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Request IR-01:

- (a) Is E1 requesting the UARB verify and approve the non-energy benefits as part of the current verification process? If not, why not?
- (b) Please describe how non-energy benefits will be evaluated and verified?
- (c) Please describe the expertise required for the evaluation and verification process before the UARB for each of the non-energy benefits sought by E1 for inclusion in the cost effectiveness testing.

Response IR-01:

- a) No. The NSUARB would determine the scope of work for the verification process.
- b) EfficiencyOne is not aware of any existing methodologies for the evaluation or verification of measure-specific NEB values, unless re-creating or updating the original Massachusetts work is considered a methodology. In this case, a similar market-research approach to the original studies would be required to be employed for any such evaluation or verification.
- c) If the re-creation or updating measure-specific NEBs is considered an evaluation or verification methodology then a firm with expertise in market research and one with expertise in DSM survey design would be required.

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Request IR-02:

Ref: Application, page 4 of 15, lines 18, 19.

Please provide the results of all research undertaken by E1 to “identify and distill the approach taken by other jurisdictions to quantify NEBs and incorporate them into the TRC test.”

(a) Please provide a list of North American jurisdictions with electricity efficiency programing that do not consider non-energy benefits as part of their primary cost effectiveness testing.

(b) Please provide a list of North American jurisdictions that use the Massachusetts calculation methodology for the purpose of including non-energy benefits in their primary cost effectiveness test.

Response IR-02:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

a) U.S.: Alabama, Alaska, Arizona, Florida, Georgia, Hawaii, Idaho, Indiana, Kansas, Louisiana, Maine, Michigan, Mississippi, Montana, Nebraska, Nevada, New Jersey, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Virginia, and West Virginia.

Canadian: New Brunswick, Nova Scotia, Quebec, and Saskatchewan.

b) Maryland and Rhode Island.

Canadian: None.



Ingrid Malmgren

Policy Manager, Transportation

**Ingrid
Malmgren**

Transportation Policy
Manager

Ingrid Malmgren supports VEIC's Transportation Efficiency department deliverables with research and collaborative project management. She researches and analyzes topics on energy policy and regulation, avoided costs of energy efficiency, and transportation efficiency. She has analyzed the feasibility of electric vehicles (EVs) as a grid resource, health and economic benefits of clean energy resources, benefits of low-income energy efficiency programs, and energy efficiency cost-effectiveness screening.

Ingrid began her career at VEIC in 2009, in policy and utility regulation. She worked closely with regulators on projects involving comprehensive energy policy in energy efficiency, carbon markets, and clean energy alternatives. She has conducted research to quantify the efficiency and environmental benefits of non-energy factors—in particular, health improvements and economic development. In 2015 she expanded her research to include the transportation sector and was part of a team that completed a NYSERDA-commissioned grid-interactive vehicle feasibility study. She drafted several papers for the Sierra Club, identifying strategies for maximizing benefits of EVs and minimizing EV impacts on the grid. She recently developed a toolkit for NASEO, to support states' mitigation plans under the environmental mitigation trust under the VW settlements.

Selected Publications and Presentations

- Malmgren, Ingrid, and Cassie Powers. **Volkswagen Settlement Beneficiary Mitigation Plan Toolkit**. National Association for State Energy Officials, 2017.
- Malmgren, Ingrid, David Roberts, and Justine Sears. **Fully Charged: How Utilities Can Help Realize the Benefits of Electric Vehicles in the Northeast**. Sierra Club, 2016.
- Malmgren, Ingrid, and David Roberts. **The Road Ahead: Maximizing the Benefits of Electric Vehicles in Missouri**. Sierra Club, 2016.
- Morse, Stephanie, Ingrid Malmgren, and Steve Letendre. **New York State Grid-Interactive Vehicle Roadmap**. New York State Energy Research and Development Authority, Report 16-01, 2015.
- Malmgren, Ingrid. **Non-Energy Benefits of Clean Energy Programs**. Presented at American Council for an Energy- Efficient Economy: Intelligent Efficiency Conference, 2015.
- Malmgren, Ingrid, and Lisa Skumatz. **Lessons from the Field: Practical Applications for Incorporating Non-Energy Benefits into Cost-Effectiveness Screening**. ACEEE Summer Study of Efficiency in Buildings, 2014.

Other Professional Experience

- **Vermont Housing Finance Agency:** Research Analyst
- **ICF International:** Research Manager. Managed projects from research design through final delivery. Social science research, including behavioral health and projects for Temporary Assistance to Needy Families (U.S. Department of Health & Human Services).

Education

- **MA, University of Vermont,** Geography, 2000
- **BA, Pennsylvania State University,** Geography, 1994

Lessons from the Field: Practical Applications for Incorporating Non-Energy Benefits into Cost-Effectiveness Screening

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ABSTRACT

The literature on non-energy benefits (NEBs) has shifted in the past several years from the recognition of these benefits by regulators and program administrators to recommendations on how best to incorporate these benefits into cost-effectiveness screening. This new treatment of NEBs is now seen as a best practice for energy efficiency programs. The three primary classifications of NEBs—participant, utility, and societal—have varying effects in the context of the value of energy efficiency. This paper presents case studies of four different types of efficiency programs, with different regulatory structures and cost-effectiveness screening tools. The case studies show practical applications of how to account for NEBs under different regulatory regimes and programmatic guidelines. This paper examines practical applications of how these various entities were able to identify, measure, and incorporate NEBs into their cost-effectiveness screening.

Introduction

For decades, researchers have recognized that a significant portion of the value of energy efficiency programs comes not only from the energy savings, but from the programs' other impacts, their non-energy benefits. Unfortunately, these non-energy benefits are seldom counted or are frequently undercounted when assessing their value to energy efficiency programs. Thus, the costs of energy efficiency programs are factored into the equation, but many of the benefits are not. The literature argues that NEBs add value to energy efficiency programs. Researchers also classify NEBs into different collection points, according to who benefits from their effects. Other literature discusses ways to quantify NEBs and measure the value that they bring to programs. The most recent literature looks at incorporating the value of NEBs into cost-effectiveness screening and recommending those methods as best practices for evolving cost-effectiveness tests in efficiency programs.

This paper provides a brief background on the literature about NEBs and methods for their classification and quantification, and examines the “best practice” assumption of recent recommendations for incorporating NEBs into cost-effectiveness screening. Four case studies of different programs describe the processes that emerged in those programs to quantify and count NEBs. Each case study also presents lessons learned and the various challenges along the way.

