge the heat that has been accumulated during the charge period (off peak).

ECOMBI is designed to store only what it is needed to maintain the set up temperature desired in one room or area. Consequently, ECOMBI will try to maintain the set up temperature in the room or area. If storage energy is not enough it will compensate the temperature drop with an internal emitter.

Therefore is very important to consider this when working with other heat sources. If for whatever reason, the other heat source is not working, ECOMBI will compensate that heat lost with it´s internal emitter. Additional charges in electricity may arise.

This has to be considered when sizing the heating requirements in a house.



DETERMINE THE CORRECT SIZE OF ECOMBI

In order to keep energy bills in check while homeowners stay in the warm comfort of their home, installers have to make sure that they are installing ECOMBI properly and efficiently. To do this, they must calculate the appropriate sizing of ECOMBI, as well as the best location of the installation.

CALCULATE THE SQUARE FOOTAGE OF THE AREA

Calculate the square footage of the desired room where ECOMBI will be placed. Use a tape measure. Note the width and the length of the entire room. Multiply the width and the length to get the square footage of the room. For example, a room that is 10 feet in width and 10 feet in length is equivalent to 100 square feet.

NOTE THE CEILING HEIGHT

Houses that have higher than average ceilings must also be considered. The installer must adjust the wattage accordingly. When the ceilings of the houses are above the typical 8 feet ceiling, then the installer needs to adjust the wattage requirement, if the ceiling is 25 percent higher, then it would be necessary to multiply the square footage by 1.25.

CHECK THE INSULATION LEVEL OF THE ROOM

Sizing ECOMBI correctly also requires that installer determines the insulation levels of the house. The level of insulation can be rated as poor, average, or full. Poor levels of insulation denotes that the house needs about 12.5 watts per square foot. Average levels of insulation in homes necessitate 10 watts per square foot, while full insulation levels that have R-19 in the walls and R-38 in the ceilings only need 7.5 watts per square foot. Additionally, an energy audit will reveal the insulation levels of different areas in the house. The auditor has specialized equipment such as infrared cameras to determine if walls are insulated. Installers can also use an infrared thermometer to get an estimate of the insulation levels in the home. You have to compare the interior and the exterior walls' temperatures to estimate the amount of insulation.

LOOK FOR A GOOD LOCATION

For the best result, ECOMBI must be placed on interior walls if house insulation is poor or low. A location in the centre of the wall will provide the best convection flow. Choose the walls with shorter length to provide the most accurate convection flow to that room size.

Gabarrón

MINIMIZE OBSTRUCTION

Sofas and other fixtures in the room can reduce ECOMBI efficiency. Additionally, hanging objects must be at least 12 inches away from the target area of ECOMBI heaters.

CALCULATE THE WATTAGE NEEDED TO HEAT THE ROOM

Calculate the recommended wattage. Rooms that are 10 by 13 feet wide, have ceilings that are 8 feet in height, and need 10 watts per square foot require 1300 watts to warm the area. Alternately, newer homes with greater insulation value will take approximately 600 watts to heat a 100 square feet room. However, when the rooms have higher ceilings, whether it is new or old, installers must adjust the wattage requirement by a certain percent.

CHECK ECOMBI HEATER`S SPECIFICATION.

You can find under ECOMBI technical features in this brochure or in the USER AND INSTALLATION MANUAL, the "Storage power" of each heater. Use the most convenient, if the recommended wattage falls between two sizes choose the larger heater.

SPECIAL WARNING WHEN SIZING ECOMBI IN COMBINATION WITH OTHER HEAT SOURCES.

ECOMBI is a heat system that will provide 24h. heat. Unless these combined heat sources are going to be used also on a 24h basis, we recommend to size ECOMBI without taking into account those other heat sources.



TECHNICAL FEATURES

- Silent performance.
- Temperature sensor with calibration option.
- Overheating protection at storage heating.
- Safety thermostat with manual reset.
- Predictive heating element made of Aluminium.
- Storage heating elements made of stainless steel.
- Michrotherm G 12mm insulation, vermiculite and ecological fibre.
- Front, side and real air isolating chambers.
- Storage core made of a specially designed material for ECOMBI.
- Steel structure powder coated in epoxy RAL 9010.
- Robust plastic fittings.
- Easy to install on any kind of wall.
- Very intuitive keyboard with lock option.
- Compatible with two-period off peak electric tariff in a single 24-hour interval.
- Daily and weekly programming.
- Deferred storage energy option.
- Storage, Combined storage, Convection, Frost protection and Automatic ECOMBI operation modes can be set up.
- Weekly programming.
- Visual alarm.



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MODEL	ECO158	ECO208	ECO308	ECO408
Predictive emitter power*	450W	600W	900W	1200W
Storage power	985W	1310W	1960W	2620W
Charging (8h)	7.9 kWh	10.5 kWh	15.7 kWh	21.0 kWh
Connection	240 V ~ 60Hz	240 V ~ 60Hz	240 V ~ 60Hz	240 V ~ 60Hz
Length	55cm (21.5")	66cm (26")	89cm (35")	111cm (43.5")
Height	73cm (28.5")	73cm (28.5")	73cm (28.5")	73cm (28.5")
Depth	18cm (7")	18cm (7")	18cm (7")	18cm (7")
Weight	57kg(126 lbs)	76kg (168 lbs)	111kg (245 lbs)	147kg (324 lbs)
Insulation	Class I	Class I	Class I	Class I
Num. of bricks 7,5kg (16.5lbs)	-	8	12	16
Num. of bricks 11,3kg (25lbs)	4	-	-	-
Brick package ref.	11072	11016	11016	11016

*Storage heater elements and predictive emitter element will never operate at the same time.

Gabarrón

ECOMBI, SAFETY AND SUSTAINABILITY

The ECOMBI System does not require servicing. It has no moving parts that can break or be worn down.

Quick and easy installation, in new and old buildings alike, and there is no need for any type of alterations.

Safety is always a key factor when choosing electric heating. The ECOMBI system is 100% safe. It does not need fuel tanks or hydraulic circuits to operate, and therefore there is no risk of leaks.

The ECOMBI System is environmental friendly.

It can be used with renewable energy sources coming from natural resources such as the sun or wind.

The ECOMBI System fosters a healthy and safe environment:

- Does not consume oxygen or emit CO_2.
- Does not produce gas or fumes.
- Does not directly pollute the environment while it is operating.

"It is our responsibility to care of the planet"



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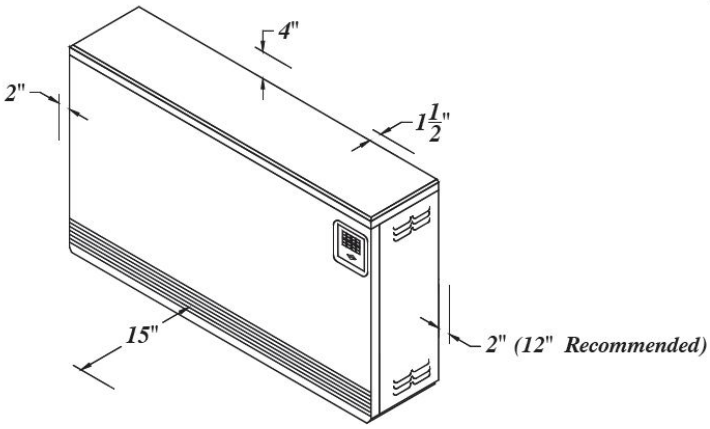
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Technical Data Sheet

2100 Room Heating Units

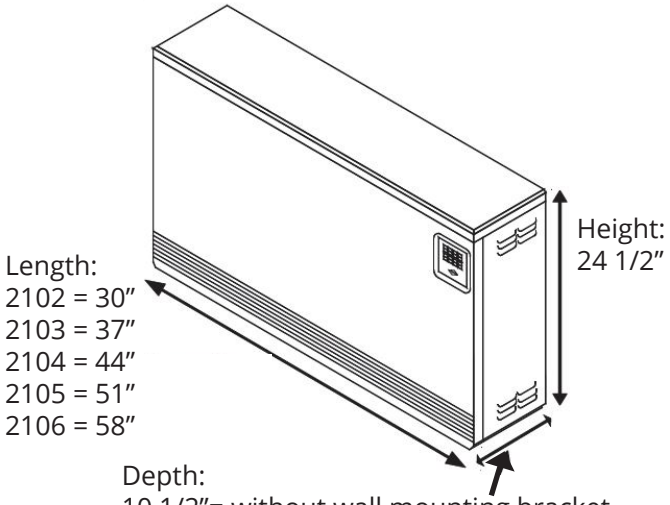
5-Year Limited Manufacturer's Warranty

Placement and Clearances



- All heater surfaces must be kept 4" minimum from combustible material.
- A minimum of 12" clearance is recommended on the right side of heater to ensure accurate room temperature sensing and for servicing purposes. If less than 12" is available, an optional remote room temperature sensor is recommended.
- Heater may be recessed into a wall but do not enclose obstruct access to heaters front panel and grill.
- Weight of heater must be considered when selecting placement location. Refer to specification chart for heater weights.
- Generally, the heater can be placed on any standard flooring. Depending on temperature threshold of floor covering or carpet thickness, it may be necessary to elevate heater off the floor.
- Room heating units are not recommended for applications where petroleum or chemical based contaminates such as paints, varnishes or other combustibles are present in the air. Odors such as these may be amplified. Special requirements must be considered if placing heater in a garage or other area where combustible vapors may be present.
- Avoid installing heater near an open stairwell or near external sources of heat or cold.
- Consult national, state and local building code requirements for electrical appliance to ensure proper installation.

Unit Dimensions



Field Connection and Circuit Breaker Sizing Reference Chart

This chart reflects only the code interpretation of Steffes. It is the responsibility of the installer to comply with all applicable codes

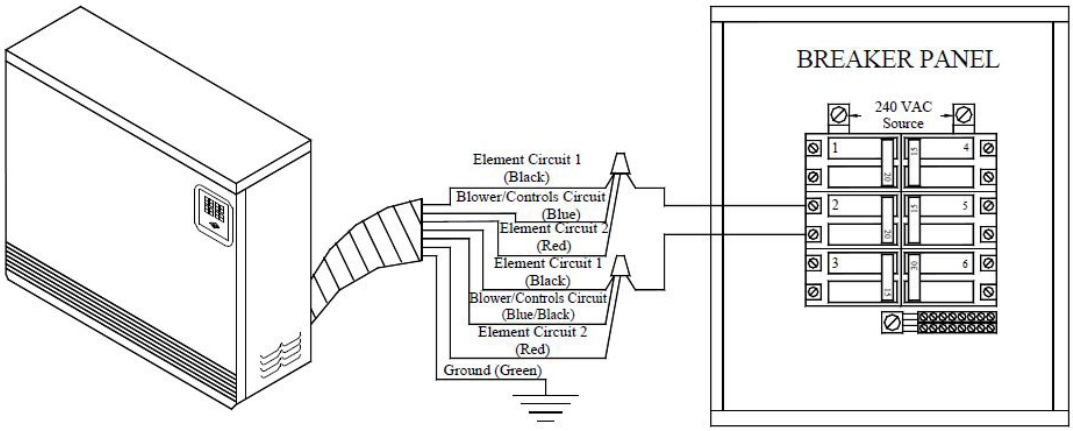
Wire Size	240 VAC	277 VAC	208 VAC	Maximum Circuit Breaker Size
#14 AWG	2.8	3.3	2.4	15
#12 AWG	3.8	4.4	3.3	20
#10 AWG	5.7	6.6	4.9	30
#8 AWG	7.6	8.8	6.6	40
#6 AWG	11.5	13.2	9.9	60

Use copper wire rates at 75 C minimum only.

Line Voltage Connections

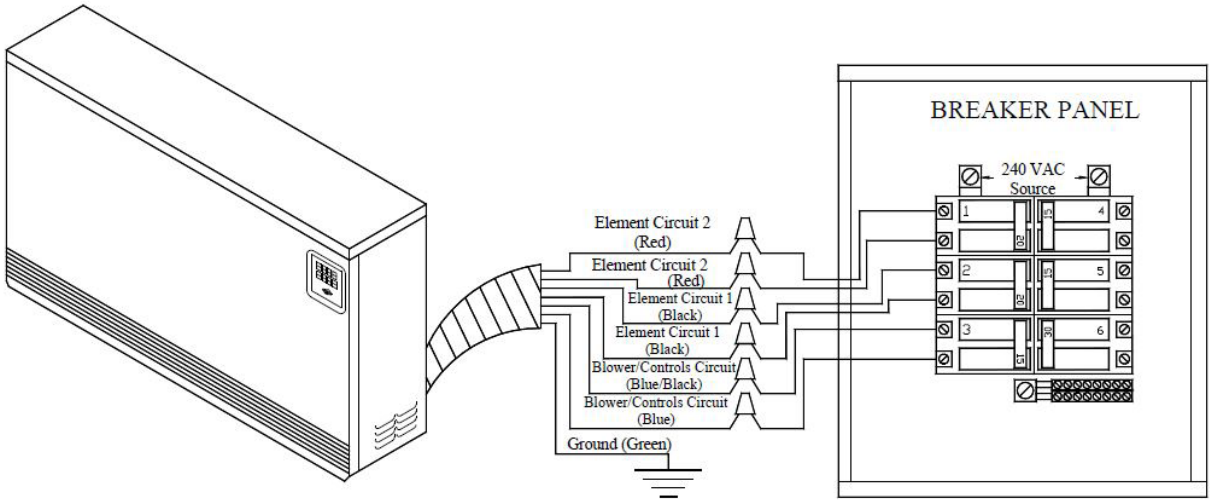
All 2100 series room heating units are factory configured for single or two circuit element feed connections. The fan/controls circuit can be powered from the element circuit or from a separate feed. (The heater must be wired in compliance with all applicable codes and regulations.)

Single Feed Connection



NOTE: Connections shown are for systems with a 240V/280V blower/controls circuit.

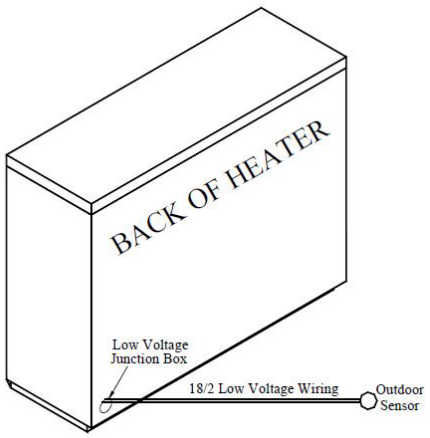
Multiple Feed Connection



NOTE: Connections shown are for systems with a 240V/280V blower/controls circuit.

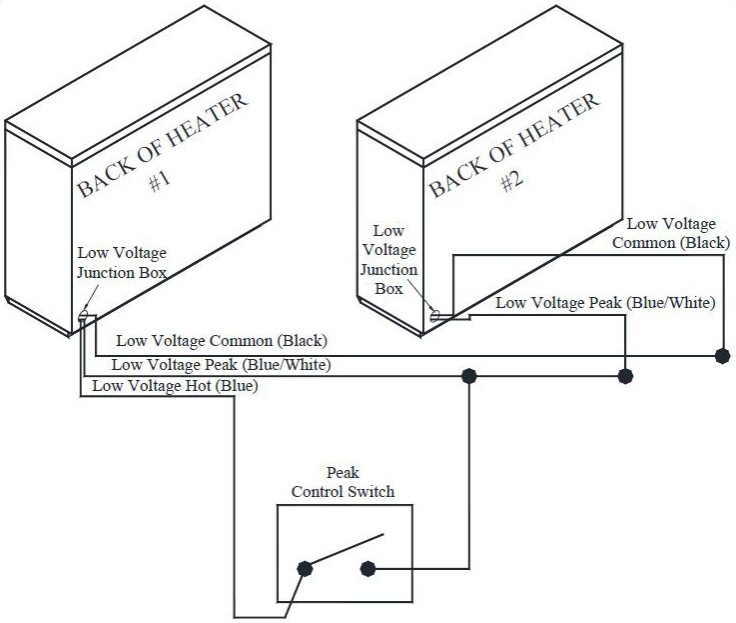
Automatic Charge Control

- An outdoor sensor is an optional device used to provide outdoor temperatures for automatic charge control (regulation of storedheat).
- One sensor per heater is required and connected to the heater via low voltage wiring.
- If using the optional Steffes Power Line Carrier Transmitter for peak control, the outdoor sensor is not needed as the transmitter will also communicate outdoor temperature information to the heater(s) for automatic charge regulation.



Peak Control Options

- **Low Voltage Control (See Diagram)**
- **Power Line Carrier (PLC) Control**
  - Recommended for multiple heater installations
  - Requires the Steffes PLC transceiver be installed in the application to interface with each heaters built-in receiving system.
  - Refer to the Transceiver's Owner's and Installer's manual for more information on the operation and installation of the PLC control system.
- **Time Clock Control**
  - Requires the Steffes time clock module be installed in each heater to enable the heater's built-in time clock feature.
  - Refer to the time clock module's instruction sheet for information on the operation and installation of this device.
- **Line Voltage Control**
  - Requires an external switching device such as a relay panel to directly control the element circuits.
  - Blower/controls circuit must be powered with an uninterrupted circuit.



Specifications (For Standard 240VAC Systems)

Model	2102 (Plug-in)	2102			2103			2104			2105			2106		
Charging Inputs (kW) -See Note 1	1.32	2.4	3.0	3.6	3.6	4.5	5.4	408	6.0	7.2	6.0	7.5	9.0	7.2	9.0	10.8
Approximate Installed Weight (lbs)	281	267			376			478			585			692		
Storage Capacity -See Note 1																
kWh	13.5				20.25			27			33.75			40		
BTU	46,063				69,093			92,124			115,155			136,480		
Element Voltage -See Note 2	120	240 (Standard)														
Blower/Controls Voltage -See Note 3	120	240 (Standard)														
Blower Wattage- See Note 4																
Minimum	30															
Maximum	120															

Note 1: The heating ability of each system is dependent upon the power company's availableoff-peak hours. Please contact Steffes for assistance in selecting the appropriate size and kW input of system required to satisfy a specific heat loss.

Note 2: 208 and 277 charging input voltage are also available as a special factory order. Standard 240V units can be connected to 208V; however, the heater will operate at 75% ofits 240V rated input wattage.

Note 3: 240V is standard blower/controls voltage. 120 and 208 blower/controls voltage are also available as a special factory order.

Note 4: The blowers are variable speed.

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Technical Data Sheet
4100 Comfort Plus Forced Air

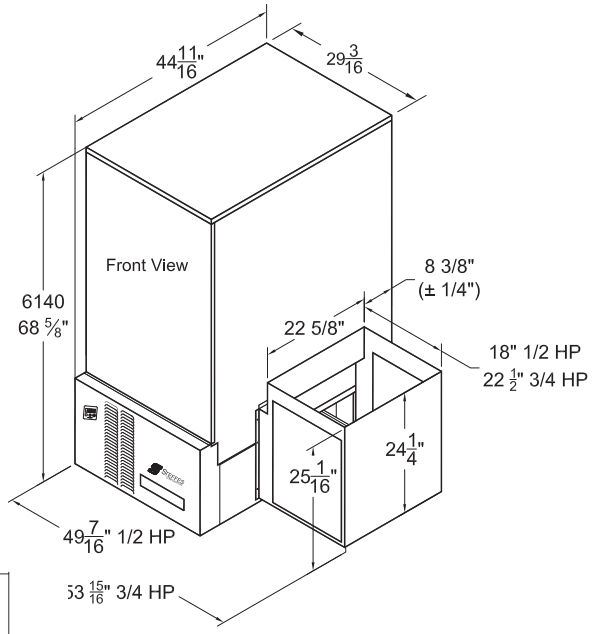
5-Year Limited Manufacturer's Warranty

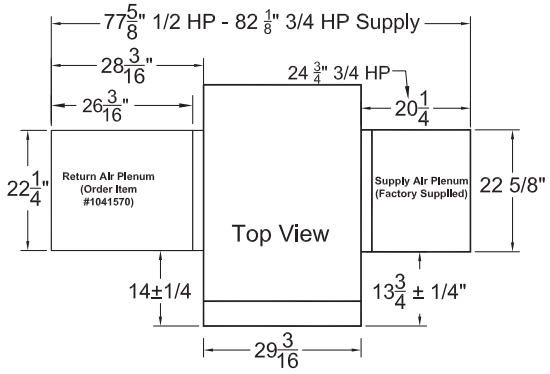


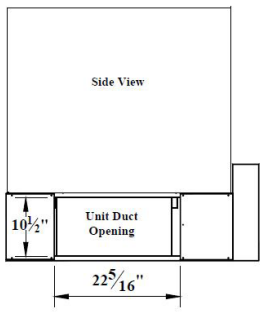
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Unit and Duct Opening Dimensions

- Unit is factory configured for left-to-right or right-to-left air-flow.
- Down flow configuration is available with the addition of the optional down flow kit accessory. In down flow configuration, the furnace must be installed in a fashion that allows access to the supply blower's plenum cover. It is recommended to elevate the furnace a minimum of 10" to achieve this access.
- Return air plenum can be ordered as an optional accessory from the factory.
- Unit will fit through a 30" doorway without disassembling. For smaller openings or for ease in moving, the unit can be disassembled.

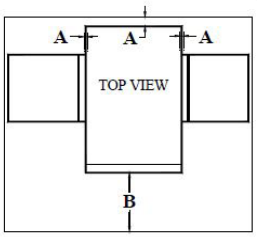


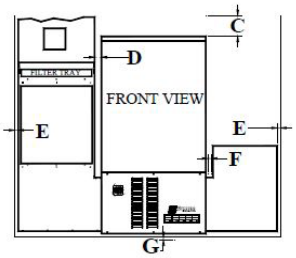




Placement and Clearances

- The area in which the Comfort Plus unit is installed must remain free of debris and adequate ventilation is required to maintain room temperature of less than 85°F.
- Adhere to all national and local electrical and building code placement requirements for electric heating appliances.
- An 18" high stand is available from the factory to elevate the system if necessary.



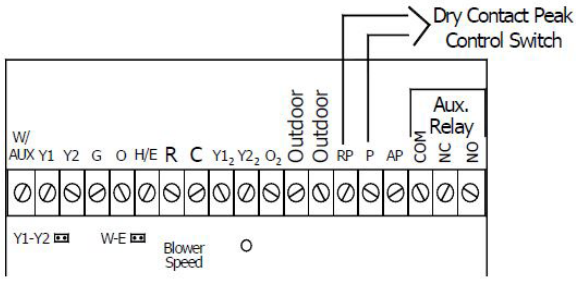


A Back and sides = 3 inches (from combustible material)
B Front = 36 inches (for ease in servicing)
C Top = 6 inches (from combustible material)
D Between Duct and Left side of system = 2 inches
E Outer Sides of Return and Supply Ducts = zero clearance
F Between Duct and Right side of system = zero clearance
G Bottom = zero clearance

Low Voltage Peak Control Connections

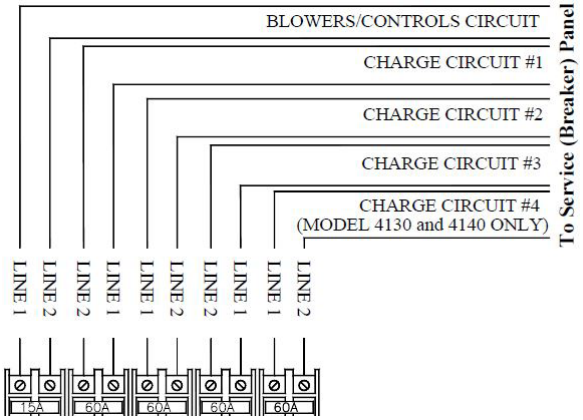
- If using the optional Steffes Power Line Carrier Transceiver or Steffes Time Clock Module for peak control, the direct wiring shown here is not necessary.

Variable Speed Blower



Line Voltage Field Connections and Circuit Phasing

- The breakers on the Comfort Plus are intended for service disconnect only. The 15 amp breaker powers the blowers and system controls circuit. The 60 amp-breakers power the element circuits.
- Units are factory configured with multiple circuit, single phase connections. If single feed is desired, a single feed kit is available from the factory. Phase-balancing is recommended when making connections in 3-phase applications.



Supply Air Delivery Matrix

- External static pressure should not exceed .75 inches water column.
- A supply blower must be specified with each furnace. Available options include a 1/2 HP or 3/4 HP variable speed blower.
- ½ HP configuration can accommodate most 1.5 to 4 ton heating/cooling coils.
- 3/4 HP configuration can accommodate most 3 to 5 ton heating/cooling coils.
- Interfaces to multi-speed air conditioners or heat-pumps. When interfaced to a 2-stage air conditioner or heat pump, the variable speed motor will operate at 70% of the selected air flow in low speed (Stage 1) compressor mode. If 50% air flow is required in low speed, a Stage 1 speed adjusting relay must be installed. Steffes recommends the Allen Bradley Relay #700-HA32A24 with Relay Base #700- HN125 or equivalent.

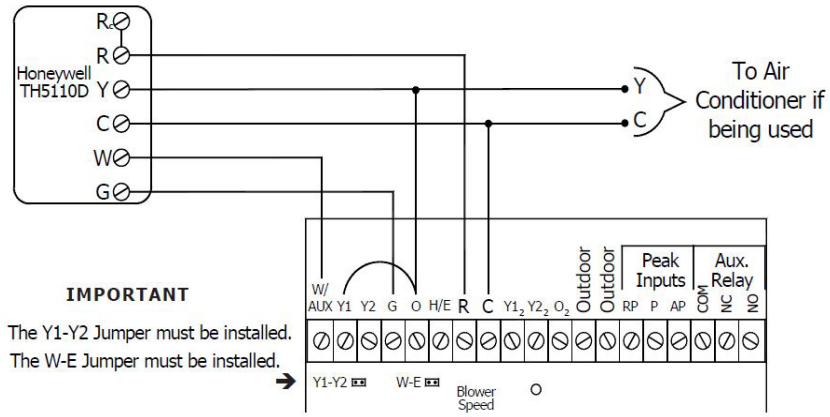
Variable Speed Blower Option:

Configuration	Field Selectable Air Flows (CFM)
1/2 HP	1000, 1200, 1400, 1600
3/4 HP	1200, 1400, 1600, 2000

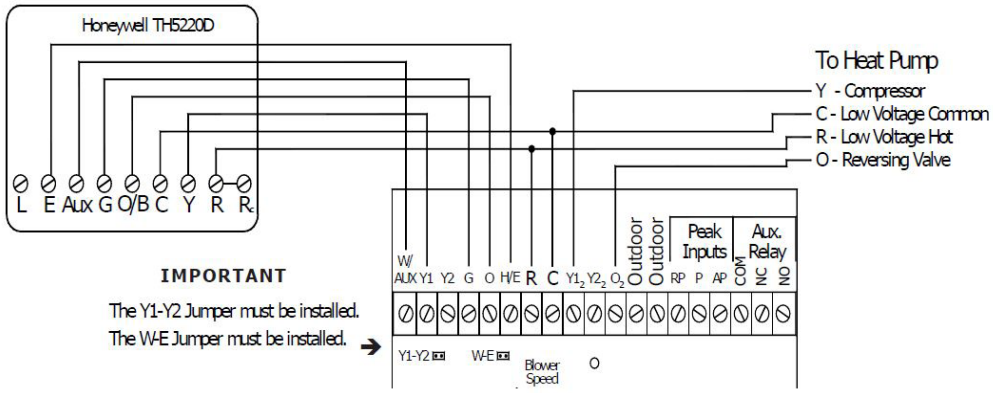
Low Voltage Wall Thermostat, Sensor, and Compressor Connections

- 24 VAC wall thermostat must be used. Honeywell brands shown in schematics and recommended.
- A digital wall thermostat is recommended for use with Comfort Plus systems. If utilizing a mechanical wall thermostat, it may be necessary to add a load resistor (250 ohm, 5 watt) due to the low current draw (.01 amp) on the heat call input circuit.
- An outdoor sensor is included with the system to provide outdoor temperatures for automatic charge control (regulation of stored heat).

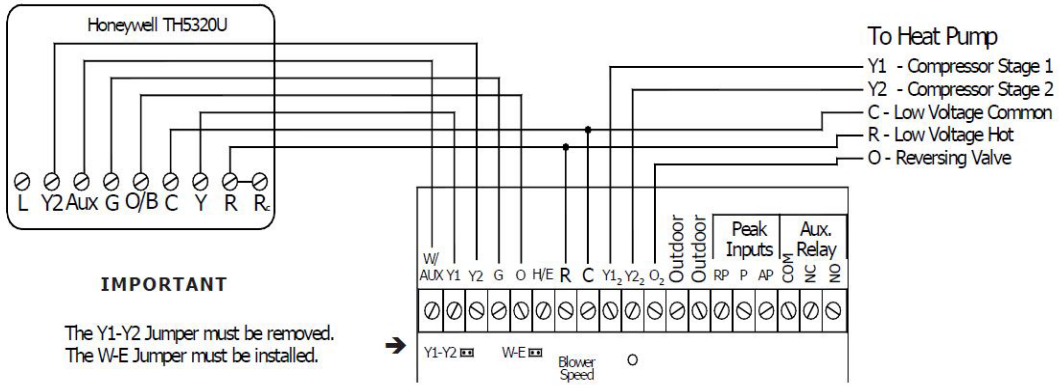
Stand Alone Furnace Application with Variable Speed Supply Blower Connections shown for Single Stage Heating/Single Stage Cooling



Single Stage Heat Pump with Variable Speed Supply Blower



Two Stage Heat Pump with Variable Speed Supply Blower



Specifications for Standard 240VAC Systems

Model	4120			4130		4140	
Charging Input (See Note 1)	14.0 kW	19.2 kW	24.8 kW	28.8 kW	37.2 kW	38.4 kW	45.6 kW
Single Feed: Minimum Circuit Ampacity (240V Systems) (Includes 25% Derate for Continuous Load	81	109	138	159	203	209	247
Element Current Draw	59 AMPS	80 AMPS	104 AMPS	120 AMPS	155 AMPS	160 AMPS	190 AMPS
Element Circuits Required (See Note 2)	1-20 AMP 2-30 AMP	1-30 AMP 2-40 AMP	1-40 AMP 2-50 AMP	4-40 AMP	4-50 AMP	4-50 AMP	4-60 AMP
Blowers/Controls Circuit Required (See Note 2)	One - 15 AMP (7 AMPS maximum load)						
Storage Capacity (See Note 3)	120 kWh (426,500 BTU)			180 kWh (614,160 BTU)		240 kWH (818,880 BTU)	
Approximate Installed Weight	2,183 lbs			3,031lbs		3,859 lbs	
Maximum Coil Dimensions (See Note 4) W x D x H	26’ x 22” x 31”						
Maximum Maintainable Heat Loss (See Note 3) 8 Consecutive Hours (BTU/hr) 12 Consecutive Hours (BTU/hr) 18 Consecutive Hours (BTU)	20,414 30,612 45,931	28,013 42,002 62,986	34,188 45,550 81,376	42,002 62,986 94,478	49,201 65,613 122,047	55,991 84,003 125,971	65,613 87,484 131,225

Note 1: Standard configuration (240V) systems can be connected to 208V; however, the charging input of the system will derate by 25%. If 208V specific charging voltage is required, it is available as a special factory order. For 277V systems,
refer to the 6100 series.

Note 2: Unit is factory configured to be field connected to multiple line voltage circuits. If single feed to the element and blowers/system controls circuits is desired, an optional single feed kit is available to order.

Note 3: The size and heating ability of the system required for an installation is dependent on the heat loss of the area and the power company’s off-peak hours. In addition, if the unit is not installed within the heated area, heat lost statically must be taken into account when sizing a system. Contact Steffes for assistance in selecting an appropriately sized system.

Note 4: The indoor coil and outdoor compressor of an air conditioner or heat pump are not included with the ETS system. A return air plenum, configured for housing an indoor coil, can be ordered from the factory as an optional accessory. Dimensions listed are that of the inner coil area in this plenum. For larger coils, field provisions to the factory built plenum are necessary or one will need to be custom built by the installer. (In heat pump applications, the indoor coil MUST be placed on the return air side.)