Twenty Years of Progress on NEBs

Over the past 20 years, NEB research has progressed from hypothesized lists of generalized benefits that might be attributable to programs, to tentative applications in low-income programs, to full-fledged estimation work of scores of categories of NEBs for literally hundreds of programs across the nation. The key steps in this progress are (Skumatz 2013, Skumatz et al. 2009):

- **Stage 1 – Perspectives and Basic Measurement Approaches (1994-1998):** Early phases of the literature organized NEB categories into “perspectives” based on beneficiary group, and established basic measurement approaches. The NEBs were categorized into groups based on the beneficiaries of their impacts. The beneficiary groups are participants (reduced building operating costs, comfort, health, worker productivity); utilities (bill payment improvements, fewer line losses, system savings); and society (job creation, emissions reductions, infrastructure). In this period, basic tenets of NEBs were determined: (1) that NEBs can be positive or negative; (2) that programs should count only NEBs associated with the upgraded equipment and at the level of the net-to-gross factor. Also during this time, the methodologies of measuring for the particularly “hard to measures (HTM)” participant-side NEBs—using specially designed surveys—were piloted and published (Skumatz and Dickerson 1998).
- **Stage 2 – Early Estimation for Programs and Exploration of Benefit-Cost Applications (1998-2001):** The literature began to provide derivations and estimates of NEBs in many categories, and projects examined the use of NEBs in benefit-cost tests. Papers covered more than two dozen NEBs, for low-income and commercial programs organized into beneficiary categories. The papers identified three measurement approaches for NEBs: (1) engineering or model-based estimates, including job creation from input-output estimates and emissions / climate-change modeling; (2) incremental incidence / marginal valuation estimates including factors from secondary literature (fewer calls valued at marginal utility staff rates, and at household opportunity cost rates; fewer sick days lost from work valued at marginal wage rates; fewer fires valued via insurance tables; arrearage studies) and (3) specialized comparative statistical surveys estimated household and business-accruing NEBs. Additional studies identified priority NEBs (based on size, for example), and the most volatile or uncertain NEB categories. In addition, the publications pointed out the range of potential applications of NEBs (marketing, targeting, barriers analysis) and provided examples of the change in program benefit-cost ratios that would result from including NEBs in whole or as subsets, depending on the test and application. This phase of NEB development work culminated in California’s commissioning a comprehensive NEB model and associated revised Low Income Public Purpose Test (LIPPT), with recommendations on which NEBs could be appropriately incorporated into a revised benefits test, specifically for low-income programs (TecmarketWorks and Skumatz, 2001).
- **Stage 3 – Measurement and Application Expansions (2001-present):** The NEB literature expanded the estimation work to many programs, explored best practices in measurement, and expanded NEB use in marketing and other applications. Increasing

interest in NEBs by program staff, utilities, and interveners led evaluation firms nationwide to conduct NEB studies for more utilities. The work included low-income programs, programs in all sectors (residential, multifamily, commercial and industrial, schools, public buildings) and on all types of programs and measures (rebates, weatherization, appliance replacement, retro-commissioning, solar programs, real time pricing). Publications specialized in studies drilling down on one NEB or one measure in detail, disaggregation of program-wide NEBs to allow association of NEB values with individual measures, comparisons and contrasts of valuation methods, and explorations of enhanced measurement approaches. Researchers gave literally hundreds of presentations at national and international conferences. The literature became more robust, and the topic became virtually its own track at the ACEEE Summer Study on Buildings Conference. The literature estimated that monetized NEBs range from 50% to more than 300% of the annual energy bill savings (depending on program and included or omitted NEBs categories), which clearly suggested NEBs represented substantial omitted effects (Skumatz et al. 2009).

- **Stage 4 - Refocusing on the Role of NEBs in Regulatory and Benefit-Cost Applications (2008-present):** With expanded and matured NEB literature that used methods tested by many researchers, and with NEB values demonstrated, it became clear that NEBs represented significant omitted program benefits. It also became clear that traditional regulatory tests excluding NEBs were biased and might not lead to optimal program investment. Program staff, utilities, regulators, interveners, and evaluators became more comfortable with NEBs, opening the door to revisiting the issue of updating benefit-cost tests to incorporate more comprehensive values. Essays on re-crafting tests appeared. This work is under way, with some states sticking with the status quo, others revisiting “adders,” and some considering significant changes. (Skumatz, et.al. 2009, Skumatz 2014).

With more than 20 years of literature, NEBs have been the subjected to deep research, the development of application of methodologies, testing in different programs, sectors, and regions, presentation at formal conferences, and associated peer and academic review. In particular, this evolution and development of the literature have moved the perception of NEBs among program staff, administrators, and regulators from that of general unfamiliarity and skepticism; to acknowledgement that some NEBs are “real,” measureable, and useful. Stakeholders now have a larger appetite for considering NEBs in uses beyond “soft” applications like marketing, and for re-considering their use in benefit-cost applications. Four case studies follow, showing how states have addressed NEBs in formal, regulatory cost-effectiveness testing.

The Case for NEBs, and National Review of NEBs in Cost-Effectiveness Testing Framework

Many regulatory cost-effectiveness tests are used to compare the cost-effectiveness of programs and optimize program investment. These are essentially the Total Resource Cost (TRC) or Societal Test, which represent the utilities and their customers; the Participant Test, representing the perspective of the participating customers; the Utility Cost Test (UCT),

measuring costs and benefits to the utility; and the Ratepayer Impact Measure test (RIM), measuring impacts on rates. The NEBs perspectives (societal, participant, and utility) overlap all other tests, and *if a true representation of costs and benefits is desired, elements of NEBs represent exactly the missing factors in the benefit-cost calculation that reduce bias and better guide investment between and among programs and portfolios. NEBs analysis reduces bias in benefit-cost tests.* The practical discussion usually centers on enhancing versions of the TRC (societal) test, given its broad scope. The TRC generally compares benefits in terms of avoided energy costs against program costs (involving both utility and participant costs). The theoretical consistency of the test(s) can be best improved by:

- Including monetized estimates of the NEBs (net positive and negative) in the TRC computation; or
- Excluding all NEBs and the costs associated with achieving the NEBs, or use the UCT that involves only the costs paid by the utility.

Improving the tests comes down to the costs and benefits, and the associated accuracy, of the *improvements* in values or components. Utilities and regulatory agencies struggle with how to achieve that balance. What additional NEB categories can be accurately estimated within a reasonable evaluation budget? Practically, the question should be three-fold: (1) Which NEB categories are most valuable? (2) What value range arises from its reasonable-cost measurement? and (3) Does the inclusion of this *range* of values change the benefit-cost conclusion (to include or exclude the program or measure)? If the inclusion of the high and low end of the ranges results in different benefit-cost decisions, more money might be invested in refining the measurement calculation (assuming the program investment decision is valuable, and up to just shy of the value of that potentially wrong decision) (Skumatz et.al. 2009). If the use of the high and low value of the NEB range results in the same program decision, no further investment to improve the estimate is justified. Investing a lot of money to refine estimates of a low-value NEB is money less well spent than refining estimates for a large NEB. These concepts are a type of value-based decision-making that is basic to most economists. However, regulators tend to like simple rules, not multi-part decisions. To deal with this cost-and-accuracy issue, states are taking one of several approaches:

- incorporating a simple, conservative “addor” to the benefits. Most suggest they are trying to incorporate factors related to omitted environmental or emissions effects;
- incorporating “easy to measure” NEBs into the benefits. Several states are adopting this flexible approach, with the “easy to measure” benefits varying among programs (for example, including easier-to-measure water bill savings from clothes washer programs, and omitting “softer” NEBs such as comfort, measured from surveys);
- trying to measure all NEBs, or the leading from among several dozen NEBs; or
- a hybrid approach: using an adder and measuring either easy-to-measure benefits, or as many benefits as possible beyond what is included in the adder.

A recent comparison of states in terms of the extent to which they are considering NEBs is presented in Table 1. The status of NEBs in these jurisdictions is constantly changing, as illustrated by the case studies.

Table 1. Comparison of NEB treatment in regulatory environment, by state

Regulatory / screening application	Utilities / regions	MORE AGGRESSIVE ==>
Program marketing	Fairly widespread use in utilities / states across the country	
Test / program screen: Adder	• Iowa (10% electric, 7.5% gas, 1999) • Colorado (10% adder, 25% low income, 2008) • Oregon (carbon \$15 / ton; 10% adder, 2008) • Washington (10% adder, 2008) • Vermont (15% + 15% low income) • District of Columbia (10%) • New York(\$15 adder for carbon) • NW (15%) For low income or <1 (CA*, ID, OR, WA*, UT, WY, NH, NY, CT)	
Test / program screen: Readily measured	• Massachusetts (NEBs must be "reliable and with real economic value"; utility, prop, health and safety comfort; low income; equipment, utility, all costs of complying with foreseeable environmental regulations) • California (low income) • Vermont (maintenance, equipment replacement, low income, comfort, H&S, prop, utility, societal) • Colorado (measureable with current market values) • New Hampshire (as adder; low income) • BC Hydro (maintenance, greenhouse gases, lifetime, product loss, productivity, floorspace) • District of Columbia (equipment, comfort, health and safety, prop, societal) • Oregon (especially C&I; carbon value on societal test, PV deferred plant extension, water / sewer savings, laundry soap); • Connecticut (low income) • Rhode Island (low income; quantify utility, societal; health and safety, equipment, prop, comfort) • New York (low income, equipment)	
Test / hybrid (potential adder and measured)	• Colorado (measureable with current market values) • Oregon (especially C&I; carbon value on societal test, PV deferred plant extension, water / sewer savings, laundry soap); • DC • Vermont	
Test / program screen: Broad	With quantification: MA, RI. MA decision broadening, counted in residential and ICI; demonstrable via surveys (not yet economic); broad inclusion of NEBs as official screen: not yet found.	

Source: Skumatz 2009, updated Skumatz 2014

The New York Case Study

Included in this paper, are four case studies of how non-energy benefits became incorporated into cost-effectiveness screening. If one looks at these cases chronologically, they appear to operate like a set of dominoes. In this analogy, New York is the case that started it all. In the mid-2000s, New York State Energy Research and Development Authority (NYSERDA) undertook detailed studies of NEBs as part of its revamped program evaluation work. It also commissioned research in localized state estimates of the economic and job impacts of NYSERDA programs. As part of their program performance reporting, they presented their program impact information along with net-to-gross (NTG) and NEB estimates, and their reports presented the impacts in “scenarios” of 0%, 50%, and 100% NEBs inclusion (including participant NEBs and some societal NEBs, including jobs). Although this analysis was not formally considered in the cost-effectiveness evaluation, it was illustrative, and it showed the effects of including different rates of NEB adders. This was especially valuable for programs that were close to the threshold for screening cost-effectively.

For reporting related to the system benefit charge (SBC) and energy efficiency portfolio standard (EEPS), NYSERDA presents annual retrospectives of cost-effectiveness. It runs scenarios for TRC and program administration cost tests: (1) standard; (2) standard plus NEBs excluding job impacts, and (3) scenario with job impacts. These allow viewing of the impacts these programs have beyond simple energy savings, and include low-income programs that make reference to their NEB values. NYSERDA continues to study NEBs, because they enhance its understanding of how programs drive consumers. The NEBs work is used in marketing.

However, NEBs are not formally included in the consideration or calculation of cost-effectiveness by the Department of Public Service in New York. Cost-effectiveness screening currently involves a carbon credit value (\$15 adder) related to long-run avoided cost, but traditional participant NEB impacts like health and safety and other “hard-to-measure” benefits are neither calculated nor used. Non-energy benefits are also not in the TRC.

But the story is not over. On December 26, 2013, the Public Service Commission issued an order for a review and restructuring of the TRC policy. Criticisms particularly relate to a New York requirement that every measure pass the test, rather than allowing program-wide cost-effectiveness testing. However, further discussion will open the door for broader criticisms of the TRC, including arguments for including NEBs. Interveners successful in other states are expected to come forward (potentially PACE, NRDC, and others).

It is ironic that NYSERDA has invested substantially in supporting comprehensive quantitative research on NEBs, when other states cite its research as supporting their own incorporation of NEBs—in a manner in which New York does not. The research supplied by New York was the first domino supporting decisions in Colorado to incorporate an NEB adder, which led to the decision in Vermont to incorporate a NEB adder.

Lessons Learned

Research is critically important in quantifying and validating the value of NEBs in energy efficiency programs. NYSERDA invested considerably in NEB research on all of its programs, and developed tailored, local models to estimate the job and economic multiplier effects of its

programs. This research has helped refine programs and their marketing; however, without programmatic and political support, these data might provide more benefit to other states.

The Colorado Case Study

Two main factors led to Colorado's 2008 decision to adopt an NEB adder for electric and low-income electric programs: evidence from research and the engagement of interveners. Evidence in research contributed greatly to both the 2008 proceeding and a 2011 proceeding (Docket No. 07A-420E, Decision No. C08-0560) that examined non-energy benefits within the context of cost-effectiveness screening. A large group of interveners in the dockets supported both Colorado's first and second decisions to count the benefits associated with NEBs, as an adder for electric (and later gas) cost-effectiveness screening.

Colorado's first comprehensive consideration of NEBs in cost-effectiveness screening resulted in a 2008 decision by the Colorado Public Utilities Commission (PUC) to incorporate an NEB adder into a Modified Total Resource Cost Test (modified because it incorporates consideration of NEBs). The 2008 deliberations led to the 2009/10 DSM Plan in which Public Service used proxy values of 10% for electric programs, 20% of avoided costs for its electric low-income programs, and a multiplier of 1.05 times the Total Resource Cost test ratio for its natural gas energy efficiency programs as an NEB adder in its cost-effectiveness analyses (5% adder). The company was ordered to use these values by the PUC¹ (Skumatz 2010a). However, the proxy values were not tied directly to estimates of values for specific lists of NEBs. The final order in the first Demand Side Management docket (07A-420E), addressed general policy matters, and addressed low-income cost-effectiveness. Special consideration was given to the TRC calculation for low-income programs (using a UCT in the event the TRC is less than 1.0).

136. For those low-income DSM programs that do not yield a 1.0 or greater TRC value, we direct Public Service to apply a modified utility cost test calculation and communicate the results via the biennial plan testimony. Specifically, we direct Public Service to seek out situations where the utility-provided low-income DSM expenses can take advantage of service delivery and overhead resources that already exist in the marketplace through public funding. In such situations, a "modified utility cost test" is to be applied. This will assess the total benefits resulting from such partnerships against the utility costs (versus total costs), under the rationale that the existing publicly funded infrastructure is a "public good" already in place and paid for, analogous to the roads and bridges used to reach a customer's home (Docket 07A-420E Decision No. C0-0560 page 39, paragraph 136).