Technical Data Sheet

Comfort Plus Commercial

Electric Thermal Storage Heating System

Model: 6140 Forced Air System

Model: 7140 Hydronic System

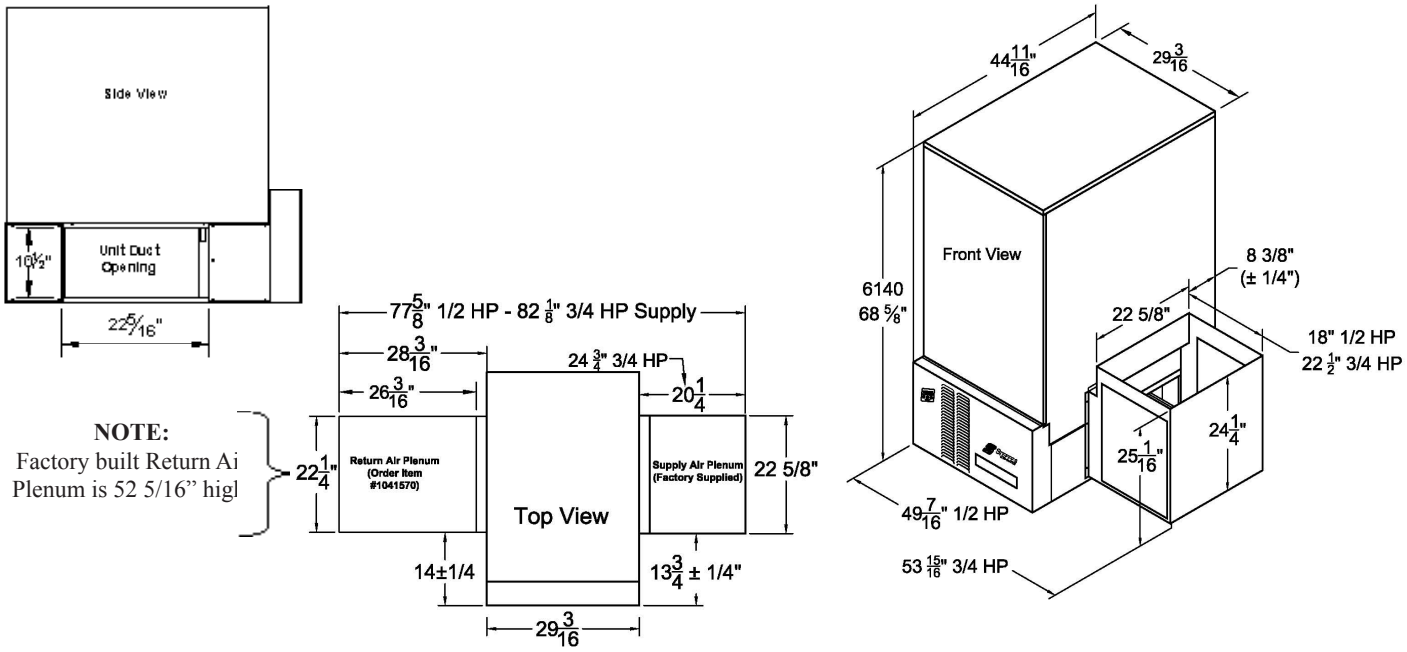
Rev 3

Dimensions

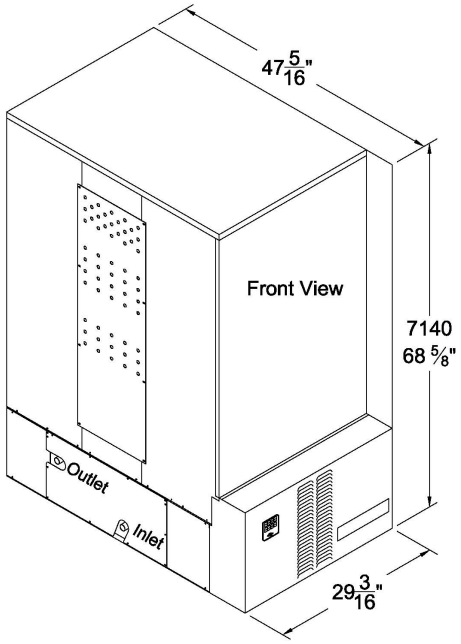
- Units will fit through a 30” doorway without disassembling. For smaller openings or for ease in moving, the units can be disassembled.

Model 6140

- The return air plenum as shown in the schematic can be ordered as an optional accessory from the factory.



Model 7140

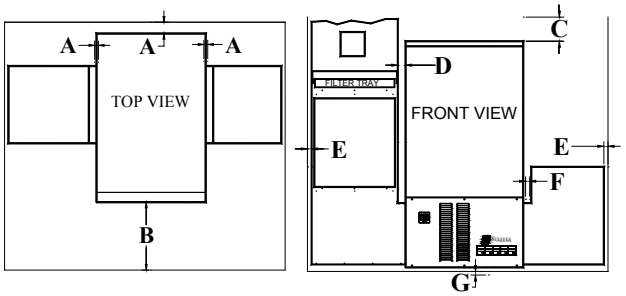


Placement and Clearances

- The area in which the Comfort Plus unit is installed must remain free of debris and adequate ventilation is required to maintain room temperature of less than 85°F.
- Adhere to all national and local electrical and building code placement requirements for electric heating appliances.
- An 18" high stand is available from the factory to elevate the system if necessary.

Model 6140

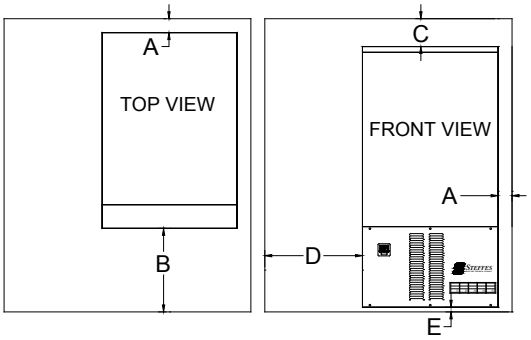
- Downflow configuation is available with the addition of the optional downflow kit accessory. In downflow configuration, the furnace must be installed in a fashion that allows access to the supply blower's plenum cover. It is recommended to elevate the furnace a minimum of 10" to achieve this access.



A Back and sides = 3 inches (from combustible material)
B Front = 36 inches (for ease in servicing)
C Top = 6 inches (from combustible material)
D Between Duct and Left side of system = 2 inches
E Outer Sides of Return and Supply Ducts = zero clearance
F Between Duct and Right side of system = zero clearance
G Bottom = zero clearance

Model 7140

- Unit is factory configured for left side plumbing attachment only.
- For room ventilation purposes, a static heat recovery unit or air handler are options that are available to move the radiant heat from the furnace outer panels to a more desirable area.

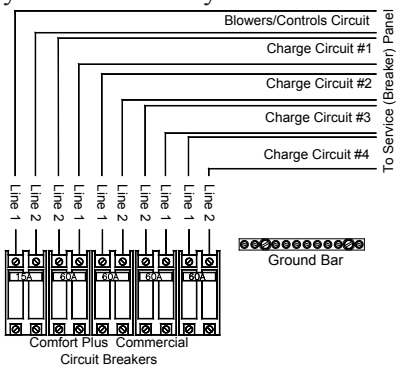


A Back and Right Side = 3 inches (from combustible material)
B Front = 36 inches (for ease in servicing)
C Top = 6 inches (from combustible material)
D Left Side = 36 inches (for ease in servicing)
E Bottom = 1 inch clearance

Line Voltage Field Connections

208V or 240V

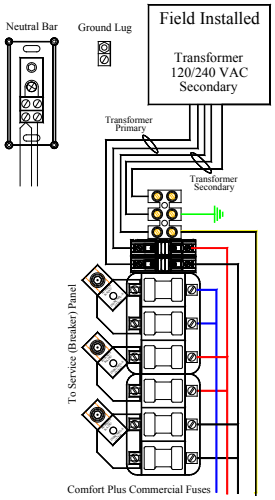
- 208V and 240V systems are factory configured with breakers which are intended for use as service disconnects only. The 15 amp breaker powers the blowers and system controls circuit. The 60 amp breakers power the element circuits.



- 208V and 240V systems are factory configured for multiple circuit, single phase connections. If single feed is desired, a single feed kit is available from the factory. Phase balancing is recommended when making connections in 3-phase applications.

277V or 347V

- 277V and 347V systems are factory configured only for single feed connections only to the element circuits. The internal controls and motors only operate at 240V/208V. A stepdown transformer is required for blowers/controls circuit if it is being fed from the element circuits. The transformer is available from Steffes or it can be sourced from a local supply outlet.
- Connections are made through fuse and neutral blocks.



Step Down Transformer Specifications			
Primary Winding	**Secondary Winding**	**KVA Rating**	**Application**
Must match units input voltage	120/240 VAC	1 KVA	◆ 7140 Model installed without a Steffes Air Handler
		2 KVA	◆ 6140 Model ◆ 7140 Model when installed with a Steffes Air Handler

Supply Air Delivery Matrix

- Applicable to Model 6140 and to Model 7140 when interfaced with a Steffes Air Handler.
- External static pressure should not exceed .75 inches water column.
- When interfaced to a 2-stage air conditioner or heat pump, the ECM motor will operate at 70% of the selected air flow in low speed (Stage 1) compressor mode. If 50% air flow is required in low speed, a Stage 1 speed adjusting relay must be installed. Steffes recommends the Allen Bradley Relay #700-HA32A24 with Relay Base #700-HN125 or equivalent.

Variable Speed ECM Blower Options:

Configuration	Field Selectable Air Flows (CFM)
½ HP	1000, 1200, 1400, 1600
¾ HP	1200, 1400, 1600, 2000

Optional Steffes Air Handler (Model 7140 ONLY)

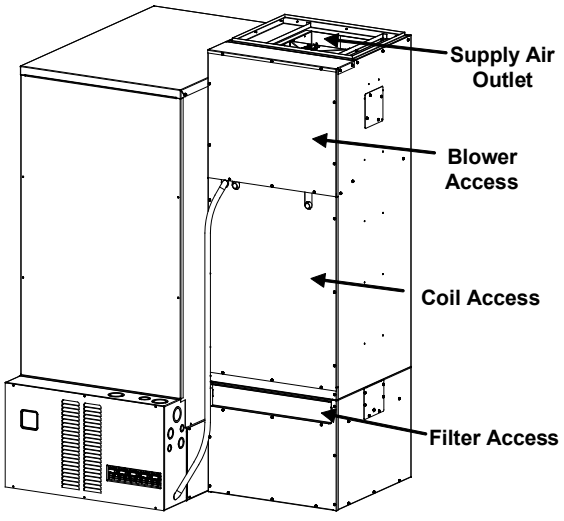
- The Steffes Air Handler is an optional device designed to interface to the Comfort Plus Commercial Hydronic furnace to allow it to provide forced air heating as a stand alone furnace or as a supplement to other ducted heating systems such as a heat pump. When used with a heat pump, it allows the Comfort Plus Commercial Hydronic furnace to serve as the back-up heat source and to provide comfort modulation. Heat pumps can be operated to much lower temperatures allowing for full utilization of its efficiency and optimizing system performance. A duct sensor constantly monitors outlet air temperature and modulates the precise amount of stored off-peak heat needed to eliminate cool and uncomfortable discharge air temperatures typically associated with heat pump systems during cool outdoor temperatures. The air handler will also direct the heat lost statically through the furnace's outer panels into the ductwork for delivery to the living space (automatic static heat recovery). The internal controls of the Comfort Plus Commercial Hydronic furnace automatically regulate the operation of the air handler. The Steffes Air Handler includes a return plenum, supply air blower, water coil, and air filter. It is painted and fully insulated.

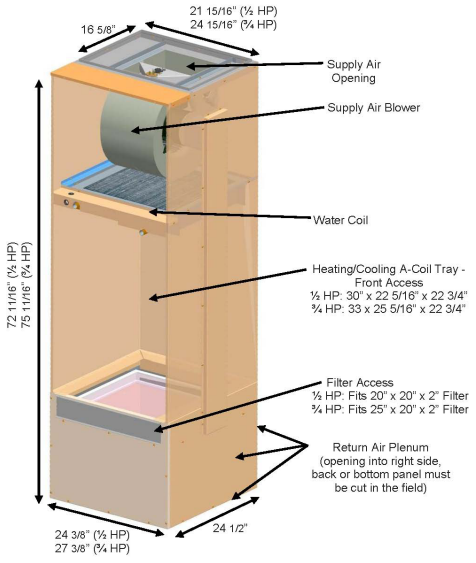
SPECIFICATIONS

	½ HP, 60 HZ Variable Speed (ECM) Air Handler	¾ HP, 60 HZ Variable Speed (ECM) Air Handler
Order Item Number	1302132	1302134
Dimensions (H x L x D)	72 11/16" x 23 1/2" x 23 7/8"	72 11/16" x 26 1/2" x 23 7/8"
Approximate Weight	200 lbs	225 lbs
Maximum Static Pressure (inches water column)	.75 inches H_20	.75 inches H_20
Maximum Water Coil Output	60,000 BTU/hr	90,000 BTU/hr
Maximum Outlet Temperature	120°F	120°F
A-Coil Tray Dimensions (H x L x D)	30" x 22 5/16" x 22 3/4"	33" x 25 5/16"x 22 3/4"
Filter Dimensions	20" x 20" x 2"	25" x 20" x 2"
Voltage	240/208 VAC	240/208 VAC
Full Load Amps (240/208V)	4.3/5.0	6.8/7.3
CFM ratings	1000, 1200, 1400, 1600	1200, 1400, 1600, 2000

- 3/4 HP configuration can accommodate most 1.5 to 4 ton heating/cooling coils
- 3/4 HP configuration can accommodate most 3 to 5 ton heating/cooling coils
- The 3/4 HP air handler 90,000 BTU/hr water coil output may decrease when using heating/cooling coils smaller than 5 tons

DIMENSIONAL DIAGRAMS



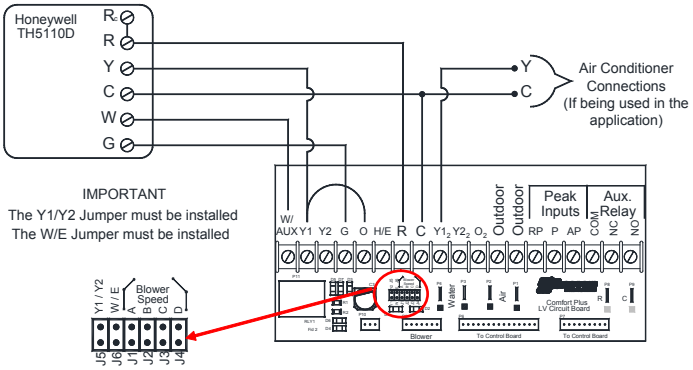


Low Voltage Connections - Wall Thermostat, Sensor, and Compressor

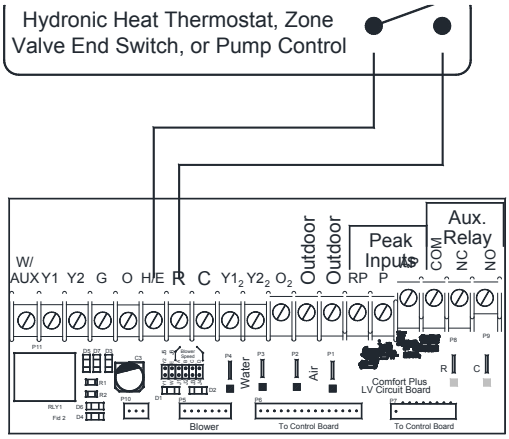
- 24 VAC wall thermostat must be used. Honeywell brands shown in schematics and recommended.
- A digital wall thermostat is recommended for use with Comfort Plus systems. If utilizing a mechanical wall thermostat, it may be necessary to add a load resistor (250 ohm, 5 watt) due to the low current draw (.01 amp) on the heat call input circuit.
- An outdoor sensor is included with the furance to provide outdoor temperatures for automatic charge control (regulation of stored heat).

Stand Alone Applications

Model 6140

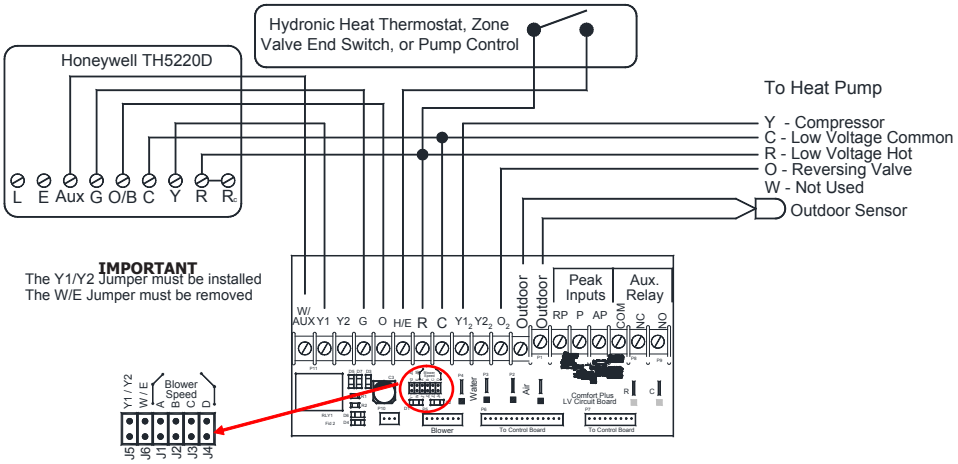


Model 7140 - Single Hydronic Heating Zone Application

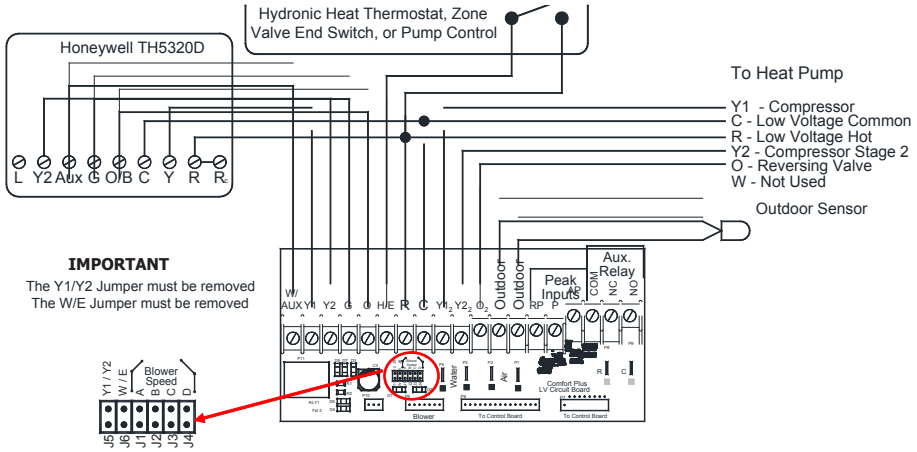


Heat Pump Applications

Single Stage Heat Pump



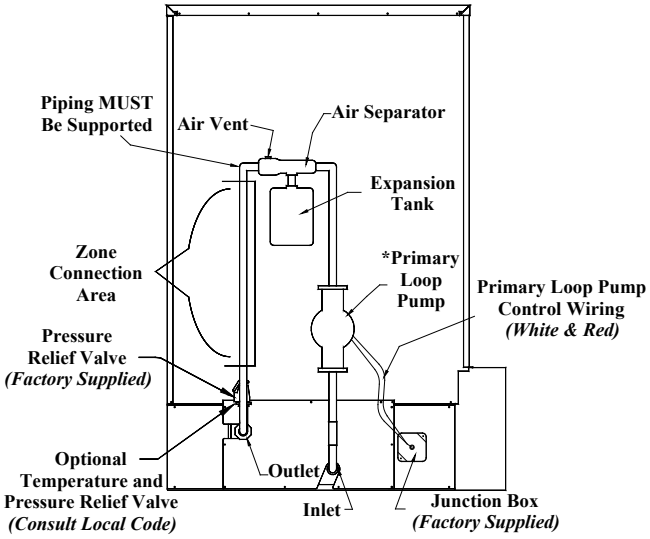
Two Stage Heat Pump



Plumbing (Model 7140 ONLY)

Primary Water Loop Plumbing

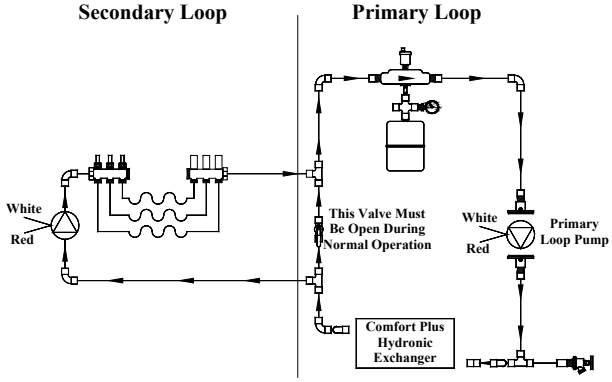
- The Comfort Plus Hydronic Commercial Unit must be plumbed with a primary water loop consisting of a minimum of 10' of 1" pipe and its own circulator pump (Grundfos UP15-42F single speed 115 VAC or equal recommended). The primary loop serves to regulate heat transfer from the unit's heat exchanger. A kit containing components generally installed with hydronic heat systems is available from Steffes. The primary loop must be powered by the Comfort Plus control system.
- The Comfort Plus Hydronic Commercial Unit is factory configured for left side plumbing attachment only.



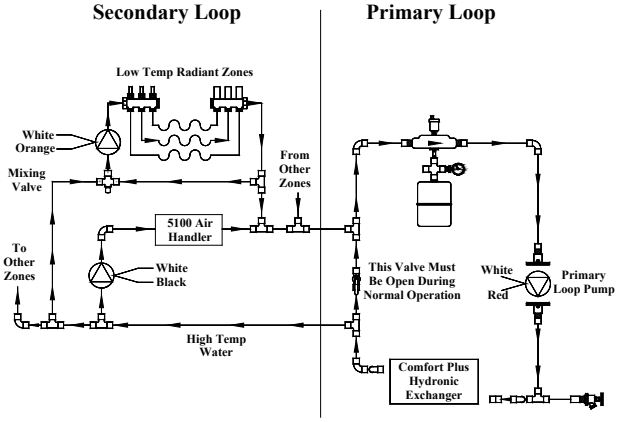
Typical System Plumbing

- There are many ways to connect plumbing and regulate temperature of water supplied from the primary loop. These are typical plumbing schematics.

Single Temperature Zone



Air Handler Applications



Pressure Drop Through Heat Exchanger

STATIC PRESSURE (Feet Water Column)	.1 ft @ 2 GPM
	.2 ft @ 4 GPM
Based on 80 degree entry water temperature with a 50% glycol mix.	.4 ft @ 6 GPM
	.7 ft @ 8 GPM
	1.1 ft @ 10 GPM

Typical Floor Zone Design

Pipe Size	Maxiumum Pipe Length
3/8"	200'
1/2"	300'
5/8"	500'

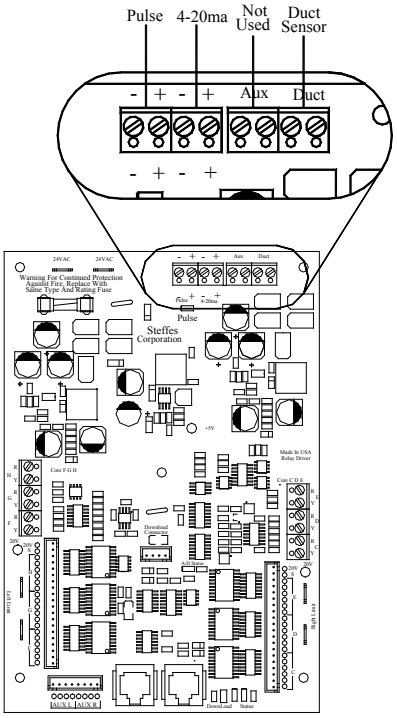
Pipe length will vary by manufacturer.

Load Management

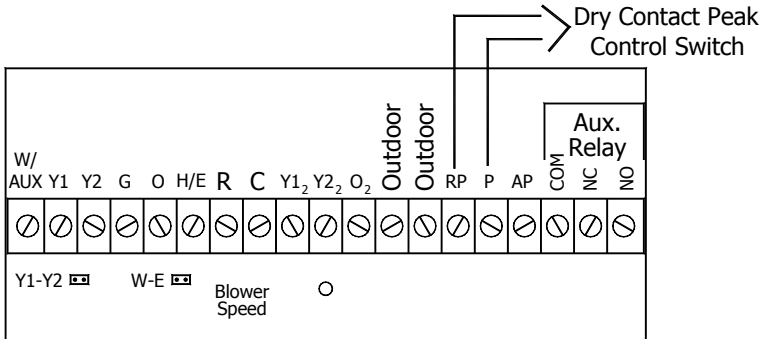
The Comfort Plus Commercial is designed to operate under any of the following load control strategies:

1. **On-Peak/Off-Peak Signal:** Comfort Plus Commercial systems respond to external load control device (contact closure) and will charge during off-peak periods. An auxiliary contact is provided on the furnace for controlling external loads. The on-peak/off-peak signal can be initiated via a direct low voltage wiring from the utility signaling device, the optional Steffes Power Line Carrier (PLC) Transceiver (only systems with 208V/240V blower control circuit feeds) or the optional Steffes Time Clock Module. Connections for direct wiring are shown. These connections are not necessary if using the PLC transmitter or time clock module. A manual or instruction sheet for these items are available upon request.
2. **4-20 Milliamp (1-5 Volt DC):** When utilizing 4-20 milliamp control, the Comfort Plus Commercial system receives a signal from an external load control device such as a building load management system. (Refer to the diagram showing connection points.) The furnace has the ability to adjust its rate of energy consumption (kW) based on the signal being received. While the furnace continuously monitors the signal and sheds its load as needed in relation to this input, restoration of all or some of its load will occur in 15 minute increments.
3. **Pulse Monitoring:** Comfort Plus Commercial units have the ability to monitor pulse inputs from the power company's electric meter and proportionally charges when demand free power is available. An optional load management control module (Order Item #1908410) is available that will allow the furnace to control up to 16 other external loads.

4-20 Milli-Amp or Pulse Monitoring Connections



Low Voltage Direct Wired Utility On-Peak/Off-Peak Connections



Bacnet (Optional)

A Bacnet control option is available for interface with the Comfort Plus Commercial systems. This device is easily integrated into most building automation systems to provide building managers full control and visibility of the heating systems operation.

Bacnet allow the following functions to be monitored with simple, twisted-pair communication:

- Real-time system monitoring
- Full thermostat control
- Monitoring of heat storage levels in the brick and all system temperatures
- Remote configuration, testing and adjustment
- Service requirement alerts

Specifications

	Model 6140							Model 7140						
Voltage	208	240		277		347		208	240		277		347	
Charging Input (kW)	36	36	42.75	38.4	46.5	36	46.5	36	36	42.75	38.4	46.5	36	46.5
Element Current Draw (Amps)	174	150	179	47	56	35	45	174	150	179	47	56	35	45
Phase	Single			Three				Single			Three			
Number of wires - See Note 1	2			4				2			4			
Pump/Blower/Controls Max Circuit Required (Amps)	7							10						
Single Feed Minimum Circuit Ampacity (Amps) - See Note 1 & 2	226	197	232	63	75	47	60	229	200	236	63	76	49	61
Blower/Controls Voltage (VAC) - See Note 2	208/240							208/240						
Pump Voltage - See Note 2	N/A							120V (Netural Conductor Required)			120V			
Storage Capacity - See Note 3 kWh BTU	240 818,800							240 818,800						
Approximate Installed Weight (lbs)	3,859							3,894						
Max Coil Dimensions (W x D x H) - See Note 4	26" x 22" x 31"							½ HP: 30" x 22 5/16" x 22 3/4" ¾ HP: 33" x 25 1/4" x 22 3/4"						
Pipe Size (Inlet/Outlet)	N/A							1"						
Primary Loop Requirements	N/A							Minimum of 10' of 1" pipe						
Output Water Temp - Selection Range	N/A							50°F to 185°F						
Available Maximum Working Pressure Ranges – See Note 5	N/A							20 PSIG requires 30 PSI Pressure Relief Valve 60 PSIG requires 75 PSI Pressure Relief Valve (Standard) 125 PSIG requires 150 PSI Pressure Relief Valve						
Minimum Flow Rate (Primary Loop)	N/A							1 GPM per 10,000 BTU of required output at 20°F temperature rise (10 GPM maximum)						

Note 1: 208V and 240V systems are factory configured to be field connected to multiple, single phase, line voltage circuits. If single feed to element and blowers/system controls circuit is desired, an optional single feed kit is available to order. Connection to 3-phase power is acceptable and can improve phase balancing.

Note 2: 277V/480V and 347V/600V systems are configured for only single feed, three phase line voltage connections to the elements. If feeding the blowers/controls from the element circuit, a step down transformer must be field installed.

Note 3: The size and heating ability of the system required for an installation is dependent on the thermal load and the demand profile of the facility. The daily rate structure of the utility can also affect size of furnace needed in an application. If the unit is not installed within the heated area, heat lost statically must be taken into account when sizing a system. Contact Steffes Corporation for assistance in selecting an appropriately sized system.

Note 4: The indoor coil or outdoor compressor of an air conditioner or heat pump are not included with the furnace. The Steffes return air plenum (for use with the 6140) and the Steffes air handler (for use with the 7140 to allow it to provide forced air heating) are each configured to house an indoor coil and can be ordered from the factory as an optional accessory. Dimensions listed are that of the inner coil area in the plenum. For larger coils, field provisions to the factory built plenums are necessary or one will need to be custom built by the installer. (In heat pump applications, the indoor coil MUST be placed on the return air side.)

Note 5: Optional pressure relief valves providing 20 PSIG or 125 PSIG maximum working pressures are available as special factory orders.