¹ In Docket No. 07A-420E, Decision No. C08-0560, the Colorado PUC directed Public Service as follows: "In applying the TRC to low-income DSM programs, the benefits included in the calculation shall be increased by twenty percent, to reflect the higher level of non-energy benefits that are likely to accrue from DSM services to low-income customers." (Paragraph 139) In the Gas Rules, the Commission stated that the initial calculated Total Resource Cost Test ratio should be multiplied by 1.05 "to reflect the value of avoided emissions and other societal benefits. The result shall be the modified TRC. A utility may propose a different factor for avoided emissions and societal impacts, but must submit documentation substantiating the proposed value." 4753 (m) (I)

The clear value of research in the decision in the 2008 proceeding is illustrated in the order that describes the advocacy position taken by the Energy Efficiency Business Coalition. They cited NYSERDA research in identifying individual values for NEBs as a reliable source for quantifying non-energy benefits:

71. EEBC (*Energy Efficiency Business Coalition*) advocates that a broader range of non-energy benefits be included in the cost-effectiveness calculation. It specifically presented these additional benefits for consideration: comfort, health, safety, equipment durability/lower maintenance; reduced financial stress; psychological benefits; improved comfort/safety during power outages; improved resale value and ability to resell; higher worker productivity; secondary energy and demand savings due to more efficient appliances yielding less heat load and thus less air conditioning demand; reduced social service costs; reduced noise and water savings. EEBC also presented macroeconomic benefits such as increased employment, increased economic activity; and increased technology development. It cited NYSERDA as a source for quantifying such non-energy benefits and factoring into DSM cost-effectiveness analysis (Docket 07A-420E Decision No. C0-0560 pages 24-25).

Colorado revisited its cost-effectiveness screening in a later proceeding which resulted in an increase and expansion of the NEB adder to 25% for low-income programs for both gas and electric energy ratepayers. Again, research played a key role in the proceeding and its outcome. In its Order approving the company's Enhanced DSM Plan, the Colorado PUC directed Public Service to "update their quantification of low-income DSM non-energy benefits on a timetable that will inform the DSM filing in 2010." (p. 63, Decision No. C08-0560, Docket No. 07A-420E). A 2010 report (Skumatz, 2010a) provided the Commission with an analysis that fortified the importance of non-energy benefits within the low-income sector.²

In both of Colorado's proceedings (the 2008 and 2011 decisions) interveners played an important role. In particular, Energy Outreach, Sierra Club, and SWEEP testified, with the goal of incorporating NEBs to reduce bias in (and increase values for) benefit-cost tests and to increase energy efficiency programs in the state. As with the other three case studies in this paper, the story is not over. In 2013, these values are in the process of yet another reassessment, with interveners arguing that Colorado's adders are too low (based on growing research and treatment by other states), and that the cost-effectiveness tests need revision, amid discussions of program budget assumptions, avoided cost discussions, and other arguments.

² The study's results (drawing on approaches in California, from NYSERDA, and by other work) found that, including all NEBs from all perspectives, the total NEBs represented additional dollar value of benefits that were: 128-286% of the value of energy savings for the four gas programs studied; 147-213% of the savings for the electric programs; and 124-175% for the combined programs (Skumatz 2010a). The adopted 25% value was an increase over previous values, but considerably below the estimated values. In 2013 testimony, the utility argued that the study's values were "too liberal."

Lessons Learned

Three lessons arise from the Colorado cases. First, research is a valuable tool for quantifying NEBs, and it supports conceptual understanding of their contribution to energy efficiency programs. Second, committed interveners can provide necessary momentum for bringing about policy change in cost-effectiveness screening, especially if there is no significant opposition (as was the case with Colorado). Third, cost-effectiveness screening of energy efficiency programs is ongoing. Changes in existing research, adopting changes in screening by similar jurisdictions, and programmatic changes contribute to a dynamic environment in which cost-effectiveness screening and the incorporation of NEBs (and at what level) are under frequent review and revision.

The Vermont Case Study

Three elements contributed to the incorporation of cost-effectiveness screening in Vermont: the quantity and nature of available research regarding NEBs, a growing number of other jurisdictions incorporating NEBs into their cost-effectiveness screening, and the collaboration of a broad group of stakeholders.

Vermont has been operating a single statewide efficiency program since 2000 through a third-party administrator. As early as 1990, the Vermont Public Service Board in Docket 5270 established cost-effectiveness guidance for utility efficiency investments made with ratepayer funds. In this docket, the Board adopted the Societal Cost-effectiveness Test as its primary method. The Board also set a 5% adder to account for the reduction of environmental externalities and a 10% adder to account for the reduced risks associated with obtaining electrical efficiency savings as an alternative to generation. (Hamilton 2009).

In 2009, the Vermont Public Service Board revisited these cost-effectiveness screening values with regard to thermal efficiency measures. There was apparent consensus among the proceeding's participants that NEBs added value beyond energy savings to efficiency. However, it became evident that more research was needed to determine how and at what level to incorporate NEBs into cost-effectiveness screening.

Three immediate developments came out of this proceeding. Riley Allen, a utilities analyst for the Board, recommended a 5% NEB adder be used as a stop-gap for screening efficiency measures associated with thermal and process fuels. He also recommended that stakeholders throughout Vermont create partnerships and seek out research to support a clearer value that should be associated with NEBs. This call to action laid the foundation for the three elements that contributed to the acceptance of a larger NEB adder for Vermont's cost-effectiveness screening.

In response to this recommendation, stakeholders reached out to other parties and thus expanded its scope. This expansion involved Weatherization agencies, affordable housing organizations, and the Vermont Department of Education. By December 2009, seven organizations representing utilities, energy efficiency providers, nonprofits, housing organizations, and economic opportunity organizations submitted joint comments to the Board, supporting an NEB adder in the State's heating-and-process fuel efficiency screening tool.

This expanded group of participants began researching NEB literature to determine the best methods for assessing and valuing NEBs. Energy efficiency researchers elsewhere also examined the same questions Vermont was asking about the valuation and incorporation of NEBs. Together, they contributed to the quantity of available research.

Of particular value to the low-income NEB adder was research on the Vermont Weatherization Assistance Program (Hall and Riggert, 2002), cited in participant comments in the proceeding. This research specifically measured the non-energy benefits of low-income programs. By quantifying reduced arrearages, fewer shut-offs, lower collection costs, lower emissions, economic impact through employment, water savings, increase in property value, fewer lost work or school days due to illness, and fewer fires, the researchers were able to quantify an NEB value per participant of \$11,391 for a program that cost \$2,259 per participant.

During the Vermont cost-effectiveness proceeding, the research was also changing. It was generally agreed that identifying and valuing NEBs were important components of energy efficiency programs; but research on the subject was also shifting to how best to incorporate NEBs into cost-effectiveness screening and recommending their incorporation as a best practice (Skumatz 2010, Woolf, et al. 2012, Daykin, Aiona, and Hedman 2010, National Action Plan 2006, NMR / TetraTech 2011, and the National Home Performance Council 2011, State & Local Energy Efficiency Action Network's Impact Evaluation Guide 2012). The information in these publications supported the Vermont partners' assertion that NEBs were real, often measurable, and an important facet of the value of energy efficiency. This research was of high value in Vermont's regulatory decision to include a NEB adder in cost-effectiveness screening.

The second element that led to the adoption of the NEB adder for efficiency screening in Vermont was the growth in the number of jurisdictions that were valuing NEBs in their own cost-effectiveness screening. Not surprisingly, this new practice in other jurisdictions was largely supported by the same research that supported Vermont's decision. Vermont looked to several other states for guidance in "counting" NEBs toward cost-effectiveness screening. The Colorado PUC's cost-effectiveness proceeding coincided with Vermont's proceeding. In 2008, the Colorado PUC adopted an NEB adder of 10% for electric programs, and a 20% adder for low-income electric programs.

The introduction of an NEB adder in Colorado (see Colorado case study) and the research that supported it (see New York case study) were beneficial to Vermont's case. But perhaps even more compelling was Colorado's review of its NEB adder in 2011, the resulting proceeding, and finally, that state's decision to increase its NEB adder from 20% to 25% for low-income electric efficiency programs in the screening of both low-income gas and electric programs. The final element that spurred Vermont's incorporation of an NEB adder was the collaboration of several Vermont entities: the Public Service Department (the State's ratepayer advocate), Weatherization agencies, affordable housing agencies, efficiency administrators, and Community Action Councils. They all collaborated to support cost-effectiveness screening measures, including the 15% NEB adder for thermal and electric efficiency screening and another 15% adder for screening for low-income energy efficiency.

The Board ordered a 15% NEB adder as a conservative rebuttal presumption that could be amended in later proceedings, as information became available to more accurately assess the exact value of NEBs in energy efficiency in Vermont.

While there is a high degree of uncertainty surrounding the magnitude of non-energy benefits, it is clear that the current value of zero is incorrect, and that 15 percent is on the lower end of the range of estimates. It is appropriate to start with a conservative estimate, and to revisit the estimate in the biennial EEU avoided-cost proceedings, with 15 percent serving as a rebuttable presumption (Vermont Public Service Board Order dated 2/7/2012 at 27³)

Lessons Learned

It all comes back to research. The three elements that contributed to Vermont's adoption of an NEB adder were (1) availability of research supporting the value of NEBs and how to incorporate NEBs into cost-effectiveness screening to obtain a more accurate measurement of the value of efficiency programs and measures (see measurement summaries in Skumatz 2002, 2009), (2) the increased number of jurisdictions that incorporated NEBs into their screening, and (3) the support of participants committed to the accurate counting of the benefits of energy efficiency. Consequently, it is likely that future changes to Vermont's NEB adder will be informed by research in years to come.

The District of Columbia Case Study

Although the population of the District of Columbia is roughly the size of the population of Vermont, there are many differences between the energy efficiency utility operated in Vermont and the DC Sustainable Energy Utility (DCSEU). Vermont has a long history of mature and evolving energy efficiency programming overseen by Vermont's Public Service Board. However, the DCSEU has been operating only since 2011, and incorporates ambitious social equity goals into the fabric of its programs.

The Council of the District of Columbia developed enabling legislation for the formation of an energy efficiency utility in its Clean and Affordable Energy Act of 2008. The act established a Sustainable Energy Trust Fund to be funded by a system benefits charge on gas and electric services, as well as from proceeds from the sale of credits from the Regional Greenhouse Gas Initiative. This legislation required that the primary cost-effectiveness test would be the Societal Benefit Test. The program is run by a third-party administrator, the Vermont Energy Investment Corporation. The contract is overseen by the District Department of Environment under the Office of the Mayor.

The cost-effectiveness screening involves NEBs "...including comfort, noise reduction, aesthetics, health and safety, ease of selling / leasing home or building, improved occupant productivity, reduced work absences due to reduced illnesses, ability to stay in home / avoided moves, and macroeconomic benefits," (DDOE-VEIC Contract, 2010). These benefits are included as a 10% NEB adder in the event that calculating NEBs requires significant original research. In addition to NEBs, the DCSEU's cost-effectiveness screening also involves a 10% risk adder, and a 10% adder for the reduction of environmental externalities.

³<http://psb.vermont.gov/sites/psb/files/orders/2012/2012-4/OrderReCostEffectivenessScreeningofHeating.pdf/>.

Although the inclusion of these adjustments for cost-effectiveness screening are important, the DCSEU stands out because of its incorporation of what has traditionally been seen as an NEB into a performance benchmark. The Clean and Affordable Energy Act specifically outlined six performance benchmarks to be achieved by the Sustainable Energy Utility:

1. Reduce per-capita energy consumption in the District of Columbia
2. Increase renewable energy generating capacity in the District of Columbia
3. Reduce the growth of peak electricity demand in the District of Columbia
4. Improve the energy efficiency of low-income housing in the District of Columbia
5. Reduce the growth of the energy demand of the District of Columbia's largest energy users
6. Increase the number of green collar jobs in the District of Columbia

Performance Benchmark 6 as a key DCSEU goal is unique. It specifically classifies what is often assessed as an NEB as a key goal of an energy sustainability and efficiency program. Job creation is typically considered an element of economic development that falls under the category of "societal" non-energy benefits in the current literature. Economic development and its associated job creation have long been considered a societal or public NEB of energy efficiency programs. In 2008, Oppenheim and MacGregor studied the economics of public utility system benefit funds. Their analysis found that:

...across the Entergy jurisdictions of Arkansas, Louisiana, New Orleans, Mississippi, and the Beaumont-Port Arthur area of Texas, investments in low-income efficiency yield more than 23 times the investment as well as 216 jobs for every million dollars of investment (Oppenheim and MacGregor).

In a recent ACEEE policy paper, Eric Mackres quotes a Brookings Institution report:

An energy efficiency investment creates more jobs than an equivalent investment in either the economy on average or in the utility sector and fossil-fuels. As an example, a \$1 million investment in a building efficiency improvement will initially support approximately 20 jobs throughout the economy. By comparison, the same \$1 million investment in the economy as a whole supports 17 jobs. As of 2010, at least 830,000 jobs related to energy and resource efficiency already existed around the U.S. and their numbers were increasing at an annual rate of 3% (Muro et al. 2011).

Although evidence of the job creation value of investments in efficiency is strong, DC's elevation of green collar job creation to the level of one of its six performance benchmarks is noteworthy. Additionally, within the DCSEU contract, performance-dependent "at-risk" compensation is determined by the degree to which the benchmarks are achieved. It is notable that the top three benchmarks account for 75% of the "at-risk" funds:

Benchmark	Share of at-risk compensation
Reduce per capita energy consumption	30%

Increase number of green collar jobs	25%
Improve energy efficiency of low-income housing	20%

The six DCSEU benchmarks indicate very specific performance criteria with regard to social equity. Implementing a program that prioritizes multiple benchmarks is challenging, because they introduce competing priorities. For example, the most cost-effective way to achieve electric efficiency savings might not be the most effective way to create local jobs. However, this laudable enterprise of social equity and sustainable energy goals is still young. The Council of the District of Columbia had the foresight in the Act to include targets that could be revisited and realigned to balance the goals surrounding sustainable energy and job creation.

As far as cost-effectiveness screening is concerned, DC incorporates a 10% NEB adder, but takes NEBs to the next level by incorporating job creation at the forefront of its goals and as one if the efficiency program's primary measures of success.

Lessons Learned

Combining social equity goals with energy efficiency goals introduces competing priorities that might require revision throughout the course of program operations. Therefore, when such goals are combined, it is important to plan for future program review and flexibility, so that adjustments can be made to rebalance and re-prioritize the efficiency and social justice objectives.

Lessons and Conclusions

Twenty years on, it appears to be time to reconsider benefit-cost tests that better represent actual benefits and costs, and support more optimal program investment. It is clear that there has been incremental progress in addressing the bias inherent in tests that exclude NEBs. In fact, we see a domino effect: as one state makes progress, another directly incorporates that progress into its deliberations. These case studies illustrate how New York's research informed Colorado's decision, which in turn influenced Vermont's decision.