Table 1: Green Heat Unitary Admin Cost

Measure	Admin Cost	Unit Count
ASHP and AWHP - Electrical | Green Heat	$37,131	95
GSHP | Green Heat	$27,491	16
Heat Pump Water Heater | Green Heat	$8,054	99
MSHP - Fully Electrical | Green Heat	$3,173,600	15,855
MSHP - Mainly Electrical | Green Heat	$333,610	4,187
Pellet Boiler/Furnace | Green Heat	$7,669	5
Pellet Stove | Green Heat	$47,300	55
Solar air heating | Green Heat	$304	3
Solar Domestic Hot Water | Green Heat	$6,264	20
Wood Boiler/Furnace | Green Heat	$7,991	5
Wood Stove | Green Heat	$128,496	137
Drain Water Heat Recovery | Green Heat	$12,603	150
Average Per Unit Admin	**$183.75**	

Table 2: BER Unitary Admin Cost

Measure	Admin Cost	Unit Count
1/2 Size Hot Food Holding Cabinet | Business Energy Rebates	$1,426.42	38
Advanced Lighting Design (Performance Lighting) | Business Energy Rebates	$1,653.04	76
Air Source Heat Pump (96kBTU/hr) | Business Energy Rebates	$0.00	0
Air-Entraining Air Nozzle | Business Energy Rebates	$746.03	38
Case Lighting for Sign Retrofits | Business Energy Rebates	$68,177.54	1882
CEE Tier 2 Commercial Washing Machine | Business Energy Rebates	$1,842.52	29
CEE Tier 3 Commercial Washing Machine | Business Energy Rebates	$2,687.95	37
Circulation Fan (Agriculture) | Business Energy Rebates	$751.96	120
Cold Climate Air-Source Heat Pump (24kBTU/hr) | Business Energy Rebates	$37,732.56	154
Cold Climate Air-Source Heat Pump (48kBTU/hr) | Business Energy Rebates	$12,358.83	25
Cooler Night Covers for Display Cases | Business Energy Rebates	$0.00	0
Cycling Refrigerated Air Dryer - 200 CFM | Business Energy Rebates	$0.00	0
Cycling Refrigerated Air Dryer - 50 CFM | Business Energy Rebates	$295.87	19
Dairy Scroll Compressor | Business Energy Rebates	$5,681.20	9
Daylighting Controls - Ceiling Mounted | Business Energy Rebates	$768.92	76
Daylighting Controls - Switch-Mounted | Business Energy Rebates	$12.43	6
Discus or Scroll Refrigeration Compressor | Business Energy Rebates	$0.00	0
Door Heater Controls | Business Energy Rebates	$126,348.45	565
Double Heat Pad (Agriculture) | Business Energy Rebates	$1,107.26	27
Dual Enthalpy Economizer Controls | Business Energy Rebates	$1,423.86	20
EC Motor for Refrigeration Applications | Business Energy Rebates1	$24,647.81	2635
EC Motor for Refrigeration Applications | Business Energy Rebates2	$10,798.09	376
Electric Combination Oven | Business Energy Rebates	$7,969.57	46
Electric Combination Oven with Gas | Business Energy Rebates	$2,522.72	5
Electric Convection Oven | Business Energy Rebates	$926.22	17
Electric Convection Oven with Gas | Business Energy Rebates	$6,656.06	20
Electric Fryer Replacement with Gas | Business Energy Rebates	$2,540.96	5
Electric Griddle | Business Energy Rebates	$0.00	0
Electric Griddle Replacement with Gas | Business Energy Rebates	$4,391.58	10
Electric Steam Cooker | Business Energy Rebates	$6,203.20	23
Electric to Natural Gas - Water Heater | Business Energy Rebates	$10,909.52	76
ENERGY STAR Pool Pump | Business Energy Rebates	$1,442.52	14
ENERGY STAR Uninteruptible Power Supplies (UPS) | Business Energy Rebates	$2,323.22	14
ENERGY STAR Washing Machine | Business Energy Rebates	$249.33	12
Engine Block Heater Timer (Agriculture) | Business Energy Rebates	$0.00	0
Evaporator Fan Motor Controls | Business Energy Rebates	$4,917.98	68

Measure	Admin Cost	Unit Count
Flood Luminaire (10000 lumen) | Business Energy Rebates	$93,790.58	3765
Flood Luminaire (48000 lumen) | Business Energy Rebates	$100,924.21	1234
Four Pin Replacement Lamps for CFLs | Business Energy Rebates	$1,193.11	565
Fuel Pump Canopy Luminaire (4000 lumen) | Business Energy Rebates	$0.00	0
Fuel Pump Canopy Luminaire (8000 lumen) | Business Energy Rebates	$0.00	0
Full Size Hot Food Holding Cabinet | Business Energy Rebates	$0.00	0
Glass Door Frezzer | Business Energy Rebates	$0.00	0
Glass Door Refrigerator | Business Energy Rebates	$493.48	23
Ground Source Heat Pump (60kBTU/hr) | Business Energy Rebates	$23,301.30	26
Heat Pump Clothes Dryer | Business Energy Rebates	$840.08	19
Heat Pump Water Heater | Business Energy Rebates	$13,856.85	188
Heat Reclaimer Unit (Agriculture) | Business Energy Rebates	$560,087.13	1789
High Bay Luminaire (15 000 lumen) | Business Energy Rebates	$58,555.42	4894
High Bay Luminaire (35 000 lumen) | Business Energy Rebates	$0.00	0
High Bay Luminaire (60 000 lumen) | Business Energy Rebates	$0.00	0
High Efficiency Circulator Pump 1.5kW | Business Energy Rebates	$2,642.23	38
High Efficiency Circulator Pump 100W | Business Energy Rebates	$304.45	26
High Efficiency Circulator Pump 300W | Business Energy Rebates	$491.62	23
High Volume Low Speed Fan (Agriculture) | Business Energy Rebates	$5,570.76	15
HVAC Hotel Occupancy Sensor | Business Energy Rebates	$7,969.57	665
Ice-Making Head | Business Energy Rebates	$753.35	23
Intelligent Freezer Defrost Controls | Business Energy Rebates	$0.00	0
LED Replacement Lamps for HID (10000 lumen) | Business Energy Rebates	$4,078.83	245
LED Replacement Lamps for HID (4000 lumen) | Business Energy Rebates	$1,655.23	248
LED Troffer (1x4) | Business Energy Rebates	$54,187.88	13048
LED Troffer (2x2) | Business Energy Rebates	$124,869.52	37649
LED Troffer (4x2) | Business Energy Rebates	$300,234.88	54323
Linear Ambient Luminaire (10000 lumen) | Business Energy Rebates	$4,006.71	340
Linear Ambient Luminaire (2000 lumen) | Business Energy Rebates	$429.80	340
Linear Ambient Luminaire (4000 lumen) | Business Energy Rebates	$7,894.15	3393
Linear Ambient Luminaire (8000 lumen) | Business Energy Rebates	$5,288.23	1054
Linear Replacement Lamp (2 foot) | Business Energy Rebates	$1,081.69	1882
Linear Replacement Lamp (4 foot) | Business Energy Rebates	$1,161,120.22	956583
Low/Zero Energy Livestock Waterer | Business Energy Rebates	$373.69	10
Low-bay Luminaire (10,000 lumen) | Business Energy Rebates	$7,910.46	547
Low-bay Luminaire (5000 lumen) | Business Energy Rebates	$43,749.36	5444
Luminaire Level Lighting Control (LLLC) - High Impact Application | Business Energy Rebates	$208.74	39
Luminaire Level Lighting Control (LLLC) - Low Impact Application | Business Energy Rebates	$220.65	20
Milk Pre-cooler | Business Energy Rebates	$2,333.85	11
Multi-Tank Conveyor Dishwasher - High Temp | Business Energy Rebates	$2,824.77	4
Multi-Tank Conveyor Dishwasher - Low Temp | Business Energy Rebates	$4,555.93	9
Natural Barn Ventiliation - Summer Only | Business Energy Rebates	$0.00	0
Natural Barn Ventiliation - Year-Round | Business Energy Rebates	$691.57	4
Natural Gas Conversion - Commercial Electric Clothes Dryer | Business Energy Rebates	$0.00	0
Networked/Connected - High Impact Application | Business Energy Rebates	$126.45	20
Networked/Connected - Low Impact Application | Business Energy Rebates	$250.79	20
No-Loss Drain | Business Energy Rebates	$403.23	6
Occupancy Sensor (Ceiling Mounted) | Business Energy Rebates	$4,189.45	316
Occupancy Sensor (Wall Mounted) | Business Energy Rebates	$2,495.26	188
Occupancy Sensor (Exterior) | Business Energy Rebates	$281.33	75
Open to Closed Cooler Conversion | Business Energy Rebates	$188,093.75	376
Outside Air Economizer | Business Energy Rebates	$31,227.62	113
Packaged Terminal Heat Pump (12kBTU/hr) | Business Energy Rebates	$63,836.01	415
Parking Garage Luminaire (4000 lumen) | Business Energy Rebates	$0.00	0

Measure	Admin Cost	Unit Count
Parking Garage Luminaire (8000 lumen) | Business Energy Rebates	$0.00	0
Pole/Arm-Mounted Area Luminaire (20000 lumen) | Business Energy Rebates	$51,495.31	5154
Pole/Arm-Mounted Area Luminaire (4000 lumen) | Business Energy Rebates	$0.00	0
Pole/Arm-Mounted Area Luminaire (60000 lumen) | Business Energy Rebates	$1,996.91	67
Pole/Arm-Mounted Decorative Luminaire (1500 lumen) | Business Energy Rebates	$0.00	0
Pole/Arm-Mounted Decorative Luminaire (5000 lumen) | Business Energy Rebates	$1,361.36	151
Pot, Pan and Utensil Dishwasher - High Temp | Business Energy Rebates	$2,649.97	29
Premium High Bay Luminaire (15 000 lumen) | Business Energy Rebates	$25,100.24	1777
Premium High Bay Luminaire (35 000 lumen) | Business Energy Rebates	$29,531.78	896
Premium High Bay Luminaire (60 000 lumen) | Business Energy Rebates	$14,677.26	260
Refrigerated Case Luminaire | Business Energy Rebates	$6,933.91	678
Refrigerated Vending Machine Controls | Business Energy Rebates	$0.00	0
Remote Condensing Unit | Business Energy Rebates	$1,658.91	19
Self-Contained Ice Maker | Business Energy Rebates	$0.00	0
Server Virtualization and Decommissioning | Business Energy Rebates	$2,613.91	11
Server-based Power Management Software | Business Energy Rebates	$0.00	0
Single Heat Pad (Agriculture) | Business Energy Rebates	$262.91	13
Single -Tank Conveyor Dishwasher - High Temp | Business Energy Rebates	$1,898.78	8
Single -Tank Conveyor Dishwasher - Low Temp | Business Energy Rebates	$5,664.13	15
Single-Tank Door type Dishwasher - High Temp | Business Energy Rebates	$4,890.74	15
Single-Tank Door type Dishwasher - Low Temp | Business Energy Rebates	$3,329.53	8
Solar DHW System | Business Energy Rebates	$0.00	0
Solid Door Freezer | Business Energy Rebates	$1,019.11	20
Solid Door Refrigerator | Business Energy Rebates	$807.62	45
Stairwell and Passageway Luminaire | Business Energy Rebates	$0.00	0
Standard Capacity Electric Fryer | Business Energy Rebates	$3,239.60	38
Strip-Curtains for Display Cases | Business Energy Rebates	$139.55	3
Track/Mono-point Direction Luminaire | Business Energy Rebates	$1,547.77	301
Under-Counter Dishwasher - HighTemp | Business Energy Rebates	$1,960.72	23
Under-Counter Dishwasher - Low Temp | Business Energy Rebates	$2,617.35	38
Variable Speed Kitchen Exhuast Fan | Business Energy Rebates	$7,041.34	12
Ventilation Fan (Agriculture) | Business Energy Rebates	$308.29	44
VFD - 10 hp - Institutional - Make-up Air Fan | Business Energy Rebates	$6,315.91	6
VFD - 10 hp - Retail - Supply Fan | Business Energy Rebates	$2,837.77	8
VFD - 20 hp - Institutional - Chilled Water Pump | Business Energy Rebates	$8,641.94	6
VFD - 20 hp - Retail - Exhaust Fan | Business Energy Rebates	$11,009.83	6
VFD - 30 hp - Institutional - Make-up Air Fan | Business Energy Rebates	$15,771.77	6
VFD - 30 hp - Retail - Supply Fan | Business Energy Rebates	$8,030.54	8
VFD - 40 hp - Warehousing - Exhaust Fan | Business Energy Rebates	$23,186.57	6
VFD - 5 hp - Institutional - Chilled Water Pump | Business Energy Rebates	$1,157.18	12
VFD - 5 hp - Retail - Exhaust Fan | Business Energy Rebates	$2,870.19	6
VFD Milk Transfer Pump | Business Energy Rebates	$438.79	6
VFD Milk Vacuum Pump | Business Energy Rebates	$6,440.73	26
Wall Mounted Area Luminaire (1000 lumen) | Business Energy Rebates	$5,687.96	1129
Wall Mounted Area Luminaire (10000 lumen) | Business Energy Rebates	$19,580.91	3629
Wall Mounted Area Luminaire (50000 lumen) | Business Energy Rebates	$0.00	0
Wall Wash Luminaire (1000 lumen) | Business Energy Rebates	$489.38	113
Wall wash luminaire (1500 lumen) | Business Energy Rebates	$177.45	19
Zero-Energy Doors for Reach-In Coolers | Business Energy Rebates	$0.00	0
Electric Steam Cooker Replacement with Gas | Business Energy Rebates	$2,458.53	5
Average Per Unit Admin	**$3.17**	

Table 3: SBES Unitary Admin Cost

Measure	Admin Cost	Unit Count
1/2 Size Hot Food Holding Cabinet | Small Business Energy Solutions	$0.00	0
Advanced Lighting Design (Performance Lighting) | Small Business Energy Solutions	$0.00	0
Air Source Heat Pump (96kBTU/hr) | Small Business Energy Solutions	$0.00	0
Case Lighting for Sign Retrofits | Small Business Energy Solutions	$250,362.06	1103
CEE Tier 2 Commercial Washing Machine | Small Business Energy Solutions	$0.00	0
CEE Tier 3 Commercial Washing Machine | Small Business Energy Solutions	$0.00	0
Circulation Fan (Agriculture) | Small Business Energy Solutions	$0.00	0
Cold Climate Air-Source Heat Pump (24kBTU/hr) | Small Business Energy Solutions	$256,136.23	167
Cold Climate Air-Source Heat Pump (48kBTU/hr) | Small Business Energy Solutions	$512,272.47	167
Cooler Night Covers for Display Cases | Small Business Energy Solutions	$8,493.68	56
Cycling Refrigerated Air Dryer - 200 CFM | Small Business Energy Solutions	$0.00	0
Cycling Refrigerated Air Dryer - 50 CFM | Small Business Energy Solutions	$0.00	0
Dairy Scroll Compressor | Small Business Energy Solutions	$45,709.77	11
Daylighting Controls - Ceiling Mounted | Small Business Energy Solutions	$0.00	0
Daylighting Controls - Switch-Mounted | Small Business Energy Solutions	$0.00	0
Discus or Scroll Refrigeration Compressor | Small Business Energy Solutions	$0.00	0
Door Heater Controls | Small Business Energy Solutions	$0.00	0
Double Heat Pad (Agriculture) | Small Business Energy Solutions	$1,490.09	6
Downlight Luminaire (1200 lumen) | Small Business Energy Solutions	$12,086.33	278
Downlight Luminaire (3000 lumen) | Small Business Energy Solutions	$7,251.80	67
Downlight Luminaire (800 lumen) | Small Business Energy Solutions	$34,682.53	1389
Dual Enthalpy Economizer Controls | Small Business Energy Solutions	$0.00	0
EC Motor for Refrigeration Applications | Small Business Energy Solutions1	$0.00	0
EC Motor for Refrigeration Applications | Small Business Energy Solutions2	$0.00	0
Electric Combination Oven | Small Business Energy Solutions	$6,070.45	6
Electric Combination Oven with Gas | Small Business Energy Solutions	$17,427.77	6
Electric Convection Oven | Small Business Energy Solutions	$1,846.49	6
Electric Convection Oven with Gas | Small Business Energy Solutions	$11,495.54	6
Electric Fryer Replacement with Gas | Small Business Energy Solutions	$17,339.12	6
Electric Griddle | Small Business Energy Solutions	$0.00	0
Electric Griddle Replacement with Gas | Small Business Energy Solutions	$0.00	0
Electric Steam Cooker | Small Business Energy Solutions	$0.00	0
Electric to Natural Gas - Water Heater | Small Business Energy Solutions	$0.00	0
ENERGY STAR Pool Pump | Small Business Energy Solutions	$0.00	0
ENERGY STAR Uninteruptible Power Supplies (UPS) | Small Business Energy Solutions	$0.00	0
ENERGY STAR Washing Machine | Small Business Energy Solutions	$745.60	6
Engine Block Heater Timer (Agriculture) | Small Business Energy Solutions	$612.53	6
Evaporator Fan Motor Controls | Small Business Energy Solutions	$0.00	0
Flood Luminaire (10000 lumen) | Small Business Energy Solutions	$130,123.93	834
Flood Luminaire (48000 lumen) | Small Business Energy Solutions	$5,694.33	11
Four Pin Replacement Lamps for CFLs | Small Business Energy Solutions	$2,207.07	167
Fuel Pump Canopy Luminaire (4000 lumen) | Small Business Energy Solutions	$6,958.91	167
Fuel Pump Canopy Luminaire (8000 lumen) | Small Business Energy Solutions	$0.00	0
Full Size Hot Food Holding Cabinet | Small Business Energy Solutions	$0.00	0
Glass Door Frezzer | Small Business Energy Solutions	$12,631.85	17
Glass Door Refrigerator | Small Business Energy Solutions	$737.83	6
Ground Source Heat Pump (60kBTU/hr) | Small Business Energy Solutions	$30,715.90	6
Heat Pump Clothes Dryer | Small Business Energy Solutions	$0.00	0
Heat Pump Water Heater | Small Business Energy Solutions	$128,165.53	278
Heat Reclaimer Unit (Agriculture) | Small Business Energy Solutions	$10,899.75	6
High Bay Luminaire (15 000 lumen) | Small Business Energy Solutions	$83,322.14	1112
High Bay Luminaire (35 000 lumen) | Small Business Energy Solutions	$38,883.67	222

Measure	Admin Cost	Unit Count
High Bay Luminaire (60 000 lumen) | Small Business Energy Solutions	$0.00	0
High Efficiency Circulator Pump 1.5kW | Small Business Energy Solutions	$0.00	0
High Efficiency Circulator Pump 100W | Small Business Energy Solutions	$0.00	0
High Efficiency Circulator Pump 300W | Small Business Energy Solutions	$0.00	0
High Volume Low Speed Fan (Agriculture) | Small Business Energy Solutions	$13,264.25	6
HVAC Hotel Occupancy Sensor | Small Business Energy Solutions	$0.00	0
Ice-Making Head | Small Business Energy Solutions	$0.00	0
Intelligent Freezer Defrost Controls | Small Business Energy Solutions	$0.00	0
LED Replacement Lamps for HID (10000 lumen) | Small Business Energy Solutions	$34,794.54	333
LED Replacement Lamps for HID (4000 lumen) | Small Business Energy Solutions	$4,639.27	111
LED Troffer (1x4) | Small Business Energy Solutions	$10,123.06	389
LED Troffer (2x2) | Small Business Energy Solutions	$69,296.99	3335
LED Troffer (4x2) | Small Business Energy Solutions	$211,702.34	6113
LED Wall Sconce (1200 lumen) | Small Business Energy Solutions	$3,625.90	83
LED Wall Sconce (3000 lumen) | Small Business Energy Solutions	$0.00	0
LED Wall Sconce (800 lumen) | Small Business Energy Solutions	$0.00	0
Linear Ambient Luminaire (10000 lumen) | Small Business Energy Solutions	$20,512.88	278
Linear Ambient Luminaire (2000 lumen) | Small Business Energy Solutions	$4,400.87	556
Linear Ambient Luminaire (4000 lumen) | Small Business Energy Solutions	$10,533.69	722
Linear Ambient Luminaire (8000 lumen) | Small Business Energy Solutions	$17,468.64	556
Linear Replacement Lamp (2 foot) | Small Business Energy Solutions	$4,001.93	1112
Linear Replacement Lamp (4 foot) | Small Business Energy Solutions	$2,958,749.85	389026
Low/Zero Energy Livestock Waterer | Small Business Energy Solutions	$0.00	0
Low-bay Luminaire (10,000 lumen) | Small Business Energy Solutions	$150,990.17	1667
Low-bay Luminaire (5000 lumen) | Small Business Energy Solutions	$0.00	0
Luminaire Level Lighting Control (LLLC) - High Impact Application | Small Business Energy Solutions	$0.00	0
Luminaire Level Lighting Control (LLLC) - Low Impact Application | Small Business Energy Solutions	$0.00	0
Milk Pre-cooler | Small Business Energy Solutions	$0.00	0
Multi-Tank Conveyor Dishwasher - High Temp | Small Business Energy Solutions	$26,126.98	6
Multi-Tank Conveyor Dishwasher - Low Temp | Small Business Energy Solutions	$17,932.25	6
Natural Barn Ventiliation - Summer Only | Small Business Energy Solutions	$0.00	0
Natural Barn Ventiliation - Year-Round | Small Business Energy Solutions	$0.00	0
Natural Gas Conversion - Commercial Electric Clothes Dryer | Small Business Energy Solutions	$0.00	0
Networked/Connected - High Impact Application | Small Business Energy Solutions	$0.00	0
Networked/Connected - Low Impact Application | Small Business Energy Solutions	$0.00	0
No-Loss Drain | Small Business Energy Solutions	$0.00	0
Occupancy Sensor (Ceiling Mounted) | Small Business Energy Solutions	$2,305.88	28
Occupancy Sensor (Wall Mounted) | Small Business Energy Solutions	$46,158.53	556
Occupancy Sensor (Exterior) | Small Business Energy Solutions	$0.00	0
Open to Closed Cooler Conversion | Small Business Energy Solutions	$134,669.31	43
Outside Air Economizer | Small Business Energy Solutions	$0.00	0
Packaged Terminal Heat Pump (12kBTU/hr) | Small Business Energy Solutions	$0.00	0
Parking Garage Luminaire (4000 lumen) | Small Business Energy Solutions	$115,981.78	2779
Parking Garage Luminaire (8000 lumen) | Small Business Energy Solutions	$0.00	0
Pole/Arm-Mounted Area Luminaire (20000 lumen) | Small Business Energy Solutions	$121,780.87	1945
Pole/Arm-Mounted Area Luminaire (4000 lumen) | Small Business Energy Solutions	$10,438.36	834
Pole/Arm-Mounted Area Luminaire (60000 lumen) | Small Business Energy Solutions	$0.00	0
Pole/Arm-Mounted Decorative Luminaire (1500 lumen) | Small Business Energy Solutions	$187.89	11
Pole/Arm-Mounted Decorative Luminaire (5000 lumen) | Small Business Energy Solutions	$939.45	17
Pot, Pan and Utensil Dishwasher - High Temp | Small Business Energy Solutions	$0.00	0
Premium High Bay Luminaire (15 000 lumen) | Small Business Energy Solutions	$49,186.13	556
Premium High Bay Luminaire (35 000 lumen) | Small Business Energy Solutions	$57,383.81	278
Premium High Bay Luminaire (60 000 lumen) | Small Business Energy Solutions	$0.00	0
Refrigerated Case Luminaire | Small Business Energy Solutions	$10,688.91	167

Measure	Admin Cost	Unit Count
Refrigerated Vending Machine Controls | Small Business Energy Solutions	$0.00	0
Remote Condensing Unit | Small Business Energy Solutions	$0.00	0
Self-Contained Ice Maker | Small Business Energy Solutions	$0.00	0
Server Virtualization and Decommissioning | Small Business Energy Solutions	$0.00	0
Server-based Power Management Software | Small Business Energy Solutions	$0.00	0
Single Heat Pad (Agriculture) | Small Business Energy Solutions	$0.00	0
Single -Tank Conveyor Dishwasher - High Temp | Small Business Energy Solutions	$0.00	0
Single -Tank Conveyor Dishwasher - Low Temp | Small Business Energy Solutions	$0.00	0
Single-Tank Door type Dishwasher - High Temp | Small Business Energy Solutions	$0.00	0
Single-Tank Door type Dishwasher - Low Temp | Small Business Energy Solutions	$0.00	0
Solar DHW System | Small Business Energy Solutions	$0.00	0
Solid Door Freezer | Small Business Energy Solutions	$1,767.37	6
Solid Door Refrigerator | Small Business Energy Solutions	$3,734.93	33
Stairwell and Passageway Luminaire | Small Business Energy Solutions	$0.00	0
Standard Capacity Electric Fryer | Small Business Energy Solutions	$2,979.94	6
Strip-Curtains for Display Cases | Small Business Energy Solutions	$1,656.79	6
Track/Mono-point Direction Luminaire | Small Business Energy Solutions	$0.00	0
Under-Counter Dishwasher - HighTemp | Small Business Energy Solutions	$0.00	0
Under-Counter Dishwasher - Low Temp | Small Business Energy Solutions	$0.00	0
Variable Speed Kitchen Exhuast Fan | Small Business Energy Solutions	$21,056.13	6
Ventilation Fan (Agriculture) | Small Business Energy Solutions	$0.00	0
VFD - 10 hp - Institutional - Make-up Air Fan | Small Business Energy Solutions	$0.00	0
VFD - 10 hp - Retail - Supply Fan | Small Business Energy Solutions	$0.00	0
VFD - 20 hp - Institutional - Chilled Water Pump | Small Business Energy Solutions	$0.00	0
VFD - 20 hp - Retail - Exhaust Fan | Small Business Energy Solutions	$0.00	0
VFD - 30 hp - Institutional - Make-up Air Fan | Small Business Energy Solutions	$0.00	0
VFD - 30 hp - Retail - Supply Fan | Small Business Energy Solutions	$0.00	0
VFD - 40 hp - Warehousing - Exhaust Fan | Small Business Energy Solutions	$0.00	0
VFD - 5 hp - Institutional - Chilled Water Pump | Small Business Energy Solutions	$0.00	0
VFD - 5 hp - Retail - Exhaust Fan | Small Business Energy Solutions	$0.00	0
VFD Milk Transfer Pump | Small Business Energy Solutions	$2,427.04	6
VFD Milk Vacuum Pump | Small Business Energy Solutions	$8,510.28	6
Wall Mounted Area Luminaire (1000 lumen) | Small Business Energy Solutions	$9,820.41	311
Wall Mounted Area Luminaire (10000 lumen) | Small Business Energy Solutions	$56,367.15	1667
Wall Mounted Area Luminaire (50000 lumen) | Small Business Energy Solutions	$0.00	0
Wall Wash Luminaire (1000 lumen) | Small Business Energy Solutions	$0.00	0
Wall wash luminaire (1500 lumen) | Small Business Energy Solutions	$0.00	0
Zero-Energy Doors for Reach-In Coolers | Small Business Energy Solutions	$1,334.61	6
Electric Steam Cooker Replacement with Gas | Small Business Energy Solutions	$0.00	0
refri | Small Business Energy Solutions	$0.00	0
Average Per Unit Admin	**$13.94**	

Table 4: HEA Unitary Admin Cost

Measure	Admin cost	Unit Count
Drain Water Heat Recovery | Home Energy Assessment	$9,204.16	85
ECM Circulator Pump | Home Energy Assessment	$0.00	0
Heat Pump Water Heater | Home Energy Assessment	$12,845.19	124
Solar air heating | Home Energy Assessment	$0.00	0
Solar Domestic Hot Water | Home Energy Assessment	$2,545.05	7
Unconverted D | Home Energy Assessment	$536,239.13	1,745
Whole Home | Home Energy Assessment	$3,483,047.39	2,804
Average Per Unit Admin	**$848.68**	

Energy Efficient Equipment Rebates: Registration

efficiencyPEI offers energy efficiency incentives for existing homes under the Energy Efficient Equipment Rebates program. To qualify for rebates, upgrades must meet all eligibility criteria. Upgrades must be completed at the date of application. Rebates are issued to the homeowners, unless assigned directly to the contractor.

OFFICE USE ONLY	
EnerGuide D-File number:	efficiencyPEI number:
Enrollment date:	

Applicant Information

Name:	
Phone:	Email:

☐ *I would like to receive email communications (tips, promotions, etc.) from* **efficiencyPEI**. *(You may withdraw your consent at any time.)*

☐ *I/we have an annual household income of $35,000.00 or less. (attach most recent GST notification)*

Attach receipts for all work related to upgrades completed.

Home Information

Civic address:	Mailing address:
City/town:	Postal code:
Phone:	PID:

The dwelling owner has the right to **allow or deny** a particular individual or contractor access to their residence for the purpose of performing these upgrades. Neither **efficiencyPEI** nor the Government of PEI is responsible for the actions or work of this or any contractor.

Certifications by Property Owner/Authorized Agent

I attest that the above information is correct and that I understand the qualifying criteria required to be eligible for incentives in the Energy Efficient Equipment Rebates program, including minimum energy efficiency requirements.

Freedom of Information and Protection of Privacy

Personal information on this form is collected under section 31(c) of the *Freedom of Information and Protection of Privacy Act* R.S.P.E.I. 1988, c. F-15.01, as it relates directly to and is necessary for the provision of programs and services operated by **efficiencyPEI**. This personal information may be shared with other public bodies under the FOIPP Act sections 37 (1)(g) and 37(1)(g.1) when the disclosure is necessary for the delivery of common or integrated programs or services. If you have any questions about this collection of personal information, you may contact the Department of Transportation, Infrastructure and Energy, **efficiencyPEI**, 69 Belvedere Avenue, Suite 1-B01, Charlottetown, PE C1A 7N8, 902-620-3690.

Prince Edward Island CANADA

Canada

This program is funded in part by the Government of Canada

Please sign and date on page 2

Energy Efficient Equipment Rebate Amounts:

Energy Efficient Equipment Rebates	Rebate (regular)	Rebate (low- income)	Minimum Requirements
Mini-split (Ductless) Air Source Heat Pump	$1,200.00 *($600.00 for 2nd unit)*	$2,400.00 *($1,200.00 for 2nd unit)*	ENERGY STAR® Most Efficient 2018 (minimum EER 12.5, SEER 20.0, HSPF 10.0)
Central (Ducted or Air-to-Water) Air Source Heat Pump	$2,500.00	$4,500.00	ENERGY STAR Most Efficient 2018 (minimum EER 12.5, SEER 18.0, HSPF 9.6)
Ground Source (Geothermal) Heat Pump	$4,000.00	$7,500.00	ENERGY STAR Most Efficient 2018*
Oil Boiler	$500.00	$900.00	ENERGY STAR w/AFUE of 87.0% or higher
Oil Furnace	$500.00	$900.00	ENERGY STAR w/AFUE of 94.0% or higher
Propane Boiler	$500.00	$900.00	ENERGY STAR Most Efficient 2018 w/AFUE of 95.0% or higher
Propane Furnace	$500.00	$900.00	ENERGY STAR Most Efficient 2018 w/AFUE of 97.0% or higher
Summerside Electric Thermal Storage Furnace	$1,500.00	$2,750.00	Must be through City of Summerside Electric Utility "Heat for Less Now!" Program
Summerside Electric Thermal Storage Heater	$750.00	$1,400.00	Must be through City of Summerside Electric Utility "Heat for Less Now!" Program
Summerside Electric Thermal Storage Hot Water Heater	$500.00	$900.00	Must be through City of Summerside Electric Utility "Heat for Less Now!" Program
Solar Thermal Hot Water Heater	$1,500.00	$2,750.00	ENERGY STAR or CAN/CSA F379 or CSA Class 2831-06, 2831-07, 2831-30, 2831-37 or Class 8854
Tankless Propane Hot Water Heater	$500.00	$900.00	ENERGY STAR w/Energy Factor of 0.90 or higher
Air Source Heat Pump (Hybrid) Hot Water Heater	$1,000.00	$1,800.00	ENERGY STAR w/Energy Factor of 2.0 or higher (< 55 gal.)
Indirect Hot Water Heater	$500.00	$900.00	
Heat/Energy Recovery Ventilator	$1,000.00	$1,800.00	ENERGY STAR
Boimass Stove	$1,000.00	$1,800.00	EPA Approved or CSA-B415.1-10
Biomass Boiler/Furnace	$2,000.00	$3,500.00	EPA Approved or CSA-B415.1-10

*Minimum Geothermal Heat Pump criteria

Closed Loop Water-to-Air GHP: 17.1 EER and 3.6 COP
Closed Loop Water to Water GHP: 16.1 EER and 3.1 COP
Open Loop Water-to-Air: 21.1 EER and 4.1 COP
Open Loop Water-to-Water: 20.1 and 3.5 COP

Low-income is defined as an annual household income of $35,000,00 or less.

Terms and conditions:

I/we acknowledge and agree that:

1. The property and dwelling that is the subject of this application under the **efficiencyPEI** Energy Efficient Equipment program is registered with the Taxation and Property Records Division of the PEI Department of Finance in my/our name, the dwelling has been occupied for at least 6 months and any upgrades that qualify for a rebate under this program have not been completed prior to the dwelling being 6 months occupied.
2. I/we have not defaulted on a previous loan with the Government of PEI or a Crown Corporation.
3. The eligibility of specific rebates under the **efficiencyPEI** Energy Efficient Equipment Rebates program shall be determined by **efficiencyPEI**.
4. Site assessments may be required and I/we agree to allow reasonable access to my/our dwelling during normal business hours.
5. If I/we are receiving any other Government of PEI funding for the implementation of upgrades subject to this application I/we will disclose this funding to **efficiencyPEI**. Funding received from all government sources will not exceed the total cost of upgrades.
6. The rebate limit per dwelling under all **efficiencyPEI** programs is $5,000.00. If the dwelling has received funding through other **efficiencyPEI** programs (loans or grants) the rebate limit will be prorated to reflect this. Rebates limits for multi-unit residential buildings or low income clients may be higher.
7. The upgrades for which I/We are applying for have been completed within the previous 12 months.

I/we have been advised that:

8. I am/we are required to inform the contractor who is completing energy upgrades on my/our dwelling that the contractor must declare to the Canada Revenue Agency all the funds paid to the contractor for the completion of the work on my/our dwelling.
9. All work requiring the installation of ozone depleting substances (refrigerants) must be completed by an individual certified as a "registered handler" as specified in the Environmental Protection Act R.S.P.E.I. 1988, Cap. E-9 (Ozone Layer Protection Regulations.) Registered handler licence number must be included on receipts.
10. All work requiring the connection of electrical components require a "Certificate of Compliance" completed by a licensed electrician as specified in the Electrical Inspection Act R.S.P.E.I. 1988, Cap. E-3 (Canadian Electrical Code Regulations.) Certificate of Compliance must be submitted with receipts.
11. Geothermal heat pumps must be installed by a Canadian Geo Exchange Coalition (CGC) Certified Installer.

Signature: _____ _____/_____/_____
DD MM YYYY

18EG15-50246

Prince Edward Island
CANADA

Payee Registration Form

(see reverse for instructions)

PAYEE #	

Freedom of Information and Protection of Privacy

The personal information requested on this form is collected under the authority of section 31(c) of the *Freedom of Information and Protection of Privacy Act* R.S.P.E.I. 1988, Cap. F-15.01, and will be used for the purpose of administering payments to the individuals or suppliers that are identified on this form. This use includes the sharing of this information within the Government of Prince Edward Island and its agencies to update and ensure the accuracy of information for administering payments. Questions on the collection and use of this information can be directed to Payment Processing at (902) 368-4010.

☐ **New Payee** ☐ **Update to Payee Information (i.e. address or updated banking)**

Section A: Personal or Business Information

Fill out this section as an individual **OR** for your business. All fields are required.

For Individuals Only

First Name	Full Middle Name(s)	Last Name	Previous Last Name(s)

Date of Birth (DD/MM/YYYY)	If you are a Provincial Government Employee: Employee Number	Department

For Businesses Only

Business Name (Legal name and operating name if different)	HST/GST No.	Contact Person & Position

For Individuals and Businesses

Current Mailing Address	City	Province or State	Postal Code or Zip Code

Phone Number (including area code)	Email Address (for payment remittance details)	Email Address (for purchase orders if different)

Previous Mailing Addresses. Please provide as many previous mailing addresses as possible. We use this information to update our records and to prevent the duplication of your account.

Section B: Payment Information

To receive payments from the Government of Prince Edward Island you **MUST** provide your banking information. Failure to provide banking information will result in unprocessed and delayed payments. Please attach **one** of the following:

☐ Void cheque

or ☐ Correspondence from Financial Institution (bank)

Section C: Certification

I, as the person named in this form in my own right, or as the representative of the company or business named in this form entitled to receive payments from the Government of Prince Edward Island, hereby authorize the Government of Prince Edward Island or its agencies to share the information collected on this form with each other for the purposes of making a payment that is due. By providing banking information for electronic payment I, as the person named in this form in my own right, or as the representative of the company or business named in this form entitled to receive payments from the Government of Prince Edward Island, hereby authorize the Government of Prince Edward Island or its agencies to electronically deposit those payments into the noted bank account until further notice. If I am the representative of the company or business named in this form, I have the authority to bind the company or business.

Authorized Signature (Forms returned without a signature will not be processed) Sign Here X _____	Printed Name (For Businesses Only)	Date

Section D: Additional Information

Section E: For Office Use Only

BUSINESS UNIT: ☐ **FIS** ☐ **MEPS** ☐ **LMDA** ☐ **ISM** ☐ **PSB** ☐ **FLSB**

NON-CONFIDENTIAL

Request IR-42:

Attachment 1 to Appendix A, lines 170-171, include the data for the Small Business Energy Demand Reduction measures and lines 150-152 include the data for the Business Energy Rebates Demand Reduction measures.

(a) Provide the source and supporting documentation of the measure life data.

(b) Provide the source and supporting documentation of the Gross Peak Demand Savings per Unit at Meter (Watts) Pre-RUL.

(c) Provide the source and supporting documentation of the Per Unit Present Value Avoided Cost Benefits ($).

(d) Provide the source and supporting documentation of all other data specified for the Business Demand Reduction measures.

Response IR-42:

a) Please refer to EfficiencyOne's response to NS Power IR-41 for this information.

b) Please refer to EfficiencyOne's response to NS Power IR-41 for this information.

c) Please refer to EfficiencyOne's response to NS Power IR-41 for this information.

d) Please refer to EfficiencyOne's response to NS Power IR-41 for this information.

NON-CONFIDENTIAL

Request IR-43:

Reference: Evidence, page 32, lines 27-28.

EfficiencyOne states: "ETS systems allow residential customers to gain access to Time-of-Use rates."

(a) Did EfficiencyOne assume that all residential participants installing the electric thermal storage would use the Time-of-Use service and rates?

(b) Will using, or not using, the Time-of-Use rates affect the calculated benefits of the ETS systems, and the demand reduction avoided costs in particular?

(c) Would the participants with the ETS benefit from the measure if they are not served under the Time-of-Use rate?

Response IR-43:

a) Yes. EfficiencyOne assumed, as is currently the case, that the Time-of-Use rate would apply to all residential customers that install an electric thermal storage (ETS) system.

b) No. The calculated benefits used for the Total Resource Cost screening of EfficiencyOne's proposed demand reduction initiatives are NS Power's applicable avoided costs and these are unaffected by use of the Time-of-Use rate.

c) Although all customers would benefit from the utility avoided costs referenced in part b), potential participants would see the Time-of Use rate as the key benefit and EfficiencyOne would be unlikely to attract significant participation through incentives alone if the Time-of-Use rate were to be discontinued.

NON-CONFIDENTIAL

Request IR-44:

Referring to EfficiencyOne Evidence, starting from page 47, line 30, "In this application, EfficiencyOne proposes and requests approval to add a third Performance Target: Lifetime Energy Savings."

(a) Explain the rationale for adding Lifetime Energy Savings (LES) as a third Performance Target;

(b) Please provide copies of any research, reports or studies relied upon EfficiencyOne to support the inclusion of LES as an additional performance metric;

(c) Please detail any and all consultation by EfficiencyOne held with regulatory stakeholders regarding the introduction of LES as an additional performance metric;

(d) Describe the measuring and verification process used to determine whether the LES performance target is in fact met. Use, as an example, a measure with an 18-year lifetime.

(e) What would be the level of uncertainty of whether the LES target is met in the first year, if the lifetime of the measure is 18 years?

(f) Please describe the process EfficiencyOne intends to implement for verifying LES.

Response IR-44:

a) As noted in Section 7.2.1 of EfficiencyOne's evidence (page 48):

> "The impact of a DSM Plan on ratepayers should be clear. Lifetime Energy Savings, as a Performance Target, provides a direct link to the long-term ratepayer benefits ultimately achieved by a DSM Plan. While annual energy and demand savings are important measures, the cost-effectiveness and benefits of a DSM Plan are best demonstrated through Lifetime Energy Savings.
>
> EfficiencyOne is asking that Lifetime Energy Savings be added as a Performance Target for the 2020-2022 DSM Plan, in order to more comprehensively measure the Plan's direct impact on ratepayers. Further, the addition of this Performance Target will allow this impact to be presented in a manner meaningful to ratepayers.
>
> While annual energy and demand savings provide useful information on the annual level of DSM resources acquired (e.g. energy and capacity savings), Lifetime Energy Savings provides additional useful information which is more closely correlated to Lifetime Ratepayer Benefits."

b) Please refer to Attachment 1 of this IR response, which provides a 2015 report on Performance Indicators prepared by Dunsky Energy Consulting and submitted as part of EfficiencyOne's 2016-2018 DSM Resource Plan Application.

c) EfficiencyOne first stated its intention to consider LES as part of a subsequent three-year Plan, during the 2016-2018 DSM Resource Plan regulatory process.

When asked by Synapse Energy Economics why LES was not being proposed as a Performance Target within the 2019 DSM Resource Plan, EfficiencyOne responded:

> "EfficiencyOne continues to maintain the position advanced during the 2016-2018 DSM Resource Plan regulatory process, namely that *'…EfficiencyOne is open to considering lifetime energy savings as a Performance Target in a subsequent three year Plan.'* "[1]

EfficiencyOne presented more detailed information related to the proposal of LES as a Performance Target on February 20, 2019 at the 2020-2022 DSM Resource Plan Technical Conference.

d) Econoler's current Evaluation process relies upon the sourcing of Effective Useful Life (EUL) from one of two methods, which are not dependent on the length of the EUL (e.g., 18 years):

i. EUL values are sourced based on a secondary literature review of available values. The EUL values obtained from this review typically originate from other jurisdictions' Technical Reference Manuals and/or measure persistence studies conducted in other jurisdictions.

ii. Derived EUL values based on product rated lifetimes in hours, and specific annual hours of use for a given application and/or product type.

In addition, Econoler also introduced dual-baseline considerations for Light Emitting Diode lighting as part of the 2017 Evaluation process.

The Nova Scotia Utility and Review Board's Verification Consultant will verify the methodology employed by the Evaluator. Of note, the 2017 Savings Verification report,

[1] M08604, E-11, E1 (Synapse) RIRs 1-22, filed May 30, 2018, at RIR-03(c).

prepared by H. Gil Peach & Associates LLC, found that "All 2017 evaluations conducted by Econoler are within accepted industry frameworks"[2] and that "Econoler has appropriately developed savings-weighted measure life analysis for net energy savings at the generator for all program components reporting energy savings for 2017."[3]

EfficiencyOne is proposing to rely on evaluated and verified LES results for reporting purposes related to the LES Performance Target.

e) The uncertainty of a given measure's EUL value is dependent on the specific methodology used to originally produce that value. Econoler has not included specific indications of uncertainty relating to each value relied upon in the Evaluation process within Evaluation Reports. EfficiencyOne understands that Econoler relies upon qualitative technical assessments of a given value's reliability and accuracy when selecting appropriate EUL values.

f) EfficiencyOne intends to continue to rely upon independently evaluated and verified LES results for the purposes of reporting on LES as a Performance Target. EfficiencyOne is not currently aware of any material changes to Econoler's approach to evaluating LES, relative to current practice as referred to in part d) of this response.

[2] M08604, E-5, Report of H. Gil Peach, Filed May 3, 2018, at page 26.
[3] *Ibid,* at Pages 26-27.

DSM SCREENING IN NOVA SCOTIA

TOWARD A BALANCED COST-EFFECTIVENESS FRAMEWORK

PREPARED BY
DUNSKY ENERGY CONSULTING

Philippe Dunsky, President
François Boulanger, Senior Consultant

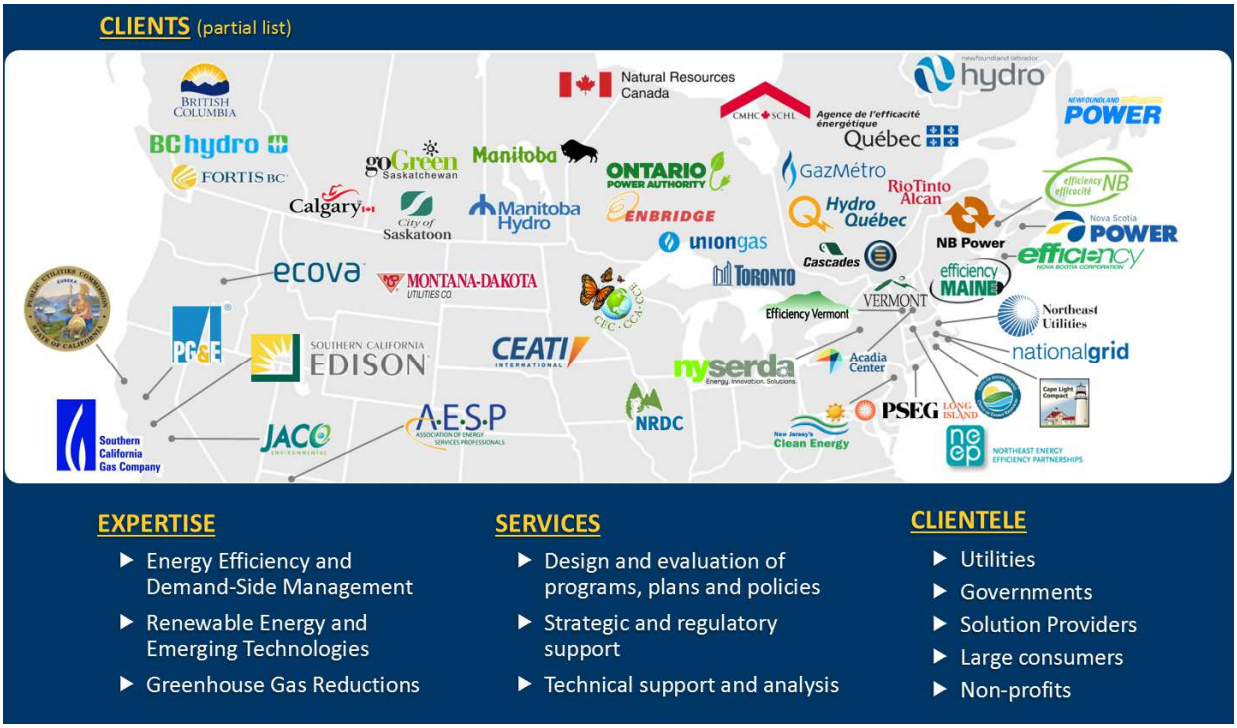
SUBMITTED TO
EFFICIENCY NOVA SCOTIA

February 23rd, 2015

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TABLE OF CONTENTS

EXECUTIVE SUMMARY **1**

INTRODUCTION TO DSM SCREENING **4**

Brief History 4
Standard Cost-effectiveness Tests 4
Choice of Tests: The Rise of the TRC and More Recent Trends 6
Cost-Effectiveness in Nova Scotia 7

CONCERNS WITH THE CONVENTIONAL TRC **9**

Introduction 9
Issue #1: accuracy: Is the TRC Calculated Correctly? 10
Issue #2: Bias: Does the Conventional TRC Neglect Important Benefits? 13
Issue #3: Ratepayer Value: Does The TRC Best Reflect A Ratepayer Perspective? 20
Issue #4: Policy: What if the TRC Is Inconsistent with Public Policy? 22

RECENT CHANGES TO STANDARD PRACTICES **24**

Trends in Leading Regions 24
The NESP's Resource Value Framework 26
New Northeast Cost-Effectiveness Guidelines 27

OPTIONS FOR NOVA SCOTIA **28**

Overview 28
Option A. Fix the TRC (Assess Non-Energy Benefits + Other Changes) 29
Option B. Move Focus to PAC Test 32
Primary Recommendation 33
Notes on Application 34

CONCLUSIONS & RECOMMENDATIONS **35**

REFERENCES **37**

APPENDIX A: RESOURCE VALUE FRAMEWORK – N.S. ASSESSMENT **41**

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EXECUTIVE SUMMARY

The Total Resource Cost (TRC) test was first defined, along with a series of other "standard" tests, in 1983, in the context of California's initial, utility-driven energy efficiency and demand-side management (DSM) programs.[1] Since the early to mid-1990s, the TRC has commonly been used as the primary method to determine the cost-effectiveness of demand-side management (DSM) options.

More recently, the DSM community has come to question the wisdom of basing key decisions on the TRC. Specifically, four concerns have come to light:

1. **Accuracy:** To many, the TRC has been approached as a black box – assumed to be right, but rarely opened. In practice, key assumptions vary significantly from region to region, and are often more accidental than the result of deliberate choices and tradeoffs. Many TRCs may be using inappropriate inputs that can significantly impact the accuracy of key results.

2. **Bias:** While the TRC is meant to address all costs and all benefits, in practice it often addresses all costs *but only a portion of benefits*. **This fundamental flaw in the way the TRC is often practiced produces a systemic bias against DSM** as compared with supply-side options. As a result, the test often fails to fairly reflect its intended "total" cost and benefit perspective.

3. **Ratepayer Value:** The TRC perspective itself is focused on a sort of theoretical optimum – a maximization of the combined economic welfare of participants and non-participants. Yet in doing so, it ignores a more practical perspective: maximizing the value that ratepayers receive from the dollars invested on their behalf.

4. **Policy Conflict:** In some circumstances, DSM screening may clash with policy objectives, especially to the extent policymakers have defined a quantified savings target (or related goals) outside of the TRC framework. In Nova Scotia's case, no such targets exist, but emphasis on utility least-cost procurement provided for in 2014 legislation may be inconsistent with the TRC.

As a result, the majority of leading DSM regions across North America today have either sought to modify their TRC to account for the missing (non-energy) benefits, among other changes, or moved toward other tests such as the Program Administrator Cost (PAC) test. These jurisdictions include four of the "Top 5" and eight of the "Top 10" states as rated by the most recent American Council for an Energy-Efficiency Economy (ACEEE) Scorecard.

[1] For all intents and purposes, the tests have remained unchanged for the past 30 years.

In the same vein, the National Efficiency Screening Project[2] (NESP) recently developed best practice guidelines that similarly call for either wholesale changes to the TRC, or a shift toward the PAC test. Finally, the Northeast Energy Efficiency Partnership's (NEEP) Evaluation, Measurement and Verification Forum[3] adopted similar guidelines at the end of 2014 (NEEP EM&V Forum, 2014).

Our review of the issues and options for Nova Scotia concurs with the need for changes to the current cost-effectiveness framework, to ensure internal consistency and reflect best practices. In the absence of significant change, we find that current practice cannot accurately reflect the costs and benefits of DSM, potentially leading to inefficient levels of investment and program design choices, to the detriment of ratepayers as a whole.

Correcting this problem can be done either through complex corrections to the TRC itself, including its inputs, or by moving to the more straightforward PAC test. While both options involve tradeoffs, in the case of Nova Scotia, the preponderance of arguments point strongly toward focusing on the PAC test:

- **Simplicity:** Applying the PAC will be a far simpler – and far less expensive – exercise than "fixing" the current TRC by, among other things, assessing non-energy benefits. It may also be less contentious (see below).
- **Accuracy:** Even if the TRC were to be corrected, in part by efforts to account for non-energy benefits (NEBs), the accuracy of such assessments may raise concerns, leading to lengthy discussions, ongoing debate, and more contentious hearings than otherwise necessary.
- **Relevance:** While the TRC (once corrected) arguably would provide a more balanced picture of cost-effectiveness from the perspective of all consumers, our experience with past Nova Scotia UARB hearings and stakeholder sessions points to a strong interest in the value of ratepayer DSM dollars, a perspective reflected only by the PAC test.
- **Alignment:** Similarly, the PAC test perspective, with its utility cost focus, would be more aligned with the structure created by the Nova Scotia *Electricity Efficiency and Conservation Restructuring (2014) Act* in that it requires the utility to procure DSM services.

As a result of our review, we make the following recommendations:

[2] The National Efficiency Screening Project (NESP) is comprised of organizations and individuals focused on improving the way that electricity and natural gas energy efficiency resources are screened for cost-effectiveness. For more information: http://www.nhpci.org/natlscreeningprinciples.html

[3] NEEP's EM&V Forum consists of nine states across the Northeast and mid-Atlantic regions. It is steered by a committee of state public utility commissioners, energy office and air agency representatives. Its participants include state energy and environmental agency staff, program administrators and evaluation practitioners/experts.

RECOMMENDATIONS

1. **Nova Scotia adopts the Program Administrator Cost (PAC) as the primary test for purposes of screening DSM cost-effectiveness;**
2. **The PAC test be applied for information purposes at the program and portfolio levels, and for decision-making purposes at the sector level;**
3. **That critical inputs, including most notably the discount rate, be re-examined for consistency with Nova Scotia's DSM context as well as risk; and**
4. **That a transparent reporting template, adapted from NESP's Resource Value Framework and designed to address key test inputs, be developed to facilitate future understanding of critical test choices by all parties involved.**

INTRODUCTION TO DSM SCREENING

BRIEF HISTORY

In the early 1980s, following on the heels of the second energy crisis, California's utilities moved to encourage improved customer energy efficiency. In order to provide a framework for judging the appropriateness of utility DSM spending, the California Energy Commission and California Public Utilities Commission jointly developed a series of standardized "tests", published in 1983 in what is commonly referred to as the Standard Practice Manual (SPM). While the manual has since undergone two revisions, they have been by and large cosmetic.[4]

STANDARD COST-EFFECTIVENESS TESTS

The tests provided an analytical framework designed to reflect different perspectives. Among them, three are commonly used today[5], namely:

- **The Total Resource Cost (TRC)** test is designed as a sort of combination of the participant and non-participant perspectives, seeking to compare all direct costs (both utility and participant contributions) to all direct benefits. As we will see, the TRC in particular has often overlooked considerable participant benefits, a bias that is the subject of strong critique because of the lopsided results it can produce. As a result, a number of regions have established Modified Total Resource Cost (MTRC) tests, primarily to integrate non-energy benefits into the equation.
- **The Societal Cost Test (SCT)** is treated as a variant to the TRC in California Standard Practice Manual; however, it provides a distinct perspective from the TRC that has been used by

[4] The bulk of changes brought to the second version of the original manual, published in 1987, were focused on semantics – the names of various tests (the "Non-Participant Test" became the "Ratepayer Impact Test"; the "All-Ratepayer Test" became the "Total Resource Cost (TRC)" test. A similarly cosmetic change involved declaring the Societal Cost Test a variant of the TRC rather than an entirely distinct test. This was again largely the case with the 3rd edition, published in 2001 (wherein the Utility Cost Test was renamed the Program Administrator Cost test, in recognition of the fact that a new, non-utility entity was by then responsible for parts of California's overall DSM effort. Additional changes involved defining self-generation as a type of DSM, and expanding on the nature of externalities that should be included in the Societal Cost Test (California Public Utilities Commission and California Energy Commission, 2001).

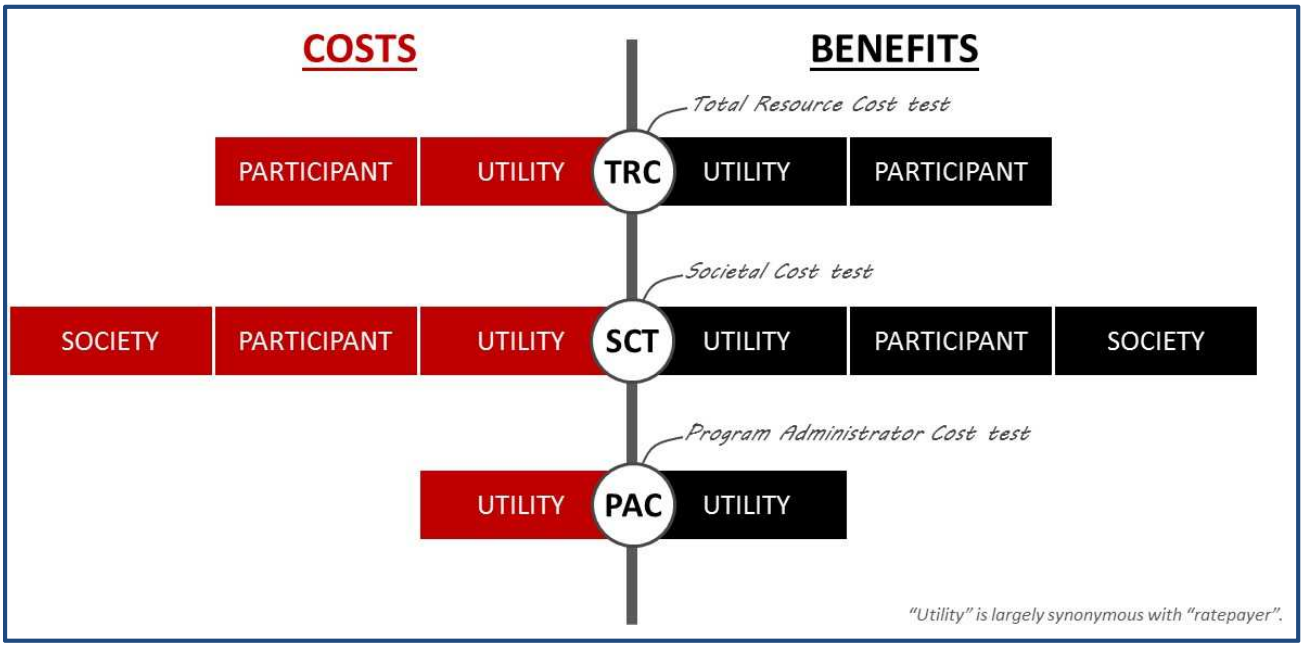
[5] In addition to the three perspective presented here, the manual also includes tests to reflect the narrower participant and non-participant perspectives. While providing useful information for program design, notably to determine incentive levels, these are not used as screening tests since they each address only one group of customers.

different jurisdictions. The SCT takes a more holistic view than the TRC by accounting for other benefits to society, primarily environmental.

- **The Program Administrator Cost (PAC) test,** previously known as the Utility Cost test, compares the utility's savings (primarily the present value of long-run avoided energy and capacity costs) to its DSM expenditures. This effectively compares its cost of procuring DSM with the alternative cost of procuring supply, and treats DSM in a manner analogous with alternative supply options.

Figure 1 below provides an illustrative view of the costs and benefits included in these three tests. We will return to this illustration later in the paper.

Figure 1: Simplified Illustration of the Intended Primary Benefit/Cost Tests



The tests described in the Standard Practice Manual should be viewed in relation to each other. The tests with a broader perspective typically include either, implicitly or explicitly, the components of some of the other tests.

Finally, it is worth mentioning that in all cases, the tests were initially devised to provide guidance to inform reasonable judgment, rather than to be used individually as a hard "go/no-go". To wit:

> "The tests set forth in this manual are not intended to be used individually or in isolation… This multi-perspective approach will require program administrators and state agencies to consider *tradeoffs between various tests*." (*our emphasis)* (California Public Utilities Commission and California Energy Commission, 2001)

While some regions have maintained the original intent by using the test results as guidance within the context of multiple perspectives and considerations, many regions have, over time, drifted toward the use of hard thresholds, often relying on a single test.

CHOICE OF TESTS: THE RISE OF THE TRC AND MORE RECENT TRENDS

Through the vagaries of time and the shifting importance given to DSM, most states and provinces that gave it consideration have, in the end, landed on the use of the TRC test as either the primary or sole indicator of cost-effectiveness.

One of the reasons this was deemed acceptable to even the most ardent DSM advocates was that, in practice, few measures had difficulty passing the standard TRC. Indeed, throughout the 1990s, significant "low-hanging fruit" (low-cost and achievable) was available to DSM administrators, the result of a dearth of codes and standards, and the relative newness of DSM programs themselves that had not yet made a significant dent in market penetration of more efficient technologies. With inefficient equipment so ubiquitous, opportunities readily passed the TRC, with portfolio-wide benefit/cost ratios routinely exceeding 3 or even 4 to one. This context was further heightened by the arrival, at the turn of the century, of fluorescent lighting equipment (CFLs and high performance T8s), which offered tremendous savings opportunities at extremely low cost.[6] As a result, the limitations of the TRC, which we will address later in this paper, were to a large extent considered theoretical, and serious consideration of them was, notwithstanding the odd paper or report[7], largely non-existent.[8]

Today, however, with much of the low-hanging fruit already picked, and with a recent resurgence in the adoption of tighter codes and standards, ensuring a proper assessment of the costs *and benefits* of DSM potential is no longer a luxury. Indeed, some Program Administrators have begun to examine more closely their application of the TRC, including the simplifying steps that may inadvertently have removed some of DSM's inherent value (e.g. measure lives cut artificially short because of software limitations); or neglected it altogether (e.g. ignoring the lower risk profile offered by DSM as compared to supply options). Similarly, some are taking a second look at key assumptions.

---

[6] For much of the first decade of this century, CFLs alone accounted for an overwhelming share of residential electricity savings. For example, CFLs accounted for fully 90% of Efficiency Vermont's residential electricity savings in 2009 (Efficiency Vermont, 2010).

[7] One example of an early challenge can be found in (Fulmer & Biewald, 1994).

[8] Similarly, a variety of application problems were also given scant attention. For example, in some regions the useful lives of longer-lasting measures (e.g. envelope improvements, which arguably persist for decades) were severely restricted because a planning tool initially designed for another purpose could not accommodate more than 15 or 20 years of data. Again, because the limitation was more theoretical than practical – i.e. because there were so many low-hanging fruit and savings goals were not as aggressive as today – the cost of accommodating more appropriate inputs was not deemed a worthwhile investment.

Most significantly, many are considering and to varying degrees integrating the value of non-energy benefits (otherwise known as NEBs) that accrue to participants and, to a lesser extent, utilities. Finally, some authors and a number of leading regions have begun to take the position that the TRC is just not the appropriate test to begin with. As we will see in the case studies presented on page 24 and beyond, **the vast majority of DSM leaders now apply something other than the traditional TRC test.**

COST-EFFECTIVENESS IN NOVA SCOTIA

REGULATORY DRIVERS

While the current effort at DSM in Nova Scotia is relatively new, the province's consideration of DSM dates back over fifteen years. Indeed, in the mid-1990s, in the context of an Integrated Resource Planning (IRP) process, the province's UARB selected the TRC as the primary screening tool for consideration of DSM opportunities. At the time, the Board determined that the IRP should integrate DSM to the extent that it met an economic threshold equivalent to a TRC of 0.8 (Faulkner, 2015). More recently, the role of DSM in Nova Scotia Power Inc.'s 2009 IRP update is rooted in a 2006 potential study that screened DSM opportunities using a threshold of 1.0 on the TRC. While the UARB initially applied this threshold at the measure level (Nova Scotia Power Inc. (NSPI) - Demand Side Management (DSM) - Proposal for 2010 & Cost Recovery Rider for 2010 and beyond, 2009), it later raised this threshold to the program level, recognizing that there may be valuable interaction between measures that do and do not pass the TRC, so long as the program as a whole passes (NSUARB - Decision In The Matter of an Application by ENSC for Approval of its Electricity Demand Side Management Plan for 2012, 2011).

The Terms of Reference of NSPI's 2014 IRP specify that "the primary criterion will be cumulative present worth of the annual revenue requirements of the resource plan over the planning horizon" (NSPI, 2014). Synapse Energy Economics (Synapse Energy Economics, 2014), in its October 3rd Commentary on the NSPI draft 2014 IRP final report, applied this definition to the analysis of the candidate resource plans, and did not include customer costs in the revenue requirement, and thus assessed DSM components of NSPI's revenue requirements from a PAC perspective.

Finally, in its *Electricity Efficiency and Conservation Restructuring (2014) Act*, the Province has created a structure whereby the *supply* of energy efficiency by the Efficiency Nova Scotia Franchise is a means to *reduce costs for [NSPI] customers* (Nova Scotia General Assembly, 2014). This perspective is reflected by the Program Administrator Cost (PAC) test, which accounts for the utility's payments for those services.

POLICY DRIVERS

Nova Scotia's DSM is arguably driven by imperatives outside of the strict regulatory arena as well. We note that in 2012, an equivalency agreement between the Province and the federal government was reached on climate change, allowing the province's individual power plants to be exempt from plant-level carbon emissions ceilings, in exchange for the province's plan to achieve broader, sectoral carbon reductions. The province's renewable energy *and DSM activities* are part and parcel of this policy equation.

More recently, the 2014 Electricity Efficiency and Conservation Plan (Nova Scotia, 2014) introduced or formalized several key elements to the Energy Policy environment that can serve as additional guidance in the assessment of DSM cost-effectiveness. Among these, one is of particular relevance to the discussion around cost-effectiveness screening tests: the new franchise (ENS) will "*sell long-term energy savings in direct competition with energy supply options. It if costs less to save energy than it costs to produce energy, saving energy wins"*. The emphasis on the competition between demand-side and supply-side options is analogous to a utility least-cost procurement process, which in turn is consistent with the PAC test perspective.

As we will see, Nova Scotia is not alone in reconsidering the question. In fact, more often than not, it's for the same, or similar, reasons.

CONCERNS WITH THE CONVENTIONAL TRC

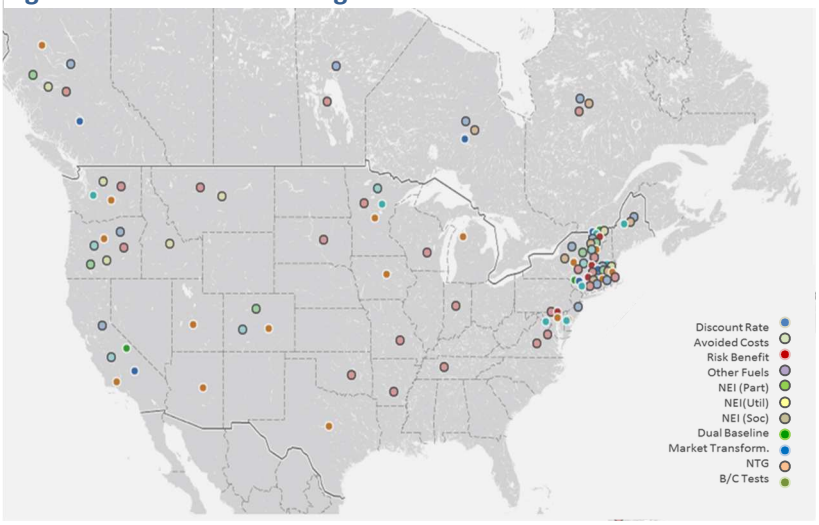
INTRODUCTION

The Total Resource Cost test is meant to measure cost-effectiveness from the perspective of consumers, writ large, i.e. something akin to a societal perspective. In itself, this is a valid and important perspective. However, as we noted previously, a growing number of DSM professionals and jurisdictions have begun to raise concerns regarding either the TRC itself, or the way in which it is often applied. We note four concerns of particular importance:

1. **ACCURACY**: Is the TRC (and its critical inputs) calculated correctly?
2. **BIAS**: Does the TRC systematically neglect important benefits?
3. **RATEPAYER VALUE**: Does it matter that the TRC does not reflect a ratepayer value perspective?
4. **POLICY CONFLICT**: What if the TRC is inconsistent with formal policy goals?