Billions of dollars are invested nationwide each year in energy efficiency programs. To accurately account for both the costs and the benefits of these programs, NEBs must be counted in cost-effectiveness tests. Society, ratepayers, and utilities will benefit by including NEBs in program evaluations, thus reducing bias in determining program cost-effectiveness. Inclusion of some NEBs is better than exclusion of NEBs, but long-term progress in addressing the bias in tests should not be delayed. Value-based decision-making can address the short-term measurement questions. We look forward to the next twenty years!

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Evaluating Health and Economic Benefits of Clean Energy Programs

Ingrid Malmgren
December 7, 2015

Beyond Energy Savings?



Why do Co-Benefits Matter?



The Challenge

Quantification

- Computational
- Participant Surveys
- Statistical Analysis of Revealed Preferences
- Existing Research-other jurisdictions
- Percent Adder

Incorporating these Values

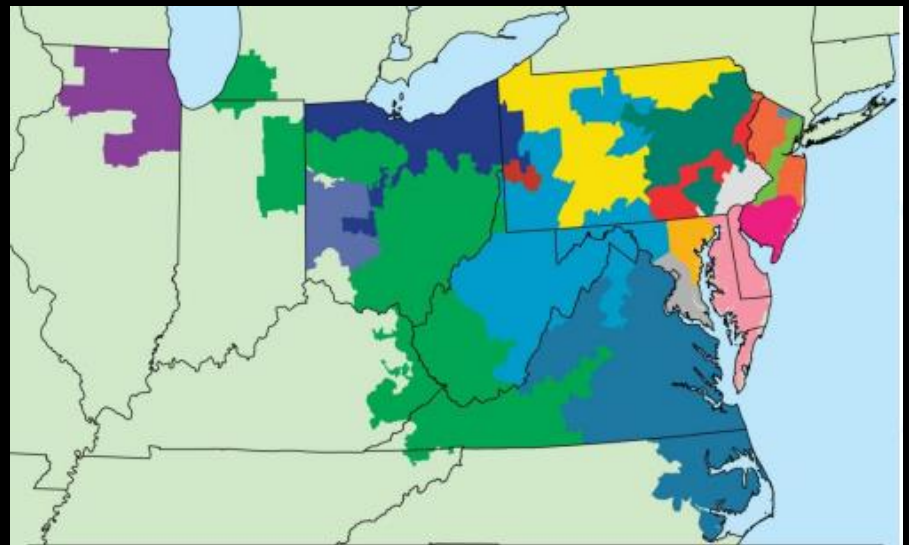


Adapted from Skumatz Report for NRDC/State of Maryland March, 31, 2014

Research Goal

Identify kWh values in existing research and economic analyses for:

- Health Benefits
- Economic Development / Job Creation



Map Source: cleantechnica.com

Health Impacts from Reduced Emissions

Installed PV Capacity (GW)	5	10	70	100
Cases Reduced				
Mortality	22	49	300	437
Chronic Bronchitis	15	34	206	300
Heart Attacks	36	81	493	717
Hospital Admissions-Respiratory				
Chronic Lung, less Asthma (20-64)	1	2	14	21
Asthma (0-64)	2	4	25	36
Pneumonia (65+)	7	17	102	148
Chronic Lung (65+)	1	2	13	18
Total	11	25	153	223
Hospital Admissions - Cardiovascular				
All Cardiovascular (20-64)	4	8	51	74
All Cardiovascular (65+)	5	12	73	106
Total	9	20	124	180
Emergency Room Visits for Asthma	24	53	324	471
Acute Bronchitis	35	78	479	697
Lower Respiratory Symptoms	397	894	5,462	7,945
Upper Respiratory Symptoms	319	718	4,387	6,381
Work Loss Days	2,538	5,710	34,894	50,755
Minor Restricted Activity Days	17,439	39,239	239,791	348,787

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Quantified Health Benefits of Reduced Fossil Fuel Generation

Estimated Cost of Health Impacts				
Fuel Type	2012 PJM Marginal Generation	Machol and Rizk 2013	National Research Council (2010)	Epstein et al. 2011
Coal	58%	32¢/kWh	3.2¢/kWh	14¢/kWh
Natural gas	30%	2¢/kWh	.16¢/kWh	-
Oil	6%	13¢/kWh	-	-
Weighted average		20¢/kWh	2¢/kWh	-
Mid-Range Value	11¢/kWh			

[1] All values presented in 2013 \$.

[2] 2012 Marginal Fuel Type Mix Table 2-16, page 62 of the 2012 State of the Market Report from PJM, Volume 2: Detailed Analysis, March 14, 2013, by Monitoring Analytics, LLC, Independent Market Monitor for PJM. From Memorandum from Tetra Tech to VEIC dated October 14, 2014.

[3] Includes SO₂, NO_x, and PM emissions.

[4] National Academy of Sciences (2009). http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/hidden_costs_of_energy_Final.pdf

[5] Paul R. Epstein, et al. 2011. Full cost accounting for the life cycle of coal in “Ecological Economics Reviews.”

Economic Benefits of Clean Energy

Energy Source	Direct job creation	Direct+ Indirect job creation	Direct+ Indirect+ Induced job creation
Oil And Natural Gas	(# of jobs per \$1 million in output)		
	0.8	3.7	5.2
Coal	1.9	4.9	6.9
Solar	5.4	9.8	13.7
Building retrofits	7.0	11.9	16.7
Mass Transit/ Freight Rail	11.0	15.9	22.3