Some of these questions are inherent to the TRC itself, while others have more to do with the way in which the TRC is being applied. We examine each of these four questions below.

Figure 2. Identified "Leading or Innovative" Practices Elsewhere



Several jurisdictions have undertaken to review some of these issues, and as a result have made deliberate changes to either the way in which the TRC is calculated, or use of the TRC itself. In one survey we conducted (Figure 2) we identified 100 “leading-edge or innovative” practices across 33 jurisdictions, tackling either the choice of tests or the inputs to those tests. **The extent of experimentation underway underscores a point that is often lost when considering the TRC: while it was borne of a Standard Practice Manual, its use today is anything but standardized.**

As other jurisdictions have demonstrated, cost-effectiveness methodologies can evolve to address the issues presented in this paper and to reflect the appropriate perspective for a given jurisdiction.

ISSUE #1: ACCURACY: IS THE TRC CALCULATED CORRECTLY?

The TRC is the most common test currently in use, and compares all direct benefits, expressed through avoided energy and capacity supply costs, to all direct costs, both for the DSM program administrator *and* related participant contributions. Its general benefit/cost ratio formula is expressed with this simplified formula:

$$TRC\ ratio = \frac{Avoided\ Energy\ and\ Capacity\ Supply\ Costs}{Program\ Administrator\ costs + Participants\ costs}.$$

While the simplified TRC ratio formula is straightforward, it is important to note that the detailed algorithm in the Standard Practice Manual – Figure 3 below – is not entirely clear in prescribing key inputs and assumptions.

Figure 3. TRC Equation[9]

$$BCR = \frac{\left[\sum_{t=1}^{N} \frac{UAC_t + TC_t}{(1+d)^{t-1}} + \sum_{t=1}^{N} \frac{UAC_{at} + PAC_{at}}{(1+d)^{t-1}}\right]}{\sum_{t=1}^{N} \frac{PRC_t + PCN_t + UIC_t}{(1+d)^{t-1}}}$$

where:
BCR = Benefit Cost Ratio
UAC_t = Utility avoided supply costs in year t
UAC_{at} = Utility avoided supply costs for the alternate fuel in year t
TC_t = tax credits in year t
PAC_{at} = Participant avoided costs for the alternate fuel in year t
PRC_t = Program Administrator program costs in year t
PCN_t = Net participant costs in year t
UIC_t = Utility increased supply costs in year t

Specifically, at least six key components of the TRC calculation may be subject to entirely different methodological approaches (many of these apply to other tests as well):

i. **Measure Costs:** The TRC seeks to account for the full cost of DSM measures, irrespective of who (the Program Administrator or the participant) pays. Yet one issue that is approached very differently from region to region is the extent to which costs and/or benefits associated with free riders are accounted for. For example, in some regions (e.g. Ontario), the cost of measures adopted by free riders is considered a transfer payment and, as such, the TRC accounts for neither the benefits (savings) nor the measure costs.[10] In other regions (e.g. California), the incentive portion of the cost is included, but neither the customer share nor the savings are accounted for. And in others still (e.g. Quebec), the TRC accounts for the full

[9] Note that the utility avoided cost terms (UAC and UIC) are further defined as the reductions in net energy use or demand in each year, multiplied by the marginal cost in each year.

[10] This is arguably the most appropriate approach, conceptually, for reflecting the intended perspective.

cost of the measures adopted by free riders (irrespective of who paid them), but none of the savings.

ii. **Avoided Costs:** Avoided costs should encompass generation, transmission, distribution as well as any relevant ancillary costs. Ideally, avoided costs should include both energy and capacity as distinct components, and in some regions are differentiated by time.[11] While some do all of this, others may bundle costs together; in some cases, not all cost components are fully accounted for.

iii. **Net Savings:** While the test refers to "net" savings, there is a variety of approaches to determining what "net" means. In some regions, net is interpreted as gross savings minus estimates of free ridership. In others, estimates of spillover (aka "free drivers") are also considered. And in others still, broader market effects are considered, as well as a program's potential impact on longer-term market transformation (including realized or anticipated savings from codes and standards). Finally, a related issue concerns the rate at which future savings should be discounted, irrespective of the choice of tests.

iv. **Life of Savings:** The TRC clearly attempts to account for the stream of benefits associated with a stream of savings over time. Some regions have adopted a simplified approach to the time component of this equation, assuming that energy savings last for the expected lifespan of the new equipment. Other regions, in particular those that practice what are called "discretionary" DSM (e.g. early replacement or removal of functioning equipment such as a second refrigerator or a T12 lamp), have adopted a dual baseline approach that accounts for both the life of the new equipment (effective useful life, or EUL) and the likelihood that the original equipment would have otherwise been replaced by a more efficient version after some number of years (Remaining Useful Life, or RUL). Calculating dual baselines can be more complex but also lead to more accurate savings forecasts.

v. **Capital and O&M Savings:** While most DSM options involve "like-to-like" replacements, others involve equipment with very different lifespan profiles. For example, an LED bulb may be expected to last 20 years, while the CFL or incandescent counterpart would have lasted 5 and 1 year respectively. The TRC should normally capture this difference by accounting for the avoided cost of *twenty* (not one) incandescent bulbs or of *four* (not one) CFLs. Yet some regions have not adjusted their models and continue to assume matched lifespans, thereby

[11] This is meant to account for the different load shapes of DSM measures which, in turn, should provide a different economic value. Some regions' avoided costs are developed on an "8760" – meaning distinct costs for each hour of the year – basis, though it is not clear that the increased precision necessarily improves accuracy, nor that it would always be worth the additional cost and complexity.

leading to potentially significant inaccuracies for certain measures. Similarly, O&M profiles may also involve substantial cost differences.[12]

vi. **Other Fuels:** In many cases, DSM initiatives may have either a direct or indirect impact on the consumption of other resources such as natural gas, heating oil or water. The most obvious example is a deliberate fuel switching program. But many other examples abound: electronically-commutated motors on an oil furnace will be largely offset by increases in oil consumption; similarly, a part (but not all) of the gains from efficient lighting and appliances can lead to increases in space heating needs in the winter (and/or a reduction in space cooling needs in summer and shoulder seasons); conversely, efficient faucets and showerheads can lead to a reduction in water consumption. Different regions account for these impacts on non-electric resources in a variety of ways, from taking a comprehensive approach, to limiting their consideration to only cases of direct fuel switching, to not considering them under any circumstances.

As we can see, test inputs are not applied uniformly, and the approaches taken on any or a combination of the above issues can lead to vastly different results. Indeed, results for the very same measure (assuming the very same avoided costs) can differ substantially from one region to another. This raises important questions as to the appropriateness of the specific methodologies and algorithms used to calculate the TRC, and to the accuracy which one should reasonably expect of any TRC analysis.[13] As noted previously, this concern applies equally to other tests.

It is worth noting that some regions have deliberately considered and debated some or all of the issues and options noted above, making clear choices that presumably best reflect their needs (e.g. striking the appropriate balance between accuracy and cost/complexity). Yet in many other cases, methodologies have been more accidental than deliberate: a new staff member may have built a spreadsheet in whatever way seemed logically intuitive at the time, leading to a *de facto* methodological approach that was never questioned thereafter. Often, the test – a "black box" to many – is just *assumed* to incorporate a universally-applied methodology. As a result, accidental methodological choices with a significant impact on the bottom-line results become permanent, and unverified, fixtures.

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[12] For example, when considering CFLs in a large hotel, the avoided annual incandescent replacement involves cost savings not only from the saved energy and the avoided purchase of five standard bulbs, but also from staff time needed to install them. This can be particularly important in high-bay applications.

[13] Beyond these issues of interpretation, our experience also suggests that TRC calculations sometimes involve errors that may not be noticeable when examining results. For example, in some regions, planning models are limited in the number of years of analysis they can account for, and the benefits of measures with longer lifespans (e.g. new construction, envelope retrofits, ground source heat pumps) may literally be cut short as a result.

ISSUE #2: BIAS: DOES THE CONVENTIONAL TRC NEGLECT IMPORTANT BENEFITS?

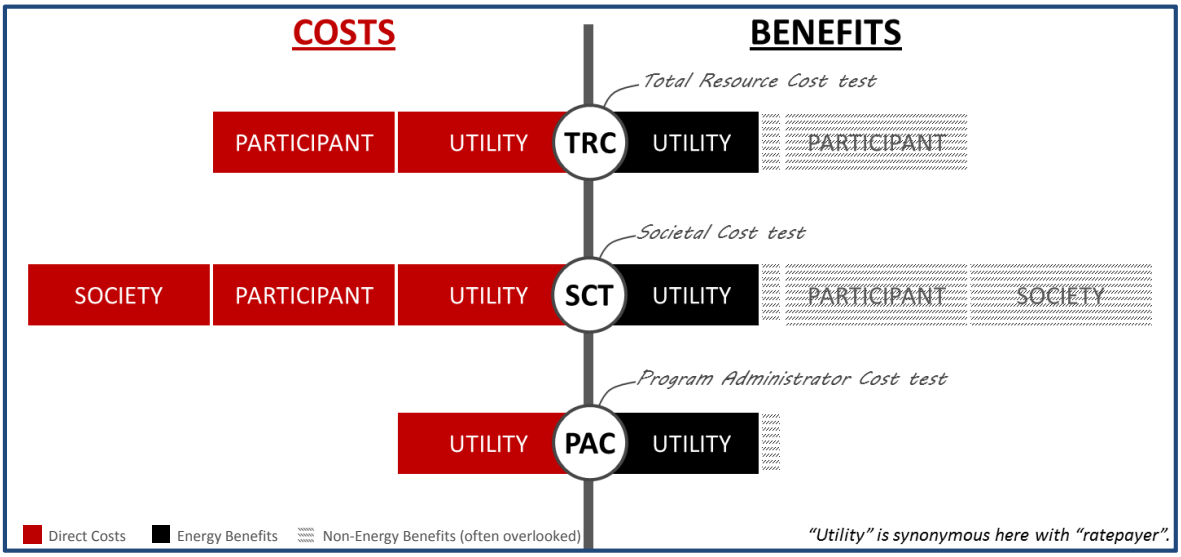
Beyond issues of interpretation, many now question whether and to what extent the Total Resource Cost test, as commonly applied, may also contain an inherent bias.

The TRC is *meant* to account for all costs and all benefits of a DSM measure or program, irrespective of who bears the cost or to whom the benefits accrue. The test does a good job at accounting for all costs, since they are tangible.[14] Yet on the other side of the equation, the TRC, at least as it was initially designed, is able to account for only a portion of benefits.

The benefits *not commonly* accounted for can be broadly defined as "non-energy benefits (NEBs)" that accrue to three groups: participants, the utility, and society at large.

There are three common themes to this discussion: first, that non-energy benefits can be substantial (while non-energy *costs* are rare); second, that they are often hard to quantify; and third, that as a result, they are often ignored, i.e. effectively valued at *zero*. The simplified illustration of the costs and benefits accounted for in each cost-effectiveness test, presented initially on page 5, can therefore be more realistically revisited, per Figure 4 below. Here, we see that in practice, while all costs are typically accounted for by the traditional tests, many benefits are either partially accounted for, or not accounted for at all.

Figure 4: Realistic Illustration of the Primary B/C Tests



We discuss the non-energy benefits that accrue to each group below.

[14] Arguably, some of the neglected facets discussed hereafter may involve not only benefits but non-energy costs as well; however, these are very rare exceptions to the rule.

PARTICIPANT NON-ENERGY BENEFITS (NEBS)

Participant NEBs are increasingly understood to play a significant role in the overall value proposition that consumers derive from many energy efficient technologies or services. To understand the extent to which these NEBs are valued, it is worth viewing them through three distinct, but supportive, perspectives: those of program marketers, the academic literature, and market prices.

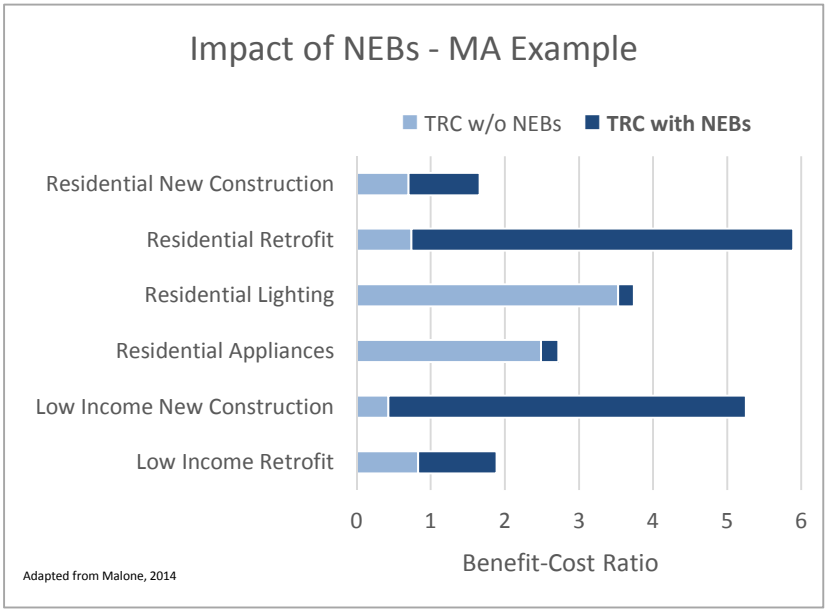
a) **Program Marketers:** While theoreticians may argue amongst themselves as to the importance of "non-energy benefits" and the theoretical basis for valuing them, they need look no further than DSM Program Administrators themselves. Indeed, good program managers, marketing specialists and account managers know that DSM measures are often sold on their *non-energy* benefits as, or more, convincingly than on their energy-related economics alone. This is regularly borne out by market research (polls, focus groups, and one-on-one discussions with facilities managers, operations VPs, home buyers and others). It is for this reason that most home retrofit programs, for example, market the increased comfort and health of occupants as much as reduced utility bills. Similarly, when talking with hotels and owners of buildings with high-bay areas about the value of moving toward fluorescent or LED lighting, account managers will typically focus on the capital savings and reduced staff time associated with much longer equipment lives (i.e. reduced frequency of equipment replacement). Meanwhile, incorporating daylighting into new commercial office buildings is sold far more on improved worker productivity and rental/resale value than on reduced power consumption for lighting, and sellers of solar hot water or solar photovoltaic systems are far more likely to push their products' "green bragging rights" – highly prized in some niche markets – than the net present value of the utility bill savings. Yet while those tasked with selling efficiency understand how significant these non-energy benefits are to customers, the TRC values them at zero.

> ***"[If NEBs are not accounted for,] the TRC Test will be internally inconsistent. This in turn will cause program administrators to underinvest in energy efficiency programs and will impose higher costs on utility customers"***
>
> - Tim Woolf et al., in "Energy Efficiency Cost-Effectiveness Screening", Nov. 2012.

b) **NEBs Literature:** In the past decade, there has been a small but growing body of literature that seeks to quantify and indeed monetize the value of participant non-energy benefits. While the literature is by no means mature, findings consistently point to significant participant NEB values across a broad spectrum of measures and sectors. Recently, Massachusetts has completed a thorough evaluation of DSM non-energy benefits for the residential (NMR Group Inc., 2011) and commercial (Tech, 2012) sectors. Figure 5 illustrates the impact of those NEBs on the benefit-cost ratios of their residential DSM programs (Malone, 2014), where non-energy benefits can represent up to 70% of a program's total benefits. Other studies conducted in the past 10 years also provide evidence of significant and material non-enegy benefits of DSM programs. For

example, for new, energy efficient homes, studies have found the value of participant NEBs alone at between 0.5 to 3.6 times the energy savings, or some $5,000-$30,000 in present value terms (Ujjwal Bhattacharjee, 2009). A U.S. DOE study found the value of NEBs to exceed the full value of energy savings from low-income weatherization programs (Amann, 2006). A similar study found NEBs to be more than five times the value of energy savings from new construction building commissioning (Evan, 2004). An assessment of 52 industrial energy efficiency improvements found productivity benefits to exceed 120% the value of energy savings alone (Worrell, Laitner, Ruth, & Finman, 2001). Even residential lighting and appliances have been shown to generate NEB benefits that participants value at between 30% and 90% of the related energy savings (Fuchs, Skumatz, & Ellefsen, 2006).

Figure 5: Massachusetts' (MA) Benefit/Cost: Impact of Neglecting NEBs



Again, while these studies often find that participants value non-energy benefits at least as much or more than they value the direct energy savings themselves, the *standard* TRC values them at zero.

c) **Market Prices:** Partly as a result of the efforts of policymakers and program administrators over the past twenty-plus years, some markets have begun to show signs of valuing energy efficiency far more than in the past.[15] For example, we recently reviewed the market price premiums fetched for homes with high-energy efficiency labels in three regions of the globe: Australia (specifically the Canberra region), the Netherlands, and the U.S. northwest (specifically the cities of Portland and Seattle). In all three cases, homes with higher energy performance, as communicated through a label or rating, were sold at a premium that varied between CA$12,090 and $29,315 (after controlling for other variables). Of course, the market's ability to value efficiency may point to opportunities to reduce incentives in certain circumstances, yet the TRC cares neither about incentives (considered a mere transfer payment), nor about homebuyers' motivations. Real estate markets could value efficiency at $20,000 per home, but if

[15] This is notably, though not solely, the case where strong energy performance labeling policies are in place.

the discounted value of avoided energy is only half that, then the TRC effectively says "the market is wrong" and suggests the measure is not worth promoting.

As we have seen, the TRC accounts for all participant costs, but for only a portion of participants' benefits. Yet our experience suggests that in many markets, participants are increasingly driven to spend their money on energy efficiency measures or options because of those very NEBs that the TRC does not account for.

It has been suggested – and we concur – that where the TRC is used to screen DSM measures or programs, its asymmetrical treatment of measure costs and benefits "fundamentally biases regulatory decisions against efficiency investments" (Neme & Kushler, 2010).[16] In the past, this bias may have had only a marginal real-world impact, as an abundance of low-hanging fruit meant that direct TRC benefits were typically double or triple the full costs of measures anyhow. In other words, few measures were screened out as a result of the test's bias. However, the combination of increasingly aggressive DSM goals and improving baselines (whether by codes and standards or market interest) is turning a largely theoretical bias into a practical – and increasingly significant – problem.

In fact, in the past two years alone, clients of ours with aggressive DSM targets have faced situation after situation – solar hot water, deep energy retrofits, ground source heat pumps, high-efficiency new construction, etc. – in which measures they deem to be of high value – indeed that may be needed to achieve their energy savings targets – fail the TRC, primarily because they neglect certain NEBs, and *despite* clear consumer interest.

> ***"A major concern with the TRC is that it typically includes the full costs, but often does not include the full benefits to customers because the [risk reduction] value and many non-energy benefits are difficult to quantify. This introduces a potential bias in the TRC against conservation programs."***
>
> -Washington Utilities and Transportation Commission, *Policy Statement on the Evaluation of the Cost-Effectiveness of Natural Gas Conservation Programs*, Oct. 2013

No test is perfect, and it is understandable that this failing was often overlooked in the past, when NEBs were not considered as significant and TRC thresholds were easier to pass. But today, thanks to the very programs the TRC previously allowed, NEBs are more prevalent, and their exclusion from one side of the equation has created a fundamental imbalance to which many have begun to give greater consideration.

As we will see, a growing number of regions that use the TRC are moving toward accounting for these participant NEBs.

[16] To the extent that the very term *Total* Resource Cost test is likely a misnomer.

OTHER NON-ENERGY BENEFITS AND ISSUES

Beyond Participant NEBs, DSM may offer additional non-energy benefits that accrue to the utility, and/or to society as a whole.

Utility NEBs

Other than avoided energy and capacity costs, DSM is often considered a lower risk option than many of its supply-side alternatives. This lower risk is primarily related to four aspects of the DSM profile:

1. **Hedge against fuel prices**: When compared with supply-side alternatives, DSM is akin to renewable energy in that it involves none of the risks of fuel price changes borne by thermal power plants (for which fuel prices can account for two thirds or more of the total levelized cost of power). The value of DSM as a fuel price hedge depends on the extent to which it avoids power generation options that require substantial fuel purchases.[17]

2. **Power Planning / Reliability:** From a power planning perspective, DSM may be considered more reliable than the construction and operation of new power plants. This is primarily because DSM does not suffer from the risks associated with permitting and/or construction delays, as well as the risk of unplanned slowdowns or shutdowns. Inversely, DSM may run the risk of not producing as much savings as planned; however, where program administrators have sufficient flexibility and incentive, this risk is greatly limited, for three reasons: (a) because DSM is fundamentally a "load-matching" resource, whose greatest non-performance risk relates to the arrival of *other,* offsetting load-reducing events;[18] and (b) because DSM Program Administrators have a vast array of levers (incentives, advertising, direct install, others) at their disposal, and furthermore work on a large diversity of opportunities (technologies, markets, sectors), such that a reduction in anticipated savings in one area can typically be offset by increases elsewhere (i.e. the risk is heavily diluted).

3. **Planning flexibility:** On a very short-run basis, conventional fossil and hydro plants offer the highest planning flexibility as they are a fully dispatchable resource. While DSM is not as fully dispatchable, as noted above, its savings are inherently likely to match loads, providing a significant value-add over intermittent renewables.

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[17] In a power pool context (not Nova Scotia's), DSM acts as a hedge against power prices, which can be a function of both fuel prices *and other market dynamics*.

[18] For example, program-related DSM savings may be at risk during an economic downturn when natural market turnover (equipment replacement, new construction) slows down. Similarly, net program impacts can be at risk when governments adopt tighter codes and standards. Yet in both cases, from a reliability perspective, total loads go down; what is at risk is the *attribution of savings to the program administrator*, not the load reductions themselves.

For all of these reasons, a number of regions – and most notably the northwest U.S., which has historically given perhaps the most consideration to power planning risk issues in North America – have chosen to attribute a risk benefit to DSM for purposes of cost-effectiveness analysis.[19,20]

→ı *Societal NEBs*

While we have discussed participant and utility NEBs, DSM is also known to generate non-energy benefits for society as a whole, primarily through (1) environmental benefits (to the extent they are not already internalized in the planning process and associated avoided costs), and (2) macro-economic benefits (as they pertain to increased economic activity related to either greater domestic content and/or productivity gains).

> ***"[The conventional TRC is] a test that is both biased against energy efficiency resources and that provides decision-makers with inaccurate information regarding 'total resource' costs and benefits."***
>
> - National Efficiency Screening Project, *The Resource Value Framework – Reforming Energy Efficiency Cost-Effectiveness Screening*, August 2014

Historically, environmental NEBs (primarily carbon emissions and, to a lesser extent, air pollutants and/or other environmental impacts) have received the bulk of attention in terms of accounting for and valuing societal NEBs within cost-effectiveness frameworks. Indeed, in a recent ACEEE survey (Kushler, Nowak, & Witte, 2012), nearly one-third of all regions surveyed reported accounting for environmental NEBs in their cost-effectiveness screening.[21]

In some regions, DSM is also considered to generate a superior macroeconomic benefit as compared with power generation alternatives. This can be a result of both a higher domestic spending multiplier (especially where DSM avoids conventional plants that require fuel imports), as well as productivity and competitiveness improvements associated with Commercial and Industrial (C&I) sector savings. A recent study (Acadia Center, 2014) found that aggressive energy efficiency efforts in Nova Scotia would

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[19] In Vermont, the Vermont Public Service Board reduces the cost of energy efficiency options by 10% "to reflect the benefits of DSM in mitigating supply-planning risk" (Investigation into Least-Cost Investments, Energy Efficiency, Conservation, and Management of Demand for Energy, 1990). In the northwest U.S., where planners have found that "It is clear that the more aggressive level of conservation results in both much lower expected cost and risk", the cost of supply options (i.e. DSM's avoided costs) are attributed a 10% risk adder.

[20] Another non-energy benefit that can accrue to utilities is related to their ability, by reducing overall energy bills, to reduce arrearages, collection costs and defaults. While conceivably applicable to all sectors, consideration of this benefit is typically reserved for DSM programs that specifically or primarily target low-income residential customers.

[21] In Nova Scotia, because of the legislated CO_2e cap applied to Nova Scotia Power Inc., carbon emissions are already internalized, at least to some degree, in the utility's avoided costs and, through them, in the cost-effectiveness analysis for DSM options. This applies to other emissions addressed through legislation in Nova Scotia as well.

generate, for every million dollars in DSM program spending, a net increase in provincial GDP of between $2.7 and $4.1M, and from 22 to 33 job-years of net employment.[22]

Other regions, Wisconsin and New York for example, account for these societal *economic* NEBs to varying degrees in their own cost-effectiveness reporting.

We note that contrary to Participant and Utility NEBs, Societal NEBs are arguably not missing, per se, from the TRC calculation, to the extent that the standard TRC is meant to reflect only the perspective of consumers (including costs and benefits that accrue to participants, non-participants and the utility), not of society writ large.

→| *Discount Rate Issues*

The TRC determines the present value of costs and savings over time. For these purposes, it uses a discount rate equal to the weighted average cost of capital (WACC) of the utility involved.

Yet a number of regions now question the extent to which the utility WACC is the appropriate discount rate, reflecting concern that it may unduly discount future benefits. While there are a number of reasons for this, the primary one is that DSM is often driven as much by public policy as by utility cost minimization (and furthermore, is often delivered by non-utility, state or state-driven entities). This raises the question: to the extent that DSM is public policy, then might it be more appropriate to apply a societal discount rate, which is commonly viewed as the government's cost of borrowing?[23] New York and many New England states use a societal discount rate within their own TRCs.

SUMMARY OF NEB ISSUES

Increasingly, non-energy benefits – especially those that accrue to participants – are viewed as significant benefit streams that the current TRC effectively neglects. This is critical to the extent that the TRC's purpose is to reflect the total costs and benefits that accrue to program participants and non-participants alike.

As a result, a number of regions have begun to either (a) modify their TRCs, often by accounting for non-energy benefits and redefining the test as a "Modified TRC", or (b) selecting a different perspective – and test – altogether. We discuss these options, as they apply to Nova Scotia, beginning on page 28.

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[22] The study assessed three electric DSM scenarios: 1.0%, 1.75%, and 2.5% annual savings over total consumption. For references, Nova Scotia's DSM programs achieved 1.52% of annual sales in 2012.

[23] In some cases, a more arbitrary "low" rate is chosen as a means of deliberately *not* unduly discounting the interests of future generations.

IMPLICATIONS FOR NOVA SCOTIA

Nova Scotia's current TRC does not account for non-energy benefits, whether they accrue to participants, the utility, or society at large. By failing to account for these benefits, while fully accounting for participant costs, the TRC inadvertently introduces a significant bias against DSM.

ISSUE #3: RATEPAYER VALUE: DOES THE TRC BEST REFLECT A RATEPAYER PERSPECTIVE?

The Total Resource Cost test seeks to find the theoretically optimal investment, irrespective of who – ratepayers (through the program administrator) or participants – contributes. This is valid from a broader perspective, but is not reflective of the concerns of stakeholders and regulators.

One way to understand this is to imagine how program administrator budgets would be set if the primary concern were indeed "total cost". In such a case, budgets would be established as the full amount of the "total cost" side of the TRC equation, and as a corollary, program administrators would merely arrange for the direct installation, at no cost to participants, of all possible measures. There would be no value to encouraging consumers to adopt measures on their own, nor would there be interest in transforming markets in the long-term, since under the TRC perspective, there is no difference – and hence no preference – between costs incurred by the consumers who benefit directly or by others (through contributions to the program administrator budget). This approach – direct installation of all TRC-positive measures – could well achieve the most possible savings that are deemed cost effective from the TRC perspective, at the least *total* cost.[24]

"[T]he costs of the DSM 'resource' in the TRC test are based on the total costs of the program, including costs incurred by the participant. Supply-side resource options are typically based only on the costs incurred by the power suppliers."

- CPUC and CEC, *California Standard Practice Manual for Economic Analysis of DSM Programs*

[24] We make the simplifying assumption here that the PA's installation costs would be more than offset by both economies of scale and the elimination of marketing, incentive processing and other associated costs.

Of course, in practice, regulators and stakeholders are usually very interested in the question of "Who pays?" Indeed, while they care about minimizing the theoretical total costs, they also care deeply about maximizing program efficiency, i.e. achieving the most savings possible with the lowest ratepayer-funded program budgets (as opposed to total costs).

Unfortunately, because it bundles all costs together, the TRC does not provide any indication of program efficiency. Nor does it provide an indication of how efficiently program funds *could* be used to achieve energy savings. Rather, if too much emphasis is placed on the TRC results, measures and indeed entire programs that could be delivered cost-effectively from the standpoint of program budgets, may never be approved, or vice versa. This may use more ratepayer funds than necessary to achieve the desired results.

Because the TRC accounts for *all costs* and not just program costs, it may arguably be an unfair measure by which to compare options. This is noted in the California Standard Practice Manual's own discussion of the TRC:

> "In addition, the costs of the DSM 'resource' in the TRC test are based on the total costs of the program, including costs incurred by the participant. Supply-side resource options are typically based only on the costs incurred by the power suppliers."

Furthermore, the TRC can create occasional distortions *between measures*. Indeed, because consumers may derive far greater value than reflected in the TRC, and because this value varies tremendously from measure to measure, programs that are too-strictly constrained by TRC requirements may unwittingly be losing savings opportunities and/or incurring unnecessary costs.[25]

IMPLICATIONS FOR NOVA SCOTIA

Nova Scotia has been using the TRC, which attempts to reflect the sum of participant and non-participant perspectives, to screen DSM programs. The Electricity Efficiency and Conservation Restructuring (2014) Act sets the structure of DSM as a procurement by the utility, in direct competition with procurement of supply. Only the Program Administrator Cost (PAC) test reflects the costs and benefits of DSM from a utility least-cost procurement perspective.

[25] For example, if consumers value solar hot water (SHW) systems more than, say, a heat pump water heater, a program may be able to provide lower relative incentives and generate greater energy savings through the SHW option, i.e. the most efficient use of ratepayer dollars. Yet by failing to reflect the customer's perspective, and indeed by substituting its judgment for that of consumers, the TRC may determine instead that the heat pump water heater is more theoretically beneficial, and in so doing constrain program administrators to spend more money incenting a less productive energy saving opportunity.

ISSUE #4: POLICY: WHAT IF THE TRC IS INCONSISTENT WITH PUBLIC POLICY?

Throughout the 1990s, when the TRC first took on prominence as the pre-eminent DSM screen, most program administrators were working against growing but still modest DSM goals. As a percent of total system energy requirements (a commonly used, if imperfect, indicator of DSM aggressiveness), incremental annual energy savings during that period tended to be in the range of 0.25-0.75% for the reasonably aggressive regions, with a small handful of outlier regions aiming slightly higher.

Today, DSM goals (and in some cases, legislated requirements) have by and large shifted upward, to the point where leading regions today target between 1.5% and nearly 3% annual savings.[26] These higher targets alone may demand higher-cost savings. Yet the higher relative savings are only a part of the picture.

The other part involves baselines. Indeed, in many regions today, baselines have improved considerably from where they were twenty years ago. In some markets and market segments, this is due primarily to consumer awareness and interest, whether driven by high energy prices and price swings, or a wave of "green" consumerism, or still by increased awareness of the value of (and access to) energy savings opportunities. In other markets and segments, this is due to new codes and standards affecting everything from home and building construction, to appliances, motors, and most recently and significantly, lighting.[27]

The combined result of significantly more efficient baselines *and* significantly higher savings targets are squeezing DSM administrators, pushing them toward options with higher incremental cost than in the past. Among these, in the residential sector we note a recurring focus on such measures as deep envelope retrofits, solar hot water, and advanced construction techniques, among others, needed to secure deeper, long-term energy savings.

This is not a theoretical issue. In fact, we are increasingly finding that in order for our clients to achieve their savings targets, what appear as "TRC-negative" measures are not only worth considering, but are often essential to achieving policy goals. This begs the question of which – policy goals or cost-effectiveness tests – should determine which DSM to pursue.[28]

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[26] Another way of viewing the rapid growth in goals: since 2011, the ACEEE Scorecard has reserved its top score to states with *binding* requirements in excess of 1.5%/yr (Sciortino, et al., 2011); the 2006 Scorecard reserved its top score for states that had *any* binding requirement at all (Eldridge, Prindle, York, & Nadel, 2007).

[27] While codes and standards will typically result in higher official baselines, market preferences may result in either increased baseline efficiencies *or* lower net-to-gross (or higher free-ridership) assumptions. The net effect is the same from the perspective of tightening the scope of net program savings opportunities.

[28] One recent example can be seen in British Columbia, where the Clean Energy Act established a legislated savings requirement for BC Hydro of 66% of projected load growth. At the time, this goal was deemed to be 25% higher than the highest achievable scenario when constrained by TRC cost-effectiveness, yet the regulatory framework –

In Nova Scotia, this is not yet an important concern in that specific electric DSM goals are based on an assessment of the potential for cost-effective DSM, and not on a predefined, legislated target. The Electricity Efficiency and Conservation Restructuring (2014) Act provides the legislative framework under which DSM should be assessed, and puts emphasis on the *procurement* of energy efficiency, thus treating DSM as a resource to compete with other procurement options. Cost of procurement is explicitly about the *utility*'s cost (not a conceptual *total* cost that includes participant contributions and ought to account for participant benefits), and is therefore reflected by the PAC test, not the TRC. Use of the total resource cost test to screen DSM is inconsistent with a policy of utility least-cost procurement. This situation is far more analogous to the context in Nova Scotia, where recent legislation focuses on least-cost procurement.

IMPLICATIONS FOR NOVA SCOTIA

Nova Scotia has no binding targets for energy efficiency. However, the Electricity Efficiency and Conservation Restructuring (2014) Act structures DSM as a utility least-cost procurement. As previously noted, this is the perspective reflected by the PAC test, not by the TRC.

contradictory in that all programs were required to pass the original TRC – remained in place for another five years. This framework was finally modified in December 2011.

RECENT CHANGES TO STANDARD PRACTICES

TRENDS IN LEADING REGIONS

The concerns noted previously – errors in applying the TRC, unintentional bias in TRC results, conflict with official energy policies, and neglect of bottom-line concerns – are increasingly shared across the energy efficiency community. As a direct result, a growing number of regions have been moving to either correct the TRC, or to use other tests altogether. This is notably the case of most DSM leaders across the continent.

In preparing this report, we examined eleven cases of states and provinces that have chosen to either fix or abandon the original TRC as their primary cost-effectiveness test. Interestingly, they include four of the "Top 5" rated states in the ACEEE's most recent (October, 2014) Scorecard, and eight of its "Top 10". The table below summarizes the alternatives used by each of these regions.

As can be seen, case studies include six regions that have sought to adjust the TRC, in the process adopting what may be termed a Modified Total Resource Cost (MTRC) test. Four regions have opted instead for the Program Administrator Cost (PAC) test, in combination with either the TRC or the SCT. Finally, one region uses the PAC alone, and one uses the SCT alone. We note an absence of consistency in the terms used, such that MTRC and SCT can to some extent be interchangeable.

Figure 6. Case Studies: Select Regions that Use Alternatives to the Standard TRC

STATE (2014 SCORECARD POSITION)	PRIMARY TEST	TEST COMPONENTS				SCREENING LEVEL	Notes
		Non-Energy Benefits (NEBs)			Disc. Rate		
		Participant	Utility	Societal	(Societal)		
MASSACHUSETTS (#1)	mTRC	●		●	●	Program	Hybrid delivery. Recent integration of substantial NEBs
CALIFORNIA (#2)	TRC*	*	*	●	*	Portfolio	* California is in the process of revisiting its C-E framework.
OREGON (#3)	SCT+PAC	◖	◖	●		Measures, Programs	Non-profit DSM administrator similar to ENS
VERMONT (#3)	SCT	◖	◖	●	●	Project, Program, Portfolio	Non-profit DSM administrator similar to ENS
CONNECTICUT (#6)	PAC	n/a		●		Program, Portfolio	Utility delivery. CT now actively seeks to be rated #1 on ACEEE
NEW YORK (#7)	mTRC	◖		●	●	Measures, Programs	Hybrid delivery. Participant NEBs for certain programs
WASHINGTON (#8)	mTRC|PAC	◖	◖	●		Project, Portfolio	Utility delivery. For gas, PAC *unless* TRC includes *all* benefits.
MINNESOTA (#10)	SCT+PAC			●	●	Program, Portfolio	SCT considered the primary test; PAC secondary.
COLORADO (#13)	mTRC	◖		●		Program, Portfolio	Although officially named TRC, it is closer to a SCT
BRITISH COLUMBIA (n/a)	mTRC	◖	◖	◖		Portfolio	15% adder to whole portfolio; program NEBs can be higher.
ONTARIO (n/a)	mTRC	◖	◖	◖		Portfolio	Generic NEB adder. New policy (adopted October 23, 2014).

Legend: ● Significant inclusion ◖ Partial inclusion

References: BC (Muncaster, 2011); CA (Application of Southern California Edison Company for Approval of its 2009-2011 Energy Efficiency Program Plans ans Associated Public Goods Charge, 2009) (CAPUC, 2008); NY (New York Public Service Commission, 2011) (New York Public Department of Public Service, 2011); OR (Energy Trust of Oregon, 2011); VT (Vermont Public Service Board, 2011); CT (State of Connecticut, 2011); MN (Reha, 2010) (Xcel Energy, 2009); CO (Colorado General Assembly, 2007) (Colorado PUC, 2011). (Washington Utilities and Transportation Commission, 2013)

While the table above reflects changes being brought to DSM screening by the continent's leaders, as is often the case, such changes are ushering in additional questions.

THE NESP'S RESOURCE VALUE FRAMEWORK

One result of the ongoing revision of cost-effectiveness frameworks is the recent publication of the Resource Value Framework, or RVF.

Developed by the National Efficiency Screening Project (NESP)[29], the RVF is not a test but rather a tool designed to assess a state or province's cost-effectiveness screening against sound principles and best practices, and to provide guidance in the selection of an appropriate cost-effectiveness approach.

The RVF shares many of the concerns outlined previously with past test applications, and puts forward the following guiding principles for developing/selecting a specific cost-effectiveness test for DSM analysis:

- ***The Public Interest****. The ultimate objective of efficiency screening is to determine whether a particular energy efficiency resource is in the public interest.*
- ***Energy Policy Goals.*** *Efficiency screening practices should account for the energy policy goals of each state, as articulated in legislation, commission orders, regulations, guidelines and other policy directives.*
- ***Symmetry.*** *Efficiency screening practices should ensure that tests are applied symmetrically, where both relevant costs and relevant benefits are included in the screening analysis. For example, a state that chooses to include participant costs in its screening test should also include participant benefits.*
- ***Hard-to-Quantify Benefits.*** *Efficiency screening practices should not exclude relevant benefits on the grounds that they are difficult to quantify and monetize. Several methods are available to approximate the magnitude of relevant benefits.*
- ***Transparency.*** *Efficiency program administrators should use a standard template to explicitly identify their state's energy policy goals and to document their assumptions and methodologies.*

Among other things, the RFV proposes a template by which to assess to what extent a given cost-effectiveness approach is consistent with these principles. Based on this template, the TRC as currently applied in Nova Scotia does not appear to be consistent with the RVF principles. A completed version of the template is included here as Appendix A.

[29] The National Efficiency Screening Project (NESP) is a group of utilities, program administrators, DSM practitioners and non-governmental associations brought together to examine screening issues under the auspices of the U.S. National Home Performance Council. The current report's co-author, Philippe Dunsky, serves as an advisor to the NESP.

NEW NORTHEAST COST-EFFECTIVENESS GUIDELINES

At the time of completing this report, states across the northeast U.S. had agreed to adopt a set of guidelines largely inspired from the RVF framework. Specifically, representatives of the states of Connecticut, D.C., Delaware, Massachusetts, New Hampshire, New York, Rhode Island and Vermont came together under the auspices of the Northeast Energy Efficiency Partnerships (NEEP)'s Evaluation, Measurement &Verification (EM&V) Forum to develop cost-effectiveness screening guidelines for the region.

These guidelines do not prescribe any one cost-effectiveness test, but focus instead on five key principles:

(1) Aligning screening practices with state energy policies

(2) Ensuring a symmetrical treatment of relevant costs and benefits, notably by accounting for Non-Energy Benefits if using the TRC[30]

(3) Accounting for relevant environmental compliance costs

(4) Accounting for risk and using an appropriate discount rate

(5) Ensuring transparency by using a standard template to document key assumptions.

Given the difficulty involved in accounting for NEBs, the guidelines also suggest starting with the Program Administrator Cost (PAC) test as a foundation.

In adopting the guidelines in November of 2014, the NEEP EM&V Forum Steering Committee signaled "the states' intent to encourage the consideration, use and reference of the Guidelines in their respective state".

[30] The Guidelines use a slightly different term ("Non-Energy Impacts").

OPTIONS FOR NOVA SCOTIA

OVERVIEW

We previously discussed our concerns with current use of the TRC, as well as alternatives applied in a growing number of leading regions across the continent. The table below summarizes the implications of these concerns – and of the corresponding guidelines recently developed by the National Efficiency Screening Project and adopted by the Northeast Energy Efficiency Partnerships' EM&V Forum – for Nova Scotia.

Fig. 7. Overview of Concerns & Implications for Nova Scotia

OUR CONCERNS	NESP & NEEP GUIDELINES	CONSIDERATIONS FOR NOVA SCOTIA
ACCURACY Key assumptions may not reflect deliberate or appropriate choices.	Both guidelines insist on need for transparent documentation of key inputs	Key inputs & assumptions of the Cost-Effectiveness methodology should be reviewed and properly documented for transparency and to support a collective understanding, thus opening the "black box". This is irrespective of the *choice* of test.
BIAS The TRC may neglect significant benefits, while accounting for all costs.	Both guidelines insist on critical importance of symmetry and, if the TRC is to be used, inclusion of non-energy benefits in particular.	Critical issue. Either invest time and effort into defining and accounting for non-energy benefits within TRC, or move to the PAC test with its fully vetted inputs and inherent symmetry.
RATEPAYER VALUE The TRC does not reflect value for ratepayer dollars, a common concern.	NESP silent on whether ratepayer dollar efficiency should trump societal efficiency. NEEP recommends focusing on ratepayer dollar efficiency as a starting point.	Give strong consideration to value of the PAC test, which focuses on value of savings set against direct ratepayer funds used to procure them.
POLICY CONFLICT The TRC may not be consistent with key policy goals or direction.	NESP recommends accounting for both official state/provincial policy and broader public interest concerns. NEEP guidelines limited to clear policy direction.	No explicit policy direction or binding DSM targets. However, the Nova Scotia *Electricity Efficiency and Conservation Restructuring (2014) Act* aligns with the PAC (formerly known as the Utility Cost Test) perspective with its requirement for the Utility to purchase DSM from the Efficiency Franchise holder.

These implications strongly suggest that, going forward, Nova Scotia should consider two pathways to ensuring its cost-effectiveness framework is internally consistent and in line with best practices:

1. Fix the TRC by addressing its current shortcomings, including through valuation of non-energy benefits to ensure a balanced, symmetrical approach, or
2. Focus instead on the narrower but simpler ratepayer value perspective, conveyed through the PAC.[31]

Below, we discuss these two pathways. In all cases, we note the importance of deliberately assessing and vetting key inputs (see pages 10-12 above).

OPTION A. FIX THE TRC (ASSESS NON-ENERGY BENEFITS + OTHER CHANGES)

One solution to the above concerns is to directly address each – or as many as possible, within reason – of the missing benefits or other algorithmic concerns, namely: accounting for participant and utility NEBs, as well as deliberate reconsideration of the appropriate rate by which to discount DSM's future benefit streams.

1. ACCOUNT FOR PARTICIPANT NON-ENERGY BENEFITS (NEBS)

The exclusion of participant NEBs is arguably the most important factor in generating bias against DSM. On the other hand, the reason that NEBs have historically been excluded is that they are difficult to quantify with any accuracy – indeed, different assessments can lead to radically different valuations of the same or similar participant NEBs.

Because of this, the regions that have begun to account for NEBs have done so in different ways.

- ***Specific NEB valuations:*** conduct market research to quantify the value of NEBs to program participants and integrate them into their TRC cost-effectiveness assessments;
- ***Inferred NEBs:*** apply a simplified algorithm based on participant net incremental costs, annual energy savings, and an acceptable payback period, in order to infer a minimal participant NEB valuation;
- ***Approximate NEBs:*** adopt an arbitrary (but conservative) percentage adder to the energy benefits to represent a portion of the anticipated participant NEBs.

[31] The latter option may be chosen because it is the preferred perspective, or because of a lack of confidence that the "total resource cost" perspective can be adequately conveyed.

Should Nova Scotia choose the route of integrating participant NEBs, it may want to consider these options. Each has its strengths and drawbacks, with the first raising issues of false precision and the third raising concerns about being overly conservative. Ultimately, any approach to integrating NEBs has to balance the inaccuracies of *any value* against the inaccuracy of *no value*.

Figure 8. Participant NEBs: The Case of B.C.

In British Columbia, the ambitious DSM goals of BC Hydro and Fortis BC recently began to hit up against the limitations of the TRC. As a result, in December 2011, the province chose to redefine a number of the parameters of its TRC test, notably by directing a different approach to avoided costs and by seeking to integrate non-energy benefits in the TRC equation.

Under the new approach, participant NEBs can now be included in the TRC benefits, through one of three ways: (1) direct quantification, if NEBs are deemed sufficiently important and if there is sufficient evidence to back up the values, (2) use of a proxy (conservative) 15% adder applied to the energy and capacity benefits (avoided costs) of the program for non-low income programs, and (3) use of a proxy 30% adder for low-income programs.

The role that NEBs can play in TRC cost-effectiveness is, however, constrained *at the portfolio level* (excluding low-income programs) to a maximum 15% impact.

2. ACCOUNT FOR UTILITY NEBS

As discussed previously, DSM arguably brings additional non-energy benefits to the utility (and hence ratepayers), primarily through risk mitigation.

While risk benefits are important, they are even more difficult to quantify than participant NEBs. In fact, the two regions that explicitly account for these NEBs, Vermont and the U.S. northwest, merely use a proxy adjustment factor in their cost-effectiveness algorithms: in the case of Vermont, the cost of DSM measures is reduced by 10%, whereas in the northwest U.S. (e.g. in Oregon), the DSM's benefits (avoided costs) are subject to a 10% adder.

We also note that Nova Scotia Power may benefit from the reduced late payments, write-offs and collection costs associated with a reduction in consumer electricity bills. Several studies have analyzed these benefits and several jurisdictions have in some way included these in their analysis of low-income programs, but not as a quantified utility NEB.

3. ACCOUNT FOR ENVIRONMENTAL EXTERNALITIES?

Environmental externalities are the most common DSM non-energy benefit included in cost-effectiveness screening. A recent ACEEE study (Kushler, Nowak, & Witte, 2012) reports that 35% of the surveyed jurisdictions in the United States include environmental benefits of DSM in their primary screening test. Greenhouse gas emissions and/or other atmospheric emissions are most common, and are expressed either through a proxy environmental adder, or through a fixed dollar per ton of pollutant avoided.

We note that accounting for environmental externalities goes beyond what is needed to more accurately reflect the TRC's stated "all consumers" perspective (it is in fact only needed to reflect a societal perspective). We also note that in seeking to address externalities, care must be taken not to include those environmental costs that are already internalized, such as the cost of compliance with existing regulation. In the case of Nova Scotia, it is possible that most or all avoided emissions have already been internalized in the utility's avoided costs, given the combination of hard emissions caps and minimum renewable energy content requirements that apply to NSPI.

4. REVISIT DISCOUNTING PRACTICE

One last component that can be addressed relates to the treatment of future streams of energy savings. In the past, when utilities were by and large the sole administrators of DSM programs, the TRC typically used the utilities' weighted average cost of capital (WACC) as a simplifying assumption. Yet given the dramatic impact of the discount rate on the cost-effectiveness of long-lived measures such as building envelope improvements, measures that are increasingly required to achieve targets, a simplifying assumption may no longer be appropriate. This is more significant for a region like Nova Scotia, served by a shareholder-owned utility, than for many other Canadian provinces, served by Crown Corporations, where the cost of borrowing is much lower due to provincially-backed debt.

For purposes of the TRC (or of the PAC), Nova Scotia should reconsider what constitutes an appropriate discount rate. Administration of DSM by the non-profit ENS is one reason why the WACC may no longer be appropriate (we note that Efficiency Vermont, which shares much of ENS's model, uses a societal discount rate). Another reason is that DSM is at least in part driven by societal policy. Finally, while discount rates typically are meant to reflect risk, we note that DSM's risk profile is largely understood to be significantly more advantageous than most competing supply options (Binz, Sedano, Furey, & Mullen, 2012).

CONSIDERATIONS

We note that although a significant modification to the TRC, most notably in its treatment of DSM benefits, has the potential to address the concerns highlighted in this paper with regards to the analysis of DSM cost-effectiveness, it also brings additional challenges for the DSM administrator and the regulator.

The exercise of properly quantifying the additional benefits is not trivial, and is a considerable endeavor. And although significant insight into the value of those benefits may be gained, the accuracy of the results obtained is not of the same magnitude as what can be obtained for other measurable benefits such as energy savings.

OPTION B. MOVE FOCUS TO PAC TEST

The other primary option for Nova Scotia is to focus instead on the narrower but more straightforward PAC test.

Using the PAC test provides a clear measure of a program's (past or anticipated) performance, from a "yield" perspective. As such, it may be more meaningful to both the utility and ratepayers, for whom maximizing value for ratepayer dollars is a common goal. It also provides a clearer comparison with supply-side options, and a clear indicator of the extent to which various levels of DSM can be procured at lower cost than supply alternatives. Furthermore, because it does not need to incorporate non-energy benefits, it is far more accurate in reflecting its intended perspective.

The current application of the PAC also provides a far more symmetrical treatment of benefits and costs. Although some hard-to-quantify NEBs appear to benefit the utility, they are not nearly of the same magnitude as participant NEBs, and their exclusion is unlikely to materially impact results.

The PAC has also been reported by Efficiency Nova Scotia Corporation in its previous DSM Plan Applications and reports; stakeholders and the UARB are already familiar with its workings.

The State of Connecticut currently focuses exclusively on PAC-level results for determining the cost-effectiveness of DSM options. We note that Connecticut is not only among the historical DSM leaders in North America, but has recently adopted an unofficial goal of becoming the top U.S. state in future ACEEE scorecard results.

In the past five years, other jurisdictions have also re-evaluated their cost-effectiveness framework, and purposefully substituted an imbalanced TRC with the PAC. This is notably the case of Michigan (2008), Utah (2009), Washington (2013), and New Mexico (2013).

We note that use of the PAC raises a concern that programs aimed at ensuring equity (e.g. for low-income participants that cannot contribute to measure costs) may be viewed less favourably through its lens *in relation to* other programs. This can be addressed through specific policy exceptions, or as is already the case in Nova Scotia, with funds specifically dedicated to provide efficiency services for low-income homeowners. Another concern may arise if the PAC's algorithm does not capture DSM's potential impact on non-electric energy sources, which may matter from a broader policy perspective. This can easily be addressed either by including those impacts in the PAC equation, or through other reporting mechanisms.

As can be seen, these considerations are easily addressed in Nova Scotia, and do not change the overwhelming value of moving to the PAC as the primary test of ENS' effective use of ratepayer funds.

PRIMARY RECOMMENDATION

Our review of the issues and options for Nova Scotia concludes with the need to change the current cost-effectiveness framework, to ensure internal consistency and best practices. In the absence of significant change, we find that current practice cannot accurately reflect the costs and benefits of DSM, potentially leading to inefficient levels of investment, as well as program design choices, to the detriment of ratepayers as a whole.

Correcting this problem can be done either through potentially laborious corrections to the TRC itself, including to its key inputs, or by moving to the more straightforward PAC test. While both options involve tradeoffs, in the case of Nova Scotia, the preponderance of arguments point strongly toward focusing on the PAC test. These include:

- **Simplicity:** Applying the PAC will be a far simpler – and far less expensive – exercise than "fixing" the current TRC by, among other things, assessing non-energy benefits. It may also be less contentious (see below).
- **Accuracy:** Even if the TRC were to be corrected, in part by efforts to account for non-energy benefits (NEBs), the accuracy of such assessments may raise concerns, leading to lengthy discussions, ongoing debate, and more contentious hearings than otherwise necessary.
- **Relevance:** While the TRC (once corrected) arguably would provide a more balanced picture of cost-effectiveness from the perspective of all consumers, our experience with past Nova Scotia UARB hearings and stakeholder sessions points to a strong interest in the value generated by ratepayer DSM funds, a perspective reflected only by the PAC test.
- **Alignment:** Similarly, the PAC test perspective, with its utility cost focus, would be more aligned with the structure created by the Nova Scotia *Electricity Efficiency and Conservation Restructuring (2014) Act* in that it requires the utility to procure DSM services. It would also presumably be more clearly aligned with NSPI's latest Integrated Resource Plan (IRP) and its similar focus on utility least-cost planning.

For these reasons, we recommend moving to use of the Program Administrator Cost (PAC) test for screening DSM in Nova Scotia.

NOTES ON APPLICATION

Beyond the choice of tests, the way in which they are applied is also important. Indeed, screening tests can be applied in a number of ways: as information to be balanced with other considerations; as a hard threshold applied to the portfolio as a whole or at the sector level; as a hard threshold to be applied at the program level; or as a "soft" threshold to guide program-level decisions while allowing for exceptions (e.g. low-income or small business programs). We note that the UARB previously lifted an earlier approach of applying screening as a hard threshold at the measure level.

NSPI's recent IRP process considered DSM as a single supply source, i.e. at the portfolio level. This is consistent with treating DSM on par with other supply options. Applying this same approach on a planning basis further provides valuable flexibility to the Program Administrator – in this case Efficiency Nova Scotia – to design its portfolio in the most efficient manner possible. For example, while some Administrators opt to have many individual programs, others find that they can be more responsive to market dynamics by bundling measures and markets in portfolios of as few as 3 or 4 "programs". Applying cost-effectiveness screening at the (somewhat artificial) "program" level may force a delineation that is not considered most effective by the Administrator nor by the market it is attempting to influence – while providing no added value or protection to customers – in order to satisfy a "program"-level cost-effectiveness threshold.

On the other hand, applying a cost-effectiveness threshold at the portfolio-level raises legitimate equity concerns, in particular by leaving open the possibility of cross-subsidization between sectors. For example, if cost-effectiveness is required only at the portfolio level, it is conceivable that the costs to residential sector clients could outweigh their benefits, insofar as the imbalance were to be compensated in the commercial, institutional and industrial sectors (and vice versa). This portfolio-wide approach would be unwise; each sector should receive benefits in excess of its costs.

For this reason, we recommend using the primary cost-effectiveness test as a decision-making screen *at the sector level*. This allows flexibility needed to ensure that the Administrator's DSM portfolio is designed to be as effective as possible (and to avoid artificial delineations between markets and programs), while at the same time ensuring that the portfolio as a whole remains cost-effective *for each customer sector individually*.

Finally, per our previous discussion on the importance of developing appropriate and *deliberate* inputs for any test, we recommend developing a transparent reporting template that provides for explicit discussion of ENS' approach to critical inputs to the PAC test, including to those inputs discussed on pages 10 through 12 above.

CONCLUSIONS & RECOMMENDATIONS

There are several options available to Nova Scotia to improve the value provided by cost-effectiveness screening of DSM initiatives. Some aim at correcting the problems inherent in the TRC; others propose shifting perspectives altogether; and others still are focused on at least ensuring the basic inputs are appropriate and as accurate as possible for whatever test is used.

As demonstrated in this paper, there are sufficient concerns with the current application of cost-effectiveness analysis in Nova Scotia to warrant changes to the framework. Although more comprehensive accounting of benefits under the TRC could be valuable, this raises methodological challenges as well as concerns over time, cost, uncertainty, and risk of disagreement. In addition, a corrected TRC would still not align well with the IRP process, which is focused on minimizing NSPI's revenue requirements.

The PAC is inherently a balanced test, where the full costs and benefits accruing to the program administrator (or utility and through it, ratepayers) are accounted for and compared. It is also the appropriate measure of a plan's efficiency and value to ratepayers, i.e. of the value provided for each dollar provided to ENS. In addition, stakeholders and the UARB are already familiar with the workings of the PAC, which has been reported on in DSM Plans for several years.

Finally, the PAC perspective is strongly aligned with key objectives of Nova Scotia's Electricity Efficiency and Conservation plan, namely by focusing on least-cost procurement, and by supporting innovative technologies to achieve long term market transformation through increased demand for energy efficient technologies and practices.

RECOMMENDATIONS

1. **Nova Scotia adopts the Program Administrator Cost (PAC) as the primary test for purposes of screening DSM cost-effectiveness;**
2. **The PAC test be applied for information purposes at the program and portfolio levels, and for decision-making purposes at the sector level;**
3. **That critical inputs, including most notably the discount rate, be re-examined for consistency with Nova Scotia's DSM context as well as risk; and**
4. **That a transparent reporting template, adapted from NESP's Resource Value Framework and designed to address key test inputs, be developed to facilitate future understanding of critical test choices by all parties involved.**

This concludes our review.

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APPENDIX A: RESOURCE VALUE FRAMEWORK – N.S. ASSESSMENT

Figure 9: Resource Value Framework - NS Qualitative Assessment

Qualitative Resource Value Framework – Nova Scotia Legacy TRC			
Program Name: Electric DSM		Date: December 2014	
1. Key Assumptions, Parameters and Summary of Results			
Analysis Level	✓ Program □ Portfolio		
Measure Life	n/a	Discount Rate	WACC
2. Monetized Program Administrator Costs		**Monetized Program Administrator Benefits**	
Program Administration	✓	Avoided Energy Costs	✓
Incentives Paid to Participants	✓	Avoided Capacity Costs	✓
Shareholder Incentive	n/a	Avoided T&D Costs	Partial
Evaluation	✓	Avoided Environmental Compliance Costs	✓
Other PA Costs	✓	Other Utility System Benefits	✗
3. Monetized Participant Costs		**Monetized Participant Benefits**	
Participant Contribution	✓	Participants' Savings of Other Fuels	✓
Participant's Increased O&M Costs	✓	Participant Non-Energy Benefits:	
Other Participant Costs	✓	Participants' Water and Sewer Savings	✓
		Participants' Reduced O&M Costs	✓
		Participants' Health Impacts	✗
		Participant Employee Productivity	✗
		Participant Comfort	✗
		Additional Low-Income Participant Benefits	✗
		Other Participant Non-Energy Benefits	✗
4. Monetized Public Costs		**Monetized Public Benefits**	
Public Costs	✗	Public Benefits of Low Income Programs	✗
		Reduced Environmental Impacts (if monetized)	✗
		Public Fuel and Water Savings	✗
		Reduced Public Health Care Costs	✗
		Other Public Benefits	✗

5. Non-Monetized Public Costs and Benefits	
Non-Monetized Benefits	Comments
Promotion of Customer Equity	
Reduced Risk	
Increased Reliability	
Reduced Environmental Impacts (if not monetized)	
Increased Jobs and Economic Development	



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Request IR-45:

Reference: Evidence, Table 10 and Table 11, page 49:

(a) Does EfficiencyOne suggest that the annual energy savings (in kWh) and the annual avoided cost of energy (in $/kWh) for a measure are invariable from year to year for the purpose of the LES and Lifetime Benefits calculation, as shown in Table 10? If so, why?

Response IR-45:

a) No, measures may have variable annual energy savings throughout their Effective Useful Lifetimes and variable avoided costs of energy by year. This simplified example was provided to demonstrate the relative influence of first-year and lifetime energy savings on the resulting Lifetime Benefits.

NON-CONFIDENTIAL

Request IR-46:

Reference: Evidence, page 50, lines 3-5.

EfficiencyOne states that "EfficiencyOne proposes the Lifetime Energy Savings performance target be established with a threshold of 75 percent, as opposed to the 90 percent threshold established for shorter term cumulative annual energy and peak demand savings."

(a) To what extent is the proposed 75% threshold based on the evaluation of the LED lighting LES?

(b) Considering the LED lighting measure component in the DSM portfolio will be declining, provide justification for the 75% threshold under those new conditions.

Response IR-46:

a) The proposed 75% threshold is only partially based on future volatility associated with the ongoing evaluation of Lifetime Energy Savings (LES). Future volatility associated with the ongoing evaluation of LES is a risk encompassing the entire portfolio of Efficiency Nova Scotia measures. At the time of 2020-2022 DSM Resource Plan development, only one evaluation of LES had been completed. This makes analytical strategies to ascertain and manage future risk more challenging.

b) Other rationale for the selection of a 75% Performance Target include:

- EfficiencyOne's relative experience with LES is significantly less than for Incremental Energy and Demand Savings at the time they were proposed and accepted as Performance Targets. Incremental Energy and Demand savings were first proposed and accepted as Performance Targets for the purposes of the 2015

DSM Resource Plan. At that time, these metrics had been foundational in DSM planning and implementation since 2008, which facilitated detailed tracking and management system development, as well as organizational alignment to achieve these important Performance Targets. This is not the case for LES, for which EfficiencyOne has three years' experience tracking and managing, and within an evolving methodology.

- Future regulatory volatility is also relevant in the selection of an appropriate LES threshold, since regulatory expectations can affect the evaluation treatment of LES. While this affect is particularly relevant for LED lighting, given uncertainties about the exact timing and nature of expected regulations with respect to this technology (presumably through modification of Canada's *Energy Efficiency Regulations*), this affect is also relevant for other technologies, which may have similar volatility in future regulatory amendments.

NON-CONFIDENTIAL

Request IR-47:

Please explain or reconcile the statement that the 2020-2022 Preferred DSM Resource Plan has a Total Cost Ratio of 2.1 (Appendix A, 2020-2022 DSM Plan, page 2, lines 15-18) versus the TRC of 2.0 in the bottom row of Table 1 (Appendix A, 2020-2022 DSM Plan, page 10).

Response IR-47:

The statement in Appendix A, page 2, line 18 is a typographical error and should read "with a Total Resource Cost ratio of 2.0…".

NON-CONFIDENTIAL

Request IR-48:

Please explain how "long-term requirements for energy and system-peak demand savings" (Appendix A, 2020-2022 DSM Plan, page 4, lines 11-13) were balanced in the Preferred Plan development process.

Response IR-48:

EfficiencyOne's Preferred Plan balances the long-term need for energy and system-peak demand savings by introducing demand-focused DSM activities, and more specifically, demand reduction activities into the broader 2020-2022 DSM portfolio.

These introductions are described in detail in Evidence and Appendix A, but can be summarized as:

- Prescriptive demand reduction offerings within the Home Energy Assessment, Green Heat, Business Energy Rebates and Small Business Energy Solutions program components; and
- Custom demand-focused support within the Custom Retrofit program component.

Past DSM Resource Plans provided independently evaluated and verified demand savings, however the source of those savings were largely energy efficiency measures, as opposed to measures that specifically targeted system peak demand savings.

This emphasis on energy savings was due to low values of near-term annual avoided capacity costs, relative to the availability of near and long-term utility and customer savings from energy savings.

Table 1 below displays the "Base-DSM" avoided costs from the 2014 Integrated Resource Plan (IRP) which illustrates this trend and shows markedly higher avoided capacity costs beginning in 2019.

Table 1: Base-DSM Avoided Costs - 2014 IRP

Base-DSM	Avoided Capacity Costs $/kW	Avoided Energy Costs $/MWh
2015	0	64
2016	0	60
2017	0	58
2018	0	55
2019	418	57
2020	196	60
2021	179	62
2022	190	84
2023	207	85
2024	201	86
2025	215	87
2026	202	89
2027	198	93
2028	195	98
2029	195	102
2030	193	108
2031	189	113
2032	188	120
2033	193	113
2034	192	130
2035	196	143
2036	192	150
2037	196	155
2038	197	163
2039	173	169

It is this increased emphasis on demand savings, through the introduction of specific demand-focused activities which balances long-term needs for energy and system peak demand savings.

To illustrate the increased emphasis on balancing these two objectives within the 2020-2022 DSM Resource Plan, Table 2 below provides the proportion of Net Present Value (NPV) avoided costs

from energy and capacity (inclusive of transmission and distribution) within the 2016-2018 DSM Resource Plan, as compared to the 2020-2022 DSM Resource Plan.

Table 2: Proportion of Total NPV Avoided Costs from Energy and Capacity

	NPV Energy Avoided Costs (% of total NPV Avoided Costs)	NPV Capacity Avoided Costs (% of total NPV Avoided Costs)
2016-2018 DSM Plan	74%	26%
2020-2022 DSM Plan	59%	41%

The 2020-2022 DSM Resource Plan achieves a more balanced mix of short and long-term energy and system peak demand avoided costs, as expressed on an NPV basis.