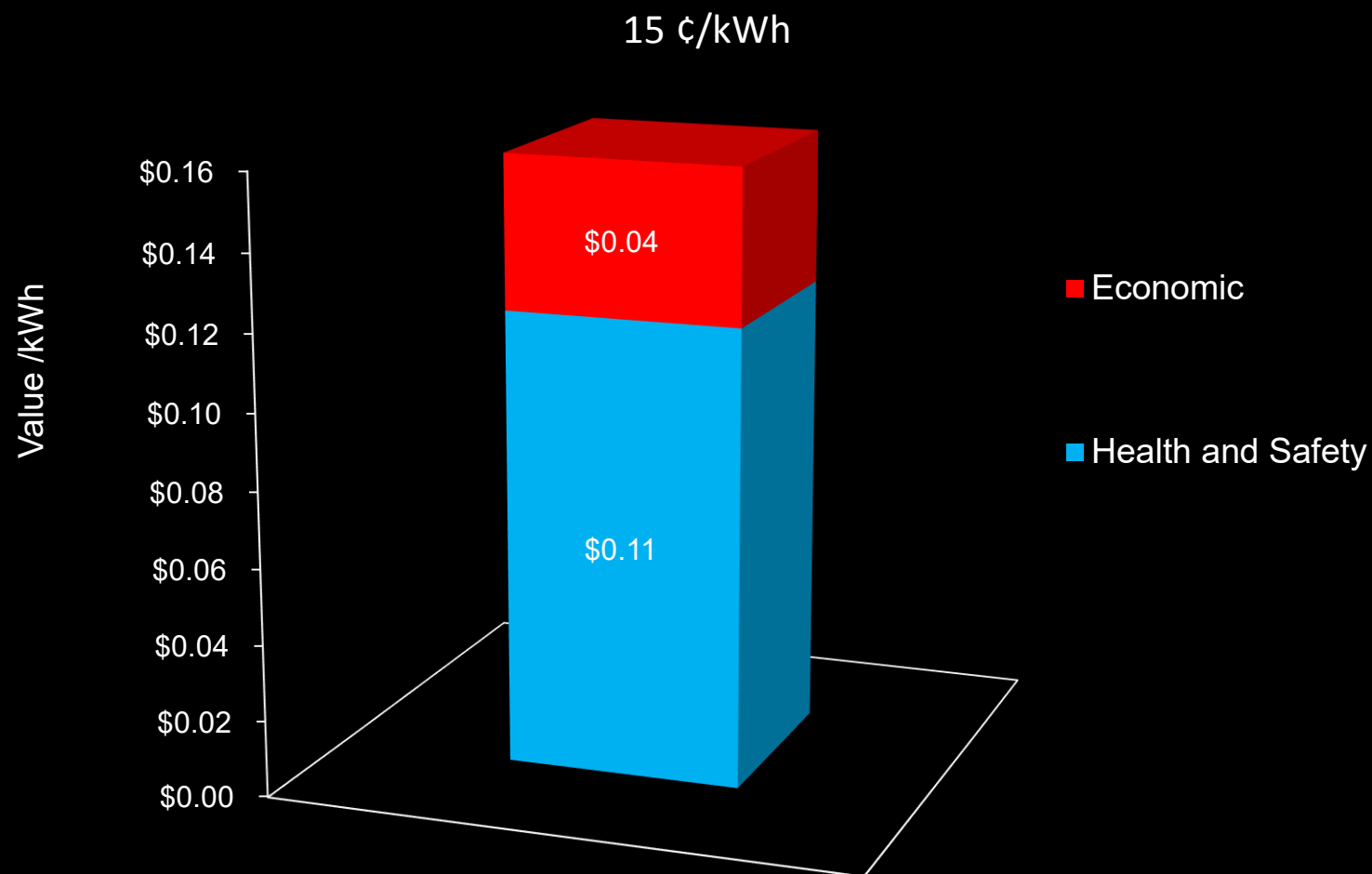
Source: Pollin, Robert, Heintz, James and Garrett-Peltier, Heidi. "The Economic Benefits of Investing in Clean Energy", Political Economy Research Institute, Center for American Progress. June 2009 p.28-29.

Value of Distributed Solar Electric Generation by Location

Category			Value (¢/kWh)								
	Pittsburgh, PA	Harrisburg, PA	Scranton, PA	Philadelphia, PA	Jamesburg, NY	Newark, NJ	Atlantic City, NJ	ME	NY	MA	CT
Fuel cost savings	4.1	4.1	4.1	3.8	4.2	3.9	4.1	8.1			
O&M cost savings	2.0	2.0	2.0	1.8	2.1	1.9	2.0				
Security enhancement value	2.3	2.3	2.3	2.2	2.3	2.2	2.2		2.5		
Long-term societal value	2.8	2.9	2.9	2.7	2.8	2.8	2.8		3.5		
Fuel price hedge value	3.1	4.2	4.2	4.7	2.4	4.4	2.5	3.7	4.0		
Generation capacity value	2.2	1.6	1.7	2.2	1.9	2.6	1.8	4.0			
T&D capacity Value	0.6	0.1	0.1	0.3	0.1	0.8	0.2	1.6	6.0		
Market price reduction value	3.5	6.7	6.9	5.4	5.2	5.1	5.4	6.6			
Environmental value	5.4	5.5	5.5	5.2	2.3	2.2	2.3	9.5	4.5	6.5	6.6
Economic development value	4.4	4.5	4.5	4.2	4.5	4.4	4.5		3+		
(Solar penetration cost)	2.3	-2.3	-2.3	-2.2	-2.3	-2.2	-2.3	0.5	2.5		
Total Value	29.0	29.0	29.0	29.0	29.0	29.0	29.0	33.7		24.3	22.6

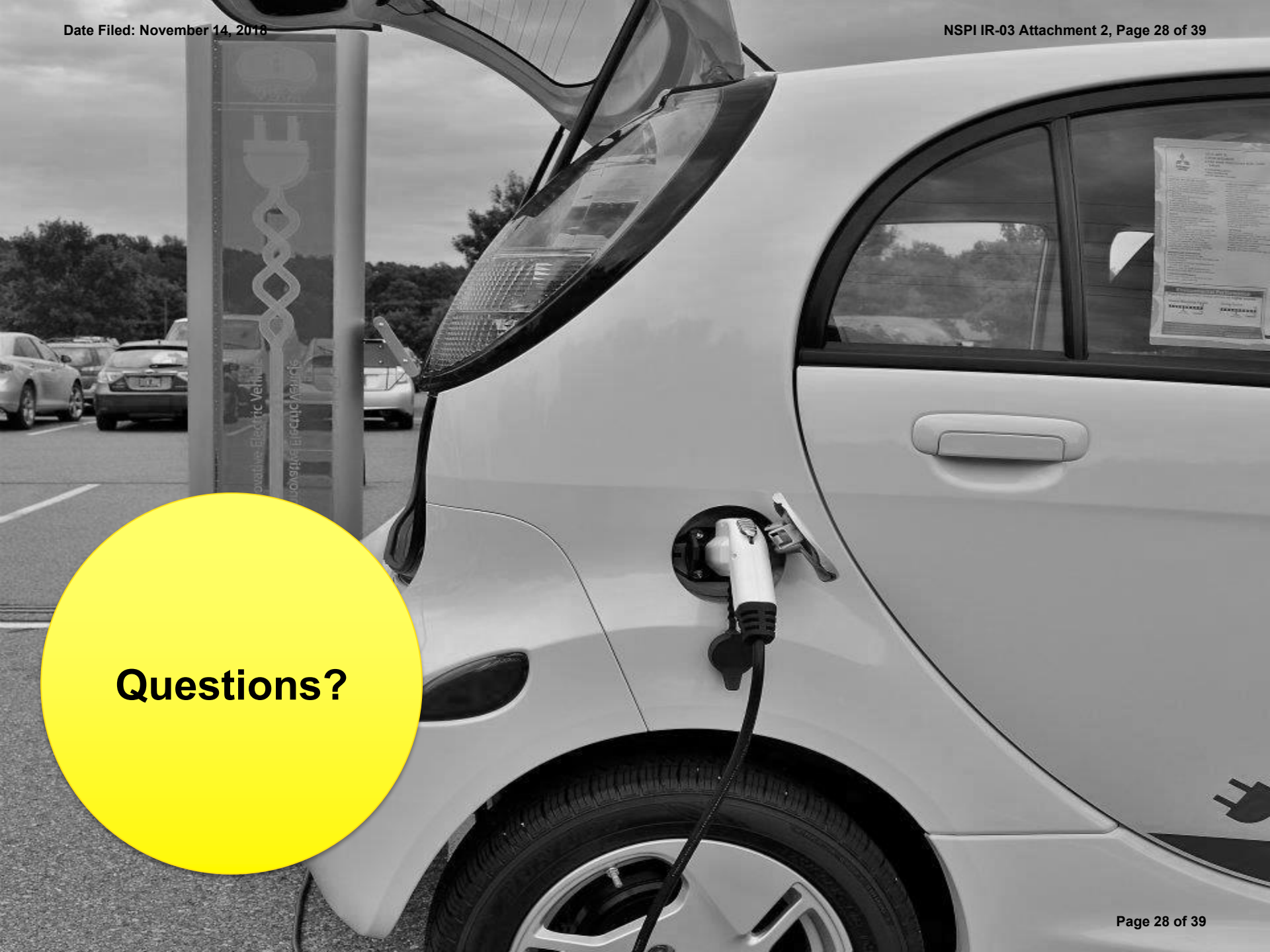
Sources: Perez et al., Maine PUC, Acadia Center

Proposed Adder



Next Steps



A black and white photograph of a white electric car parked at a charging station. A charging cable is plugged into the car's port. In the background, other cars and a charging station sign are visible. A large yellow circle is overlaid on the left side of the image, containing the text "Questions?".