NON-CONFIDENTIAL

Request IR-49:

Reference: Appendix A, 2020-2022 DSM Plan, sections 2.2 and 2.3.

Please explain why EfficiencyOne did not provide NS Power with a working (other than the Lumina-licensed Analytica software platform) copy of the Navigant ProCESS model and data files that were used for EfficiencyOne's DSM resource plans.

Response IR-49:

EfficiencyOne did not provide NS Power with a working copy of the Navigant ProCESS model. The ProCESS model is proprietary to Navigant. EfficiencyOne has no ownership interest in the Model. However, after consultation with Navigant, EfficiencyOne did offer to provide NS Power with access to the "static" model, i.e. the model in a "read only" version. This version was consistent with what Navigant has provided in the past in relation to similar requests. This level of access would allow NS Power to review input data and output results as it relates to EfficiencyOne's Preferred Plan and Alternate Scenario for validation purposes.

EfficiencyOne, through Navigant, provided NS Power with access to the working ProCESS model wherein NS Power provided input data and constraints directly to Navigant via email and in direct communication. NS Power's input data and constraints were applied to the working model and the modeled results were provided directly to NS Power.

In accordance with the requirements of the *Public Utilities Act*, NS Power and EfficiencyOne are required to enter into a Supply Agreement for the provision of electricity efficiency and conservation activities. The Supply Agreement is required to include a prescribed term of three years, specified termination provisions, a description of the electricity efficiency and conservation services EfficiencyOne will provide to NS Power and identification of the amount

NS Power will pay to EfficiencyOne for the services[1]. The *Public Utilities Act* further provides that in seeking the Board's approval of the Supply Agreement, EfficiencyOne is primarily responsible to justify the proposed efficiency and conservation activities and NS Power is entitled to rely upon EfficiencyOne's expertise in delivery of the proposed activities[2]. The Supply Agreement establishes energy savings and demand savings as key deliverables.

In addition to the provisions of the *Public Utilities Act* which suggest NS Power ought to rely upon the expertise of EfficiencyOne in the development of the DSM Plan, EfficiencyOne is now required to present at least one Alternate Scenario to the Nova Scotia Utility and Review Board (NSUARB) for consideration in approving a DSM Plan. The Alternate Scenario presented in the current Application presents an energy and demand savings target, together with an investment level, lower than the proposed Preferred Plan. Provision of this Alternate Scenario information is consistent with the Standardized Filing Template adopted by consensus and approved by the NSUARB in the 2019 DSM Plan approval proceedings.

Accordingly, EfficiencyOne does not consider it appropriate or necessary that NS Power have access to a 3rd party proprietary working Model which is used by EfficiencyOne to develop a detailed, and measure level, output for a DSM Plan. Such Plan development is wholly within the legal purview of the DSM utility and is subject to rigorous stakeholder and regulatory review through this Plan approval process.

[1] PUA s. 79J
[2] PUA s 79L (6)

NON-CONFIDENTIAL

Request IR-50:

Reference: Appendix A, 2020-2022 DSM Plan, page 7, lines 16-24.

Please provide detailed information regarding the directional differences in DSM portfolio results resulting from the transition from Navigant's ELRAM model to the ProCESS model, due to their "key differences".

Response IR-50:

The role of software in a short-term planning process such as this three-year DSM Plan is to calculate key performance indicators, summarize portfolio performance, and to perform cost-effectiveness test screening of the portfolio designed by EfficiencyOne. Both the ELRAM and ProCESS model have these abilities. However, the ProCESS model is a more up-to-date software tool with additional features and efficiencies, such as:

- increased computational efficiency/speed of reporting;
- greater reporting flexibility such as the ability to quickly summarize results at different levels, e.g. measure, end-use, program component, program, sector, and portfolio level;
- optimizer module;
- easy addition of scenarios and counterfactuals;
- increased transparency of mid-stream results and functions (node-based algorithms); and
- inline documentation.

EfficiencyOne makes portfolio design decisions which include program design, choosing which measures to offer, the cost, and quantity.

NON-CONFIDENTIAL

Request IR-51:

Describe the sequence of "initial test runs" of the ProCESS model (Appendix A, 2020-2022 DSM Plan, page 8, lines 7-8), with detailed emphasis on any that compared the quality of ProCESS results with those of ELRAM using the same/similar data inputs.

Response IR-51:

The initial test runs described in Appendix A, page 8, lines 7-8 were administrative in nature and served to verify proper functioning of the model and its outputs. For example, ensuring the output report is formatted appropriately; that the report contains all key metrics (e.g., first year energy savings, lifetime energy savings, and demand by program); and that results are organized using EfficiencyOne's naming convention (e.g., Appliance Retirement is a program component under the Residential Efficient Product Rebates program). Additionally, unit testing was performed on key functions to ensure that model algorithms and input selections were correctly specified. This was done using controlled mock data prior to the project initialization phase.

Since both the ELRAM and ProCESS model serve the same function in a short-term DSM planning exercise (i.e., calculate key performance indicators, summarize portfolio performance, and perform cost-effectiveness test screening), there are no material differences between the ProCESS and ELRAM model outputs and those outputs' quality.

While ELRAM and ProCESS are both able to calculate the desired outputs, ProCESS is more feature-rich, transparent, and efficient, as described in EfficiencyOne's response to NS Power IR-50.

NON-CONFIDENTIAL

Request IR-52:

Please specify the ProCESS optimization model's objective function(s) in mathematical notation that was or were used in Preferred DSM Plan and Alternate DSM Plan development (Appendix A, 2020-2022 DSM Plan, page 8, lines 10-20). Provide the associated vector(s) of value parameters with labels in Excel.

Response IR-52:

EfficiencyOne used the ProCESS model for the development of both the Preferred Plan and Alternate Scenario. The ProCESS optimization model function was used for the Preferred Plan. Please refer to Attachment 1 of this IR response (filed electronically) for the optimizer tool's objective function in mathematical notation. The Alternate Scenario does not materially change the mix of programs and measures offered in the Preferred Plan. For this reason, the optimizer tool was not used in the creation of the Alternate Scenario. Participation levels in the Preferred Plan were reduced to produce the Alternate Scenario as described in EfficiencyOne's response to NS Power IR-67.

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Request IR-53:

Specify the ProCESS optimization model's set of constraints in mathematical notation that were used in the Preferred and Alternate DSM plan development (Appendix A, 2020-2022 DSM Plan, page 8, line 10 to page 9, line 2). Provide the associated B matrix activity coefficient parameters and RHS vector constraint parameters with labels in Excel.

Response IR-53:

As described in EfficiencyOne's response to NS Power IR-31 b), the role of the optimizer tool in the 2020-2022 DSM Plan was to quickly and easily provide a starting point for plan development. The optimizer tool specified measure quantities which broadly aligned with EfficiencyOne's goals and formed a general structure from which EfficiencyOne refined into its final Preferred Plan. The measure and program mix in the Preferred Plan and Alternate Scenario was guided by internal expertise and program delivery experience. As such, there were no constraints applied to the final Preferred Plan and Alternate Scenario as it relates to the optimizer tool, since the optimizer tool was only used in the initial stage of plan development, not to generate final results.

Please refer to EfficiencyOne's response to NS Power IR-52, Attachment 1 for constraints in mathematical notation. As stated in EfficiencyOne's response to NS Power IR-52, the Alternate Scenario is based on the Preferred Plan, and no additional optimization was used in its creation (i.e., constraints were only applied in the early development of the Preferred Plan).

NON-CONFIDENTIAL

Request IR-54:

State which optimization problem solver method was used in Preferred DSM Plan and Alternate DSM Plan development (Appendix A, 2020-2022 DSM Plan, page 8, lines 10-20). If more than one method was used, please categorize the specific objective functions or problem names with each associated solver method (linear, mixed integer, or nonlinear programming).

Response IR-54:

Please refer to EfficiencyOne's response to NS Power IR-53 for the role of the optimizer tool and application of constraints throughout EfficiencyOne's development of the Preferred Plan and Alternate scenario.

EfficiencyOne used the LP/Quadratic Engine within Lumina's Analytica Optimizer Software for the last time the optimizer tool was used in the planning process before EfficiencyOne began its internal vetting process.

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Request IR-55:

(a) Explain whether the example of a constraint "to ensure that no program has TRC less than 1.0" (Appendix A, 2020-2022 DSM Plan, page 9, lines 1-2) was included in the portfolio optimization model that resulted in the Preferred Plan.

(b) Please confirm that optimizing at the measure level would provide a more cost-effective overall program for customers. If not, please provide all supporting documentation to the contrary.

Response IR-55:

a) Please refer to NS Power IR-52 Attachment 1 for a list of constraints. A program-level TRC greater than or equal to 1.0 was a constraint. All programs in the Preferred Plan and Alternate scenario have a TRC of greater than or equal to 1.0.

b) EfficiencyOne does not agree that such an approach would provide a more cost-effective overall portfolio of DSM programs to serve the broad Nova Scotian customer base. It would not align with other goals, such as equitability, supporting income-eligible populations, balancing programming among sectors (BNI and Residential), etc. The starting points for measure-level participation for the plan development were informed by the optimization as described in NS Power IR-52 Attachment 1, with the stated objective of maximizing TRC benefits. Because cost effectiveness does not guarantee scale, it was ruled out as an objective, and was instead used as a constraint. The measure and program mix in the Preferred Plan and Alternate scenario was guided by internal expertise and program delivery experience.

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Request IR-56:

Reference: Appendix E, Direct Testimony of Glenn Reed, page 4, lines 12-14 state that, "for several rate classes, it is assumed that there are no nonparticipants, i.e., there is 100% participation among customers in that rate class and no nonparticipant bill impacts." Provide data, reports or other evidence to support the reasonableness of this assumption.

Response IR-56:

The following response has been provided by Glenn Reed.

This is an assumption that is embedded in the Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Plan. For example, this report (2020-2022 EfficiencyOne DSM Resource Plan Application. Appendix B, page 24, lines 7-9.) states:

> "EfficiencyOne employs the assumption that all customers in the Large General, Medium Industrial, Large Industrial and Municipal classes participate in BER-IR each year so that these classes show 100 percent participation in each year…"

EfficiencyOne responds to the justification of this assumption in its response to NS Power IR-66 part a).

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Request IR-57:

Reference: Appendix E, Direct Testimony of Glenn Reed, page 4, lines 15-17 state that, "additional analysis conducted for this evidence benchmarked EfficiencyOne's planned DSM activities against filed plans of other, leading North American efficiency program administrators." Lines 24-25 state, "this benchmarking was done to assess where EfficiencyOne falls compared to its North American peers on commonly used benchmarking metrics."

(a) Define "leading North American efficiency program administrator";

(b) Does Mr. Reed consider EfficiencyOne to be a "leading North American efficiency program administrator"? If so, provide any data, reports or other evidence supporting this claim;

(c) Mr. Reed states that he analyzed "North American efficiency program administrators" and EfficiencyOne's "North American peers." Did Mr. Reed include any Canadian program administrators in his benchmarking analysis?

Response IR-57:

The following response has been provided by Glenn Reed.

a) For the purposes of this study we defined a leading efficiency program administrator as one that was identified by the American Council for an Energy Efficiency Economy (ACEEE) in one of two ways:

- It appeared among the top 10 utilities in ACEEE's 2017 Utility Energy Efficiency Scorecard Report (available at: https://aceee.org/research-report/u1707).

- It was a program administrator operating in one of the top 10 U.S. states identified in ACEEE's 2017 State Energy Efficiency Scorecard report (available at: https://aceee.org/research-report/u1710).

b) Yes, I do. From 2011 through 2013, Efficiency Nova Scotia's average annual savings levels, expressed as a percentage of sales, were at or around those of its peer group (please refer to EfficiencyOne's response to NS Power IR-11). Starting in 2014, Efficiency Nova Scotia's annual savings began to lag this group. By 2017, EfficiencyOne's annual savings were 1.2% of sales vs. an average of 2.0% of the peer group. Even if one compares EfficiencyOne's annual saving to the median savings of this group, where the divergence over time is less apparent (in 2017, the median annual savings of the peer group was 1.6% vs. 1.2% for EfficiencyOne) it is appropriate for EfficiencyOne to make the proposed trend adjustment from 1.2 to 1.3%.

c) No. There are no comparable reports or studies that we are aware of that duplicate the ACEEE Scorecard methodology for Canadian utilities, program administrators, or provinces. Absent such comprehensive analyses we thought that the selection and inclusion of any particular Canadian program administrators or provinces in the benchmarking would possibly be considered arbitrary.

Request IR-58:

Reference: Appendix E, Direct Testimony of Glenn Reed, page 4, lines 19-25 refer to savings as percentage of annual sales, DSM expenditures as a percentage of utility revenues and cost of saved energy as "commonly used benchmarking metrics."

(a) Provide data, reports or other evidence to support the claim that these are "commonly used benchmarking metrics."

(b) Confirm that the per capita electric efficiency expenditures for each state in Appendix B of the American Council for an Energy Efficient Economy's (ACEEE) report titled "The 2018 State Efficiency Scorecard" (available at https://aceee.org/research-report/u1808) are reported in a similar manner as savings as a percentage of annual sales, DSM expenditures as a percentage of utility revenues and cost of saved energy.

(c) Does Mr. Reed believe per capita electric efficiency expenditure qualifies as a "commonly used benchmarking [metric]"? If not, provide any data, reports, or other evidence supporting the claim that it is not a "commonly used benchmarking [metric]."

Response IR-58:

The following response has been provided by Glenn Reed.

a) We reviewed the plan documents associated with the Program Administrators (PA) that were part of the benchmarking group. In addition, we also reviewed two broader benchmarking reports. The table below summarizes whether any of the metrics used in Mr. Reed's Direct Testimony are included in each of the referenced documents.

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1

Document	Incentives as % of Budget	Savings as % of Sales	Budget as % of Revenue	$/kWh Annual Savings	$/kWh Lifetime Savings	Per capita electric expenditure	Reference	Reference URL
Eversource MA	**X**						Massachusetts Joint Statewide Electric and Gas Three-Year Energy Efficiency Plan. October 31, 2018.	http://ma-eeac.org/wordpress/wp-content/uploads/Exh.-1-Final-Plan-10-31-18-With-Appendices-no-bulk.pdf
National Grid MA	**X**						Massachusetts Joint Statewide Electric and Gas Three-Year Energy Efficiency Plan. October 31, 2018.	http://ma-eeac.org/wordpress/wp-content/uploads/Exh.-1-Final-Plan-10-31-18-With-Appendices-no-bulk.pdf
National Grid RI		**X**			**X**		National Grid (Rhode Island) 2018-2020 Energy Efficiency and System Reliability Procurement Plan. August 30, 2017.	http://rieermc.wpengine.com/wp-content/uploads/2017/08/2018-2020-3-year-plan-puc-8-30-17.pdf
Eversource CT		**X**		**X**	**X**		2019-2021 Conservation & Load Management Plan. Connecticut's Energy Efficiency and Demand Management Plan. November 1, 2018.	https://www.energizect.com/sites/default/files/FINAL%20EEB%202019-2021%20C%26LM%20Plan_11.01.18.pdf
Baltimore Gas and Electric	**X**	**X**			**X**		Baltimore Gas and Electric (BGE) 2018-2020 EmPOWER MD Program Filing. September 1, 2017.	https://webapp.psc.state.md.us/newIntranet/Casenum/NewIndex3_VOpenFile.cfm?FilePath=C:\Casenum\9100-9199\9154\\824.pdf
Public Service of Colorado							Public Service Company of Colorado 2019/2020 Demand-Side Management Plan - Electric and Natural Gas (Publicly filed but not yet approved). February 8, 2019.	https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=899757&p_session_id=
Commonwealth Edison				**X**	**X**		Commonwealth Edison Company's 2018 – 2021 Energy Efficiency and Demand Response Plan. June 30, 2017.	https://www.icc.illinois.gov/downloads/public/edocket/449636.pdf
ACEEE Utility Scorecard		**X**		**X**			ACEEE 2017 Utility Energy Efficiency Scorecards.	https://aceee.org/research-report/u1707
Vermont Benchmarking Report	**X**	**X**	**X**	**X**	**X**		Benchmarking 2011 and 2012 Demand Side Management Results for Efficiency Vermont and Burlington Electric Department - Standard Analysis. Prepared for VT PSD. July 17, 2014.	https://publicservice.vermont.gov/sites/dps/files/documents/Energy_Efficiency/EVT_Performance_Eval/VT%202011%20and%202012%20Benchmarking%20Analysis_07172014.pdf
U.S. Electric Utility Benchmarking		**X**					Benchmarking Electric Utility Energy Efficiency Portfolios in the U.S. M.J. Bradley & Associates, LLC. November 2011.	https://www.mjbradley.com/sites/default/files/MJBA-Ceres_Benchmarking-EE-2011.pdf

2

b) No, it is not possible to unambiguously confirm that the electric efficiency expenditure data used in the ACEEE Appendix B (available at: **https://aceee.org/research-report/u1808)** are reported in a similar manner as the budget data used in Mr. Reed's direct evidence. Specifically, it is not clear if the ACEEE expenditure data are only restricted to PA electric efficiency activities and do not include additional state expenditures. For example, on page 5, the authors note that:

> "However, a few State Scorecard metrics do capture local-level efforts, including the adoption of building codes and land use policies, as well as state financial incentives for local energy efficiency initiatives."

Our analysis was restricted to PA planned and reported expenditures.

c) No, it does not appear to be a commonly used metric. Among the documents reviewed in response to the first question in this IR, we saw no reporting of spending per capita with the exception of the ACEEE 2018 State Energy Efficiency Scorecard cited by Nova Scotia Power in this IR. Further, in the ACEEE 2018 State Scorecard, the authors note on page 32:

> "We measure spending as a percentage of revenues to normalize the level of energy efficiency spending. Blending utility revenues from all customer classes gives a more accurate measure of utilities' overall spending on energy efficiency than does expressing budgets per capita, which might skew the data for utilities that have a few very large customers. An alternative metric, statewide electric energy efficiency spending per capita, is presented in ACEEE Appendix B. "

NON-CONFIDENTIAL

Request IR-59:

Reference: Appendix E, Direct Testimony of Glenn Reed, page 5, lines 1-2 state that, "for each of these states, we identified one or more leading PAs to include in the benchmarking."

(a) For states with multiple PAs, please describe how Mr. Reed selected which one(s) to include in the benchmarking, and provide any supporting data, reports or other evidence.

(b) Is it possible that this process could impact the resulting peer group?

Response IR-59:

The following response has been provided by Glenn Reed.

a) Of the seven states for which forward looking DSM plans were identified, six have multiple efficiency program administrators. Only Rhode Island has a single program administrator. This excludes any efficiency activities undertaken by the two small municipal utilities in Rhode Island.

For the other six states, we only selected top 10 American Council for Energy-Efficiency Economy (ACEEE) ranked utilities to include in the benchmarking. For Massachusetts, this entailed the inclusion of two top 10 ranked utilities. For each of these six top ranked states, there was also one or more top 10 ranked utilities operating within the state.

b) No. For each state for which there were multiple program administrators there was also at least one top 10 ACEEE ranked utility, consistent with our definition of leading energy efficiency program administrator.

NON-CONFIDENTIAL

Request IR-60:

Reference: Appendix E, Direct Testimony of Glenn Reed, page 5, lines 6-7 state that, "in addition to the utilities listed in Table 1, we also considered non-utility PAs like Efficiency Vermont that were excluded from the ACEEE Utility Efficiency Scorecard."

(a) Did Mr. Reed consider all non-utility PAs? If not, please describe how Mr. Reed selected which non-utility PAs to include in the benchmarking, and provide any supporting data, reports or other evidence.

(b) Is it possible that the decision to include only selected non-utility PAs could impact the resulting peer group?

Response IR-60:

The following response has been provided by Glenn Reed.

a) We considered non-utility PAs to the extent that they were significant participants in a top 10 ACEEE Efficiency Scorecard. This was the rationale for considering the inclusion of Efficiency Vermont as it is the principal provider of energy efficiency services in Vermont. In addition, we considered the inclusion of the Efficiency Trust of Oregon when forward looking plans for Portland General Electric could not be identified. However, such plans were not available from the Efficiency Trust of Oregon either. Finally, we did not pursue consideration of including New York State Energy Research Development Authority in the peer group given the complex relationship between the agency and the state's utilities in implementing efficiency programs in New York. In summary, there was no systematic bias against the inclusion of non-utility PAs in the benchmarking group.

b) As noted above, there was no systematic bias against the inclusion of non-utility PAs.

NON-CONFIDENTIAL

Request IR-61:

Reference: Appendix E, Direct Testimony of Glenn Reed, page 4, lines 24-25 state that, "this benchmarking was done to assess where EfficiencyOne falls compared to its North American peers on commonly used benchmarking metrics." Appendix E, page 5, lines 1-9 describe the process used to assemble the peer group for the benchmarking analysis.

(a) Confirm that the peer group consisted only of PAs in the top 10 States listed in the ACEEEE's 2017 State Efficiency Scorecard, the top 10 Utilities and selected non-utility PAs listed in the ACEEEE's 2017 State Efficiency Scorecard.

(b) Does Mr. Reed consider the selected peer group, as shown in Appendix E Table 1, to represent EfficiencyOne's "North American peers"?

(c) Mr. Reed states that the goal of his benchmarking analysis is to "assess where EfficiencyOne falls compared to its North American peers." Confirm that this statement as written does not include any restrictions on which peers should be included, such as leading PAs, Top 10 PAs or PAs in the United States.

(d) Given that the goal of the benchmarking analysis imposed no restrictions on the peer group to be used, why did Mr. Reed restrict the peer group to only include PAs in the Top 10 States, the Top 10 Utilities and selected non-utility PAs?

(e) Does Mr. Reed consider his selected peer group to be representative of all North American PAs?

(f) Explain why a peer group to benchmark EfficiencyOne's plan against should not contain any Canadian PAs or PAs that are not in the ACEEE Top 10 lists, and provide any supporting data, reports or other evidence.

(g) Does Mr. Reed believe that his benchmarking analysis accomplished its goal of assessing "where EfficiencyOne falls compared to [all of] its North American peers"?

Response IR-61:

The following response has been provided by Glenn Reed.

a) The peer group consisted only of PAs, both utility and non-utility, operating in the top ten states identified in the 2017 ACEEE State Energy Efficiency Scorecard and the top 10 utilities identified in the 2017 ACEEE Utility Energy Efficiency Scorecard. We note that EfficiencyOne's response to NS Power IR-11 references the top 10 states identified in the 2018 ACEEE State Energy Efficiency Scorecard. The top 10 states in both the 2017 and 2018 versions of the State Energy Efficiency Scorecard are identical, though the ordering of the states within the top 10 is different in the two years.

b) Yes.

c) With one clarification, we did not impose any restrictions on the inclusion of PAs in the benchmarking group, beyond how we initially identified these top PAs. We only included data from those PAs for which we could obtain forward looking (2020 and beyond) DSM Plan data.

d) It was our intent to benchmark EfficiencyOne's efforts against leading efficiency PAs. We saw no value in including PAs with minimal investment or commitment to DSM to develop a potentially broader, those less representative, benchmarking group.

e) No, as noted above and in the Direct Evidence, the intent was to benchmark EfficiencyOne against leading North American PAs.

f) Please see EfficiencyOne's response to NS Power IR-57.

g) Yes, given the data available.

NON-CONFIDENTIAL

Request IR-62:

Reference: Appendix E, Direct Testimony of Glenn Reed, page 8, lines 1-4 state that, "these caveats do not significantly diminish the value of undertaking such a benchmarking exercise, particularly in assessing whether any of the EfficiencyOne metrics are outliers compared to the benchmarking peer group."

(a) Provide data, reports or other evidence that support the claim that the many significant caveats listed "do not significantly diminish the value of undertaking such a benchmarking exercise."

(b) Does Mr. Reed agree that these caveats preclude an apples-to-apples comparison of DSM plans between different program administrators? If not, please provide data, reports, or other evidence to support this view.

Response IR-62:

The following response has been provided by Glenn Reed.

a) We are not aware of any specific studies or reports that explicitly address the extent by which the caveats listed in Mr. Reed's Direct Testimony may, or may not, diminish the value of undertaking a benchmarking exercise. Nonetheless, it is our informed experience that such an exercise is a useful, initial step in comparing Program Administrator (PA) efficiency program performance. For example, Energy Futures Group routinely calculates and compares annual and lifetime cost rates of the two Connecticut utilities when reviewing program-level budgets and savings in their Three-Year Plans and annual Plan Updates.

b) No comparison of two or more different PAs' DSM program performance will ever be an exact apples-to-apples comparison, nor should it be expected given the caveats noted and

the reality that no two PAs will ever be exactly alike. However, it is incorrect to assume that nothing can be learned by comparing the performance of different PAs' DSM plans. This applies to both specific performance metrics such as those presented in Mr. Reed's Direct Testimony as well as to broader approaches to program design and implementation. Around 20 years ago, nearly all residential lighting programs required that a customer fill out a rebate form or use an instant coupon at the point of purchase. Seeing the inefficiencies of such an approach as incentive levels for CFLs continued to decline, several PAs in the Northeast U.S. worked with retailers and manufacturers to develop and implement the first sustained upstream lighting incentive programs. These efforts then informed nearly ever residential upstream lighting program that was subsequently implemented in Canada and the U.S.

NON-CONFIDENTIAL

Request IR-63:

Reference: Appendix B, Forward Looking Rate & Bill Impact Analysis, page 10, lines 16-18 state that "…it has been suggested that the actual avoided T&D values may be in the range of thirty to one hundred times the values provided by NS Power."

(a) Please identify all stakeholders that suggested the T&D values may be in the range of 30-100x times the values provided by NS Power.

(b) Provide any statements, data, reports, and other evidence that support this representation.

(c) Should lines 16-18 be interpreted as EfficiencyOne supporting this suggestion?

Response IR-63:

a) The comment was provided by Paul Chernick of Resource Insight, consultant to the Consumer Advocate, on 11 February 2019, in his written response to a memorandum EfficiencyOne circulated relating to proposed enhancements to its Rate and Bill Impact Analysis (RBIA).

b) EfficiencyOne has no further statements, data, reports, or other evidence in its possession that it is relying upon. The full text of Mr. Chernick's comment is provided below:[1]

"***New Issue 2: Avoided costs for 2020-2022 DSM Plan RBIA***

[1] Resource Insight Inc., *Memorandum Re: Comments on RBIA Enhancements*, 11 February 2019

Using the 2014 IRP avoided generation costs in 2019 analyses for the 2020–2022 DSM Plan is regrettable, but it is not clear that NS Power can be induced to address the many outstanding problems in the avoided costs prior to the next IRP.

Efficiency Nova Scotia should not use the avoided T&D values proposed by NS Power. It is not clear whether NS Power included all the load-related projects, how it aligned the spending and load growth, and whether the distribution loads were adjusted to exclude any growth by transmission customers or discounted to reflect growth by customers served at primary voltages.

While NS Power has not provided the derivation of its values, it appears to have divided the T&D investments related to load growth by the entire NS Power load. For example, for 2016, dividing about $9M in load-related T&D (NSP presentation, p. 17) by 2,111 MW of peak load would produce about $4,500/MW. NS Power reports about $3,500/MW for that value (NSP presentation, p. 16); I cannot determine why NSP's data do not support its results. But even if NSP could explain these differences, it seems to have divided by the wrong load level. The $9M in load-related projects resulted from about 96 MW of load growth from 2013 to 2014, or an average of about 26 MW from 2013–2016. Dividing the growth-related investment by the load growth would result in avoided costs for this component of $94,000 to $346,000/MW, thirty to one hundred times NSP's estimate."

c) EfficiencyOne has not performed a detailed review of the calculations that would allow it to either support or disclaim the comment. In the event the observation is correct, at even the lower end, (i.e., avoided T&D costs are 30 times the values provided by NS Power), the results of the RBIA would be materially different, with all classes showing a net rate decrease due to DSM. Given this this potential uncertainty in input data and its resulting impact on the RBIA results, EfficiencyOne determined it warranted noting this observation.

NON-CONFIDENTIAL

Request IR-64:

Reference: Appendix B, Forward Looking Rate & Bill Impact Analysis, page 15, lines 22-25 state that, "for each year of the 2020-2022 Plan, each 2017 participation figure was scaled by two factors: one to account for differences in overall program magnitude, and one to account for differences in the program measure mix relative to 2017."

(a) Please provide an Excel file detailing these calculations for each year of the 2020-2022 DSM Plan.

(b) Provide data, reports or any other evidence used to calculate each of the two scaling factors.

Response IR-64:

a) Please refer to Attachment 1 of this IR response, filed electronically.

b) Please refer to a) for the data used to calculate these scaling factors. This method was developed by EfficiencyOne in response to a recommendation from Synapse that the Rate and Bill Impact Analysis for the 2020-2022 DSM Resource Plan account for the shift in measure mix between the year of data used to develop forecasts (in this case, 2017) and the year for which the forecasts are made (2020-2022).[1]

[1] Synapse Energy Economics, Inc., *Memo Re: M08946 – EfficiencyOne – 2018 Rate and Bill Impact Analysis and Model (E-ENSC-R-18)*, 3 December 2018

NON-CONFIDENTIAL

Request IR-65:

Reference: Appendix B, Forward Looking Rate & Bill Impact Analysis, page 16, lines 29-30 and page 17, lines 1-2 state, "it was assumed that, within each class, the decay rate of new participants over 2020-2022 would reflect that which occurred over 2011-2013, and so the ratio of new to annual participants in the 2011-2013 period was applied to 2020-2022 annual participants."

(a) Please provide any data, reports or other evidence justifying this assumption.

(b) Did EfficiencyOne conduct any sensitivity analysis to determine how much the results would vary with different decay rates of new participants? If so, provide any relevant data, reports or other evidence.

Response IR-65:

a) The scaling factor calculations are included in the models that EfficiencyOne filed electronically with its 2020-2022 DSM Resource Plan Application (Exhibits E-1(ii) and E-1(iii)). These can be found on the Nova Scotia Utility and Review Board website under Matter number M09096 (https://uarb.novascotia.ca/fmi/webd/UARB15). On each rate class 'Inputs' tab, they can be found just above the participation section in a row labelled "Ratio of New to Annual Participants".

The 2011 to 2013 decay rates, by rate class, provided the best reasonably available data to make the necessary estimate. Understanding that some customers will participate in multiple years within the 2020-2022 period, summing the number of annual participants over these three years would overstate the total number of actual participants, and result in understating the participant bill impacts for 2021 and 2022.

EfficiencyOne's historical customer database is not structured in such a way that would allow it to reasonably extract the number of 'new' participants in a more recent period of data (e.g. 2015-2017). That is, the number of 'new' participants in 2016 and 2017 relative to 2015 (i.e. the number of 2016 customers that had participated in 2015, and the number of 2017 customers that had participated in either 2015 or 2016). The database is designed to produce counts of new participants relative to 2011, which are required for each historical Rate and Bill Impact Analysis.

EfficiencyOne now tracks participation in a more sophisticated manner than it historically has, associating participant records with specific NS Power accounts. This is made possible through EfficiencyOne's access to NS Power's customer information system, which will enable more sophisticated participation reporting in the future.

b) No. EfficiencyOne did not conduct any sensitivity analysis.

NON-CONFIDENTIAL

Request IR-66:

Reference: Appendix B, Forward Looking Rate & Bill Impact Analysis, page 24, lines 7-9 state that "EfficiencyOne employs the assumption that all customers in the Large General, Medium Industrial, Large Industrial and Municipal classes participate in BER-IR each year, so these classes show 100 percent participation in Figure 8 for all years."

(a) Please provide any data, reports or other evidence justifying this assumption.

(b) Did EfficiencyOne conduct any sensitivity analysis to determine how much the results would vary with different participation rates? If so, provide any relevant data, reports or other evidence.

Response IR-66:

a) EfficiencyOne first proposed this assumption to the Demand Side Management Advisory Group in 2016.[1] In its response to EfficiencyOne's proposal, Synapse stated "We recommend that EfficiencyOne implement the changes to the re-participation rates for large customers now as the assumption seems reasonable".[2] This assumption has been employed in each Rate and Bill Impact Analysis filing since the historical analysis filed in October 2016.

There are several sub-parts that make up this assumption:

i) That all facilities which belong to the Large General, Medium Industrial, and Large Industrial use common equipment for which high-efficiency replacements are available (e.g., linear fluorescent tube lighting);

[1] EfficiencyOne, *2016 Rate and Bill Impact Analysis Background and Proposed Enhancements*, 26 February 2016
[2] Synapse Energy Economics, *Memorandum Re: Recommendations on EfficiencyOne's Proposed Enhancements to its 2016 RBIA*, 22 March 2016

ii) That EfficiencyOne offers in-store rebates on those high-efficiency versions through electrical distributors;

iii) That these facilities are of a sufficient size so that within each facility, some of this equipment burns out and requires replacement each year (e.g., fluorescent lamps burning out);

iv) That these facilities are of a sufficient size so that they rely on professional maintenance staff for these replacements, either in-house or through maintenance contracts, and that these maintenance personnel are knowledgeable about the energy consumption of the equipment and available alternatives, and make purchases through electrical distributors where the rebates are available (as opposed to retail stores); and

v) That EfficiencyOne's BER-IR incentives are sufficient to motivate the maintenance staff to purchase high-efficiency equipment with point-of-sale rebates and install this equipment in their facilities. Doing so constitutes participation in the BER-IR program, whether or not the facility owners or managers have knowledge of the participation.

For the Municipal class, which includes six customers (the six Municipal Electric Utilities), the above description still applies, but considering each Municipal Electric Utility (MEU) as a customer of NS Power. It is therefore assumed that if any customer of a MEU participates, the MEU is counted as a participant.

b) No sensitivity analysis was conducted.

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Request IR-67:

Reference: Appendix B, Forward Looking Rate & Bill Impact Analysis, page 32, lines 5-7 state that "program components were not all scaled down in proportion to one another to produce the Alternate Plan, there are minor differences in the average savings per participant."

(a) Please explain how each program component was "scaled down to produce the Alternate Plan."

(b) Why were program components not scaled down in proportion to one another to produce the Alternate Plan? Provide any data, reports or other evidence supporting the decision not to scale down program components in proportion to one another.

Response IR-67:

a) The development of the Alternate Scenario was informed by the same three key considerations used for the Preferred Plan. EfficiencyOne included in the alternate, the program components of Affordable Multi-Family Housing and First Nations intended for underserved markets at a lower investment level than the Preferred Plan. These program components have a higher unit cost than EfficiencyOne's existing programs and as a result generate fewer energy savings. EfficiencyOne made the decision to increase the investment in both of these slightly as compared to the level of investment from the 2019 pilots but not at the same level of the Preferred Plan. In addition to new program components directed at the underserved markets, EfficiencyOne has also included in the alternate, demand reduction specifically for Electric Thermal Storage at a similar level of investment as the 2019 pilot.

For EfficiencyOne's existing programs, quantities of the measures in the portfolio were then scaled down in proportion to one another. The scaling factor applied to most measures was 0.89 (i.e. measure quantities, administrator costs and resulting savings for most measures in the Alternate Plan are 0.89 times those in the Preferred Plan).

This allowed EfficiencyOne to take a balanced approach to the development of the alternate scenario.

b) Please refer to part a)

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Request IR-68:

Please provide Appendix B preferred and alternate Excel files with all formulas and links intact.

Response IR-68:

The Appendix B - Long-Term Rate and Bill Impact Analysis of the 2020-2022 DSM Resource Plan, preferred and alternate Excel files (Exhibits E-1 (ii) and E-1 (iii) respectively) that EfficiencyOne filed with its 2020-2022 DSM Resource Plan Application have all formulas and links intact and can be found on the Nova Scotia Utility and Review Board (NSUARB) website under Matter number M09096 (https://uarb.novascotia.ca/fmi/webd/UARB15).

Request IR-69:

Reference: Appendix D, Direct Evidence of Dr. David Hill, page 7, lines 15 17.

Dr. Hill states, "At the national level, VEIC recently commissioned third-party expert research from Synapse Energy Economics, Inc., of Cambridge, Massachusetts, to quantify the benefit to the electric system that has been created through efficiency programs."

(a) Please provide a copy of the referenced study by Synapse Energy Economics.

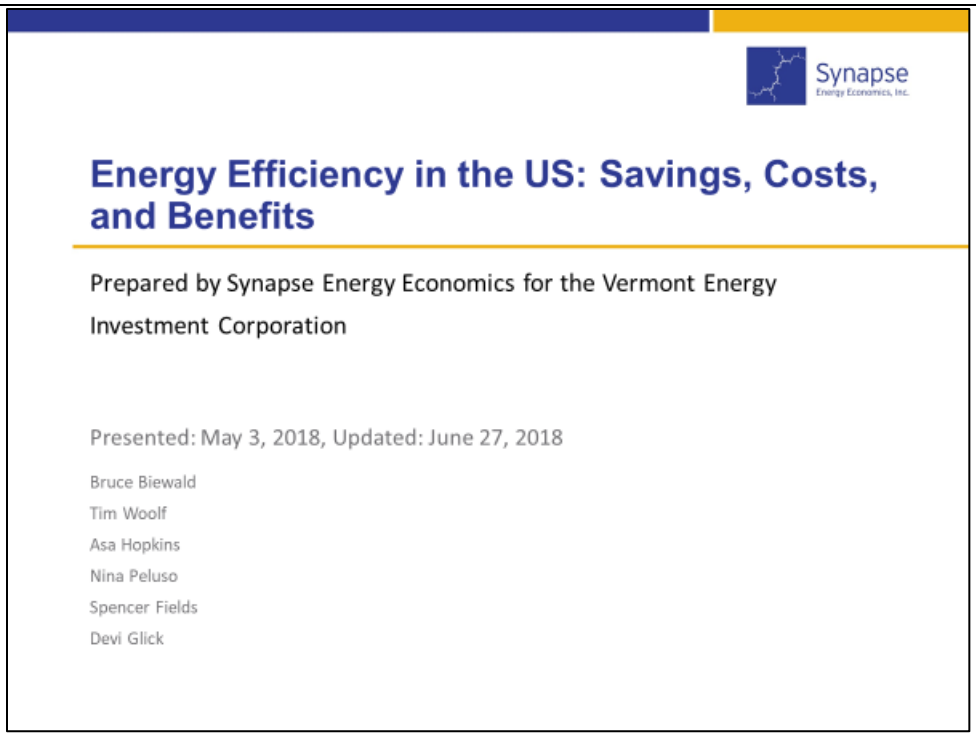
(b) Please provide the names of the author(s)/contributor(s) from Synapse Energy Economics who undertook the referenced study on behalf of Vermont Energy Investment Corporation.

Response IR-69:

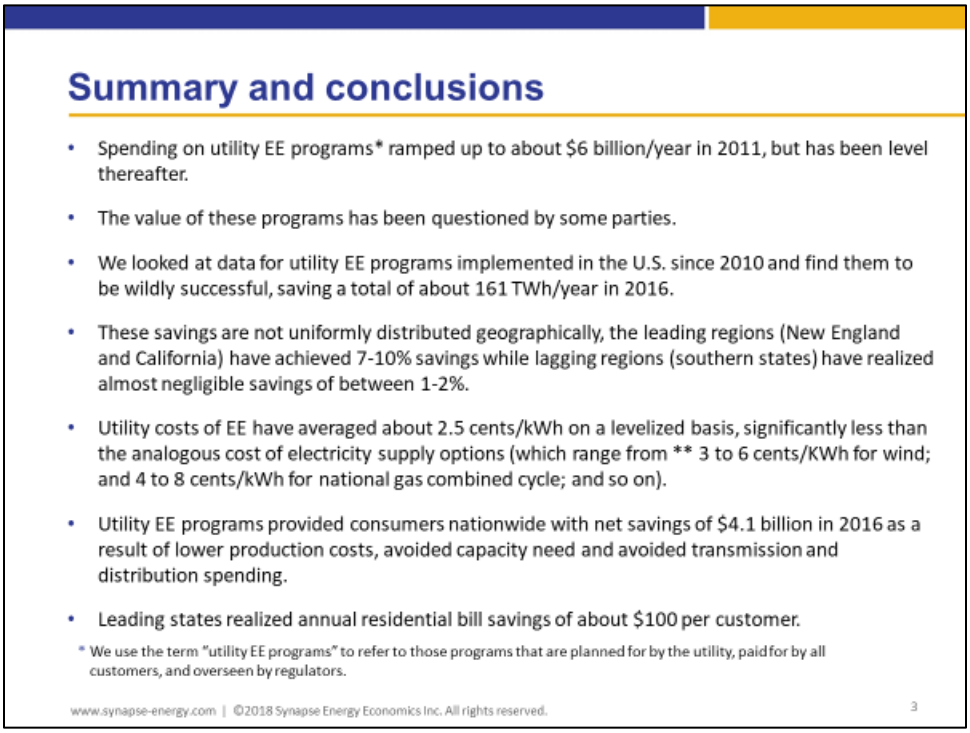
The following response has been provided by Dr. David Hill.

a) Synapse Energy Economics, Inc. conducted the referenced research in the spring of 2018. The deliverables for the research consisted of slide decks and several conference calls between Synapse and VEIC staff. The following slides summarize the research and the citations in the testimony.

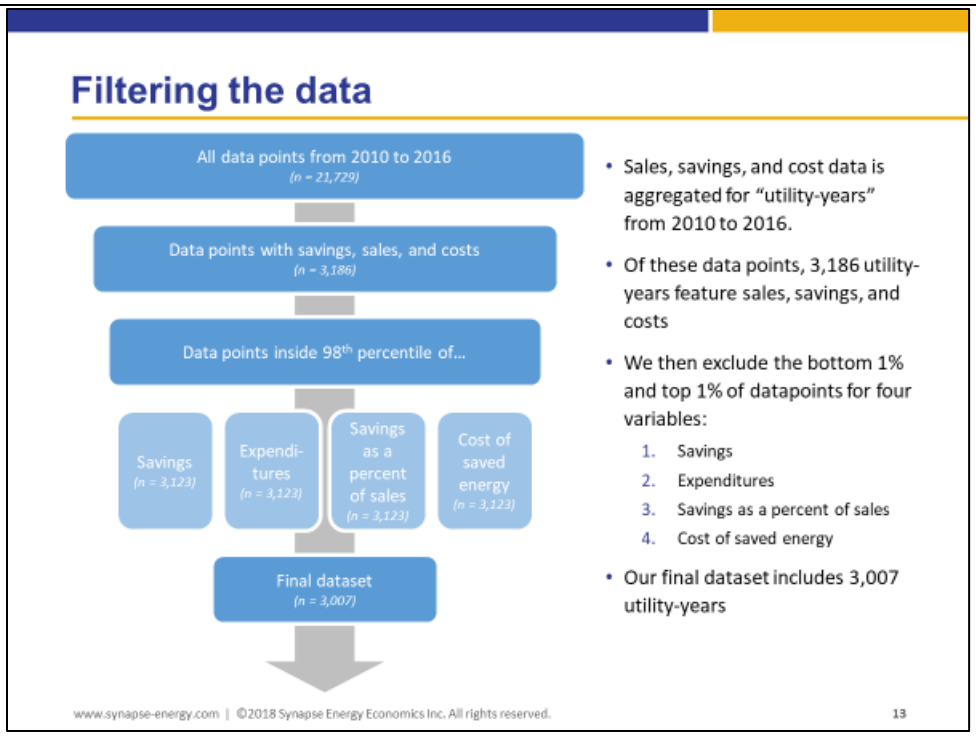
Task 1 addressed historical U.S. energy efficiency savings and spending, and is referenced in Section III of Dr. Hill's Direct Testimony. The following five slides summarize the findings for the historic efficiency spending and savings as cited in the testimony.


Synapse
Energy Economics, Inc.
Energy Efficiency in the US: Savings, Costs, and Benefits
Prepared by Synapse Energy Economics for the Vermont Energy Investment Corporation
Presented: May 3, 2018, Updated: June 27, 2018
Bruce Biewald
Tim Woolf
Asa Hopkins
Nina Peluso
Spencer Fields
Devi Glick

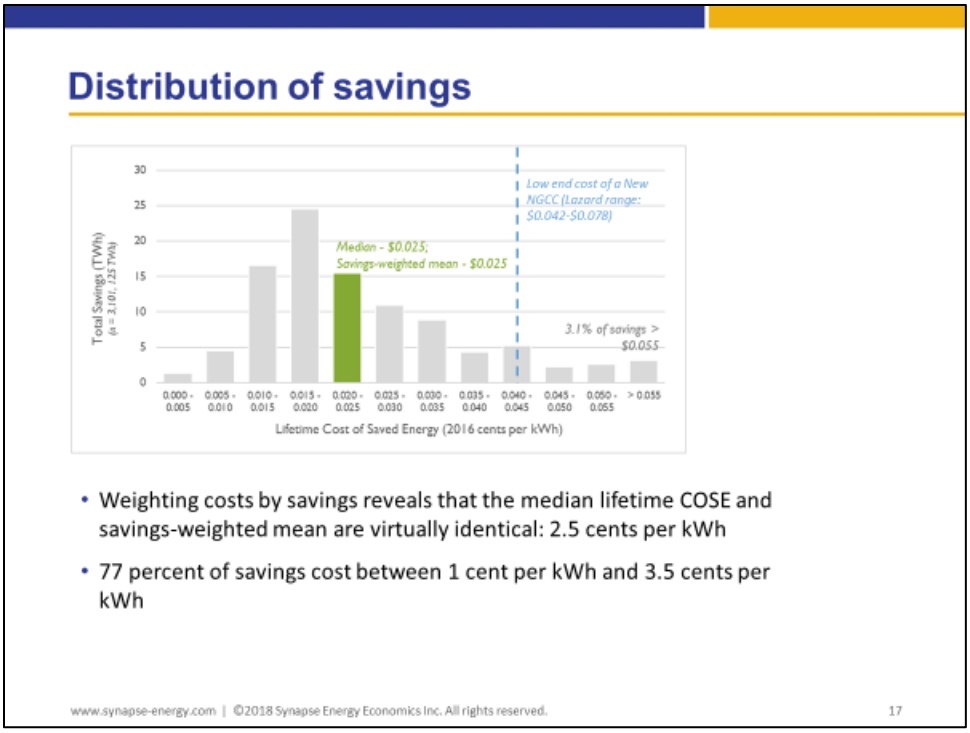
1


Summary and conclusions
• Spending on utility EE programs* ramped up to about $6 billion/year in 2011, but has been level thereafter.
• The value of these programs has been questioned by some parties.
• We looked at data for utility EE programs implemented in the U.S. since 2010 and find them to be wildly successful, saving a total of about 161 TWh/year in 2016.
• These savings are not uniformly distributed geographically, the leading regions (New England and California) have achieved 7-10% savings while lagging regions (southern states) have realized almost negligible savings of between 1-2%.
• Utility costs of EE have averaged about 2.5 cents/kWh on a levelized basis, significantly less than the analogous cost of electricity supply options (which range from ** 3 to 6 cents/KWh for wind; and 4 to 8 cents/kWh for national gas combined cycle; and so on).
• Utility EE programs provided consumers nationwide with net savings of $4.1 billion in 2016 as a result of lower production costs, avoided capacity need and avoided transmission and distribution spending.
• Leading states realized annual residential bill savings of about $100 per customer.
* We use the term "utility EE programs" to refer to those programs that are planned for by the utility, paid for by all customers, and overseen by regulators.
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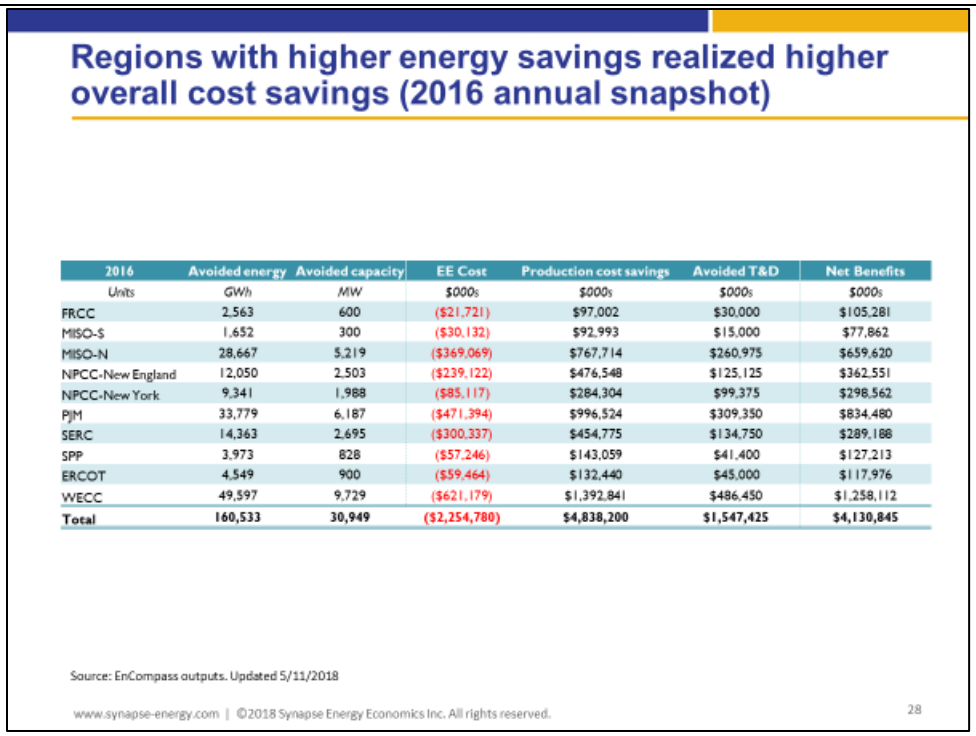
2


Filtering the data
All data points from 2010 to 2016
(n = 21,729)
Data points with savings, sales, and costs
(n = 3,186)
Data points inside 98th percentile of...
Savings
(n = 3,123)
Expendi-tures
(n = 3,123)
Savings as a percent of sales
(n = 3,123)
Cost of saved energy
(n = 3,123)
Final dataset
(n = 3,007)
• Sales, savings, and cost data is aggregated for "utility-years" from 2010 to 2016.
• Of these data points, 3,186 utility-years feature sales, savings, and costs
• We then exclude the bottom 1% and top 1% of datapoints for four variables:
1. Savings
2. Expenditures
3. Savings as a percent of sales
4. Cost of saved energy
• Our final dataset includes 3,007 utility-years
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13

1


Distribution of savings
Total Savings (TWh)
(n = 3,101; 725 TWh)
30
25
20
15
10
5
0
Low end cost of a New NGCC (Lazard range: $0.042-$0.078)
Median - $0.025;
Savings-weighted mean - $0.025
3.1% of savings > $0.055
0.000 - 0.005
0.005 - 0.010
0.010 - 0.015
0.015 - 0.020
0.020 - 0.025
0.025 - 0.030
0.030 - 0.035
0.035 - 0.040
0.040 - 0.045
0.045 - 0.050
0.050 - 0.055
> 0.055
Lifetime Cost of Saved Energy (2016 cents per kWh)
• Weighting costs by savings reveals that the median lifetime COSE and savings-weighted mean are virtually identical: 2.5 cents per kWh
• 77 percent of savings cost between 1 cent per kWh and 3.5 cents per kWh
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17

2



Regions with higher energy savings realized higher overall cost savings (2016 annual snapshot)

2016	Avoided energy	Avoided capacity	EE Cost	Production cost savings	Avoided T&D	Net Benefits
Units	*GWh*	*MW*	*$000s*	*$000s*	*$000s*	*$000s*
FRCC	2,563	600	($21,721)	$97,002	$30,000	$105,281
MISO-S	1,652	300	($30,132)	$92,993	$15,000	$77,862
MISO-N	28,667	5,219	($369,069)	$767,714	$260,975	$659,620
NPCC-New England	12,050	2,503	($239,122)	$476,548	$125,125	$362,551
NPCC-New York	9,341	1,988	($85,117)	$284,304	$99,375	$298,562
PJM	33,779	6,187	($471,394)	$996,524	$309,350	$834,480
SERC	14,363	2,695	($300,337)	$454,775	$134,750	$289,188
SPP	3,973	828	($57,246)	$143,059	$41,400	$127,213
ERCOT	4,549	900	($59,464)	$132,440	$45,000	$117,976
WECC	49,597	9,729	($621,179)	$1,392,841	$486,450	$1,258,112
Total	**160,533**	**30,949**	**($2,254,780)**	**$4,838,200**	**$1,547,425**	**$4,130,845**

Source: EnCompass outputs. Updated 5/11/2018

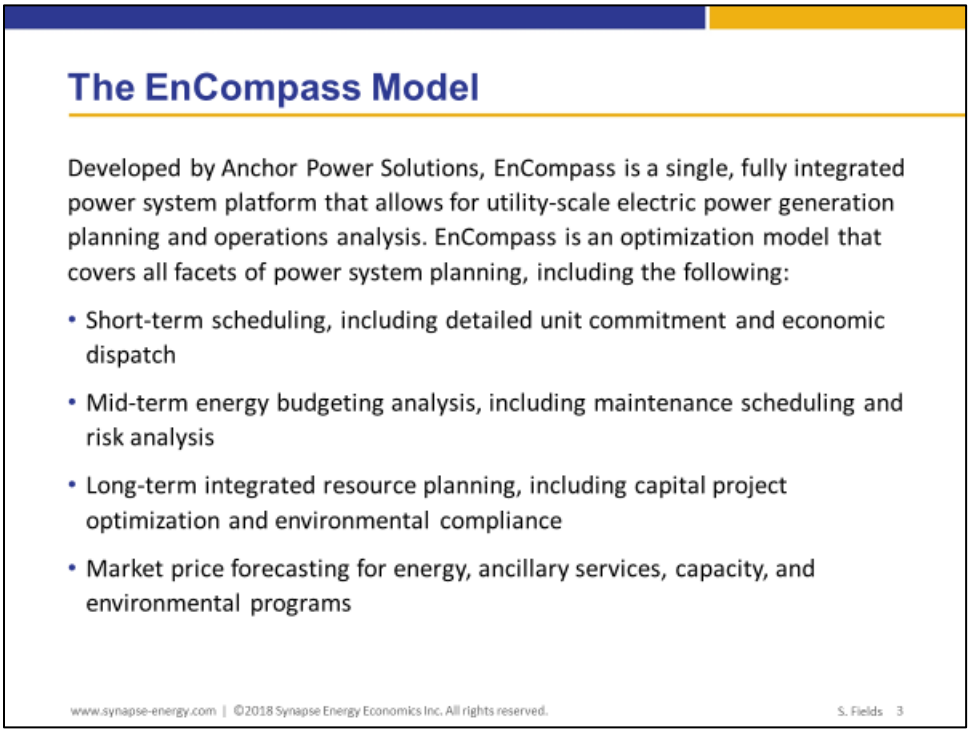
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28

Task 2 addressed projected energy efficiency net benefits through 2030, as referenced in Section VI of Dr. Hill's Direct Testimony. The following eight slides summarize the findings for the forecasted net benefits from efficiency in 2030, as cited in the testimony.


Synapse
Energy Economics, Inc.
Future Energy Efficiency Market Valuation
Prepared by Synapse Energy Economics for the Vermont Energy Investment Corporation
June 19, 2018
Spencer Fields
Nina Peluso
Devi Glick
Bruce Biewald

1


The EnCompass Model
Developed by Anchor Power Solutions, EnCompass is a single, fully integrated power system platform that allows for utility-scale electric power generation planning and operations analysis. EnCompass is an optimization model that covers all facets of power system planning, including the following:
• Short-term scheduling, including detailed unit commitment and economic dispatch
• Mid-term energy budgeting analysis, including maintenance scheduling and risk analysis
• Long-term integrated resource planning, including capital project optimization and environmental compliance
• Market price forecasting for energy, ancillary services, capacity, and environmental programs
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S. Fields 3

2

Use of EnCompass

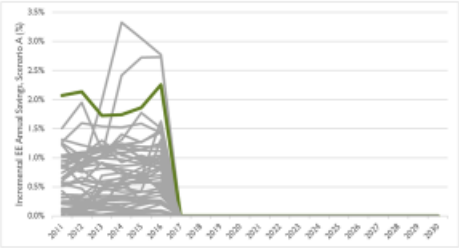
Synapse relied on EnCompass for national level optimization modeling

- Synapse ran the model for the entire US continental grid (i.e., minus AK, HI and the northernmost-tip of ME)
- Study period of 2017 through 2030
- EnCompass performs both capacity expansion and partial unit commitment providing detailed dispatch and energy price results
- Synapse input estimates of future load by state under different future efficiency trajectories
- EnCompass outputs avoided energy, capacity and production costs at the transmission area level by year
- Synapse processes the results to produce net dollar savings from EE and regional/state-level high-level bill impacts

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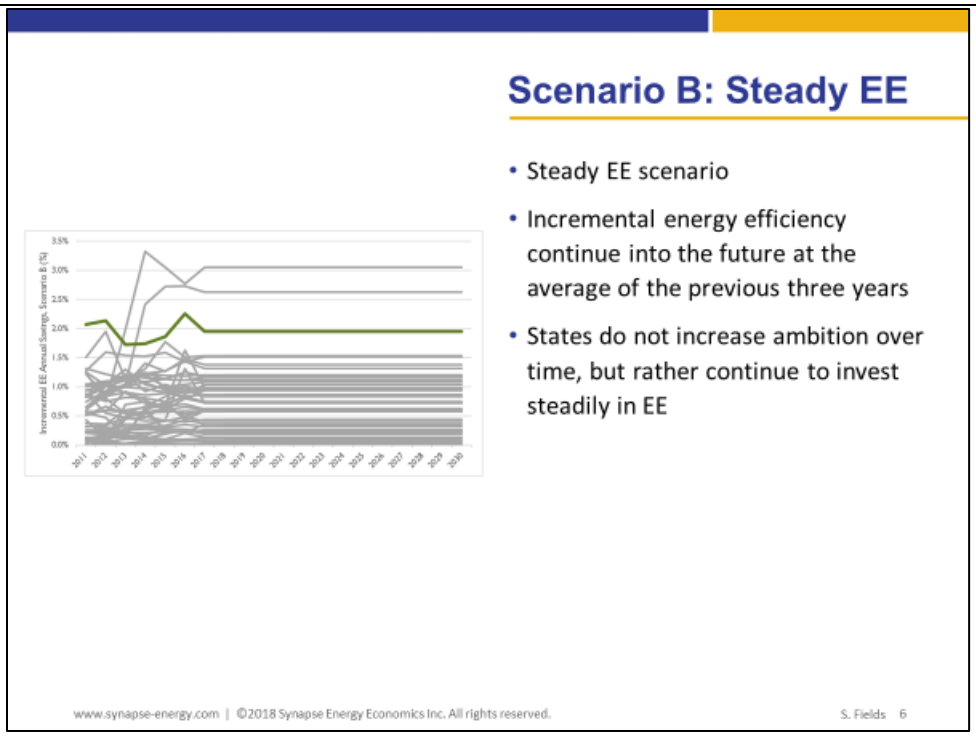
Scenario A: No Future EE



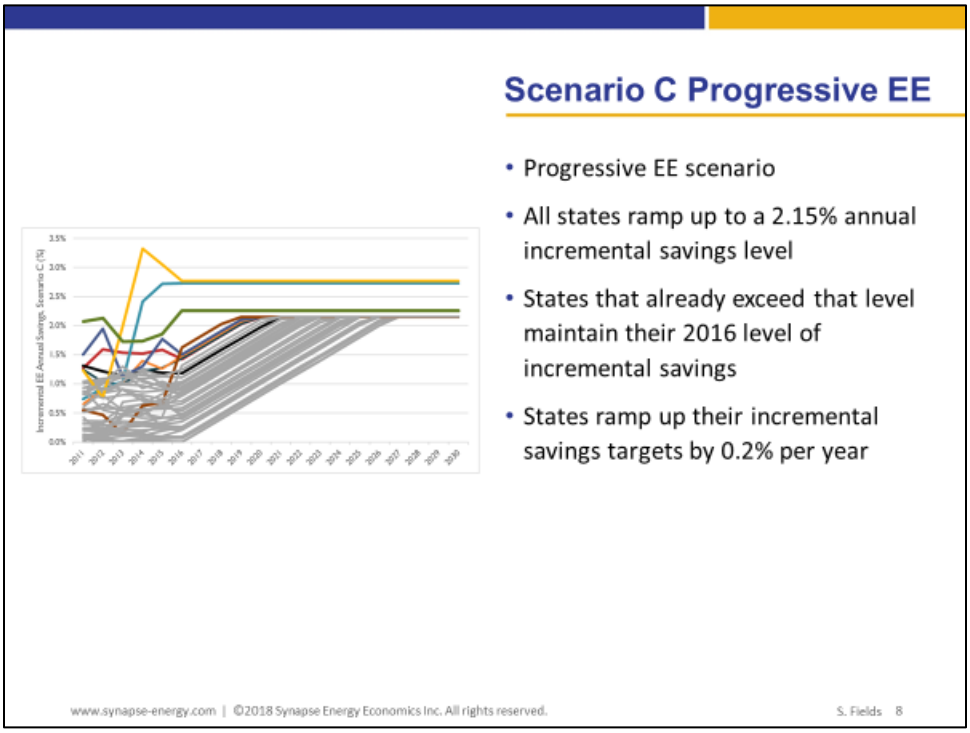
- No Future EE scenario
- Incremental energy efficiency savings end in 2017
- States continue to see the benefit of efficiency from 2011-2016 until those measures expire

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Scenario B: Steady EE
• Steady EE scenario
• Incremental energy efficiency continue into the future at the average of the previous three years
• States do not increase ambition over time, but rather continue to invest steadily in EE
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S. Fields 6

1


Scenario C Progressive EE
• Progressive EE scenario
• All states ramp up to a 2.15% annual incremental savings level
• States that already exceed that level maintain their 2016 level of incremental savings
• States ramp up their incremental savings targets by 0.2% per year
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S. Fields 8

2

2030 annual generation, capacity and T&D from EE, plus net benefit at high COSE

	Avoided energy		Avoided capacity		Avoided T&D		Net benefit	
Difference from No EE case in 2030	**Steady EE** *TWh*	**Progressive EE** *TWh*	**Steady EE** *MW*	**Progressive EE** *MW*	**Steady EE** *$MM*	**Progressive EE** *$MM*	**Steady EE** *$MM*	**Progressive EE** *$MM*
FRCC	4	37	0	3,077	0	154	232	1,093
MISO-S	13	29	521	332	26	17	367	217
MISO-N	29	66	2,741	5,893	137	295	281	672
NPCC-New England	19	30	2,927	3,530	146	176	870	1,044
NPCC-New York	7	28	824	2,264	41	113	-3	150
PJM	59	148	7,948	16,767	397	838	1,521	1,454
SERC	21	93	1,651	10,385	83	519	697	2,000
SPP	9	37	485	2,493	24	125	277	375
ERCOT	8	57	335	5,524	17	276	273	1,098
WECC	66	124	2,762	4,145	138	207	966	1,581
Total	**234**	**649**	**20,193**	**54,409**	**1,010**	**2,720**	**5,481**	**9,683**

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1

Comparison of cumulative EE savings and snapshot year net benefits between scenarios, high COSE

Region	Cumulative EE savings			Single year net benefits from EE, high COSE		
Scenario	*Historical (2016 %)*	*Steady EE (2030 %)*	*Progressive EE (2030 %)*	*Historical (2016 $MM)*	*Steady EE (2030 $MM)*	*Progressive EE (2030 $MM)*
FRCC	1.2%	1.0%	13.8%	$105	$232	$1,093
MISO-S	1.0%	1.9%	14.2%	$78	$367	$217
MISO-N	6.0%	8.2%	16.2%	$660	$281	$672
ISO-NE	10.3%	16.7%	19.7%	$363	$870	$1,044
NYISO	6.3%	8.5%	16.9%	$299	-$3	$150
PJM	4.6%	6.4%	15.8%	$835	$1,521	$1,454
SERC	2.3%	3.6%	15.0%	$289	$697	$2,000
SPP	1.7%	2.6%	14.5%	$127	$277	$375
ERCOT	1.4%	1.9%	14.2%	$118	$273	$1,098
WECC	7.4%	7.2%	13.3%	$1,258	$966	$1,581
Total	**4.3%**	**5.5%**	**14.9%**	**$4,131**	**$5,481**	**$9,683**

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2

b) The names of the Synapse Energy Economics Inc. staff contributing to and authoring each segment of this research are listed on the title slides pertaining to each task. For historical spending and savings, the contributing Synapse staff were: Bruce Biewald, Tim Woolf, Asa Hopkins, Nina Peluso, Spencer Fields, and Devi Glick. For the forecasted net benefits of efficiency in 2030, the contributing Synapse staff were: Spencer Fields, Nina Peluso, Devi Glick, and Bruce Biewald.