Questions?

Thank You

Ingrid Malmgren





October 24, 2011

Ms. Susan Hudson, Clerk
Vermont Public Service Board
112 State Street
Montpelier, VT 05620-2701

Re: Heating and Process Fuel Cost-Effectiveness Screening

Dear Ms. Hudson,

Pursuant to the September 30, 2011 Vermont Public Service Board Memorandum, Vermont Energy Investment Corporation (VEIC), serving as the entity Efficiency Vermont, submits the following comments regarding the cost-effectiveness screening of heating and process-fuel (HPF) efficiency measures, projects, programs, and the portfolio. VEIC is cognizant of Ms. Bishop's statement that, "any issues not addressed in participants' new written comments be decided based upon the current record¹." Thus, the following recommendations supplement rather than replace earlier recommendations.

1. Valuation of HPF Non-Energy Benefits (NEBs) in Non Low-Income Programs

Non-energy benefits are generally defined as any real or perceived, financial or intangible benefit accrued by a project and not reflected in energy savings². In the Board's October 30, 2009 Status Memorandum, Mr. Allen made the recommendation that the parties agree to adopt a "stop-gap" 5% NEB adder for heating and process fuel measures³. He further stated that the value might be significantly higher but that, "....it is difficult to place a clear value without more and better information, and potentially research." According to the National Action Plan for Energy Efficiency, "estimating non-energy benefits is an emerging approach in many jurisdictions. Depending on the jurisdiction, legislation and regulatory commission policies might expressly permit, and even require, the consideration of non-energy benefits in cost-effectiveness determinations."⁴

¹ September 30, 2011 Board Memorandum; page 2, paragraph 1

² BC Hydro, 2008. "BC Hydro Discussion Paper on Counting Participant Non-Energy Benefits in the Total Resource Cost Test", BC Hydro, Vancouver BC, April 15.

³ Vermont Public Service Board 10/30/2009 Memorandum, page 16, paragraph 1.

⁴ From National Action Plan for Energy Efficiency, U.S. Department of Energy and U.S. Environmental Protection Agency. July 2006 http://www.epa.gov/cleanenergy/documents/suca/napee_report.pdf



Recent research performed under contract by the Department of Public Service (Department) for the current Draft Vermont's Comprehensive Energy Plan supports earlier studies and reports findings of significant non-energy economic value.

"In sum, every \$1 million spent on energy efficiency (of which \$0.89 million comes from ratepayer funds) is projected to produce \$0.54 million in gross domestic product and \$0.86 million in wage income."⁵

Stated simply, only two NEB components create an estimated additional 57% ($\$1.4/\$.89 - 1 = 57\%$) in economic benefits. That is, these reported macroeconomic benefits do not include other possible macroeconomic component benefits such as the reduced costs of fossil fuel development, transportation and combustion, as well as reduced social service costs. Nor do they include other non-energy benefit components that are harder to quantify, yet significantly greater than zero, such as increased comfort, improved health and safety, enhanced equipment durability, reduced financial stress, psychological benefits, improved resale value, higher worker productivity, and reduced noise.

Another source of new information comes from California where Sempra Utilities commissioned the May 11, 2010 report, Non-Energy Benefits: Status, Findings, Next Steps, and Implications for Low Income Program Analyses in California⁶. This comprehensive review includes an analysis of over 100 conference papers and consultant reports, as well as interviews with "scores of state and utility professionals to identify progress, measurement approaches, policy issues, and regulatory treatments related to quantifying nonenergy benefits associated with energy efficiency interventions—with a focus on low income programs."⁷ They note that, "NEBs may reflect some of the most important effects from energy efficiency measures and programs, and may especially represent some of the most important outcomes for low-income strategies."⁸

In 2009, the Colorado Public Utility Commission incorporated a 10% electric NEB adder, a 20% low-income electric NEB adder, and a 5% natural gas adder. In March 2011, the Colorado PUC issued an Order that increased the NEB adder used in screening low-income electric and gas programs to 25%. VEIC finds this approach of different NEB adders for non-low income

⁵ <http://www.vtenergyplan.vermont.gov/sites/cep/files/Vol%202%20Public%20Review%20Draft%202011%20CEP.pdf>, page 51

⁶ This report can be downloaded at: <http://www.liob.org/DOCS/LIEE%20Non-Energy%20Benefits%20Revised%20Report.pdf>

⁷ Ibid, page 1 paragraph 1

⁸ Ibid, page 2 last paragraph



programs and low-income programs to have merit. It is administratively efficient to implement and reflects the core NEB values that accrue to all programs while recognizing the additional NEB values to low-income programs. In the December 4, 2009 multiple party memorandum to Mr. Allen, VEIC and all supported the addition of a non-energy benefit adjustment of at least 30%. Given the recent research and information that we have reviewed, VEIC finds no reason to alter that recommendation.

2. Valuation of HPF Non-Energy Benefits (NEBs) in Low-Income Programs

Fluctuations in Heating and Process Fuel markets disproportionately affect low income households. As a result, an increasing number of state programs are incorporating NEB adders for screening low-income efficiency programs. Based on 2009 research by Skumatz Economic Research Associates (SERA), eight states incorporate a NEB adder when screening low-income programs.⁹

Energy efficiency low-income programs have a well-documented history of additional non – energy benefits. For example, a 1999 report by the National Consumer Law Center by John Howat and Jerrold Oppenheim found that non-energy low-income program benefits could justify adjustments anywhere from 17 to 300%.¹⁰ The Sempra Utility report notes specific benefits to relieve “low-income hardship”.¹¹ These benefits accrue uniquely to low-income program participants because the financial impacts of energy costs fall disproportionately to those of limited income. Although the following quote and accompanying statistics are several years old, VEIC believes that the dynamic it explains remains valid today.

“While a median household spends about 3 percent of its income on energy, the typical low-income household spends nearly 12 percent of its limited income on energy, with very low-income households spending 20 to 25 percent. Energy prices have increased in recent years, but the incomes of low-income households

⁹ Findings and Next Steps in Energy Efficiency Measurement and Attribution, Skumatz, 2009. http://uc-ciee.org/downloads/EEM_A_presentation.pdf slide 44.

¹⁰ ANALYSIS OF LOW-INCOME BENEFITS IN DETERMINING COST-EFFECTIVENESS OF ENERGY EFFICIENCY PROGRAMS; John Howt and Jerrold Oppenheim, national Consumer Law Center, April 14, 1999; page 23, paragraph 1.

¹¹ Non-Energy Benefits: Status, Findings, Next Steps, and Implications for Low Income Program Analyses in California, Lisa Skumatz, Ph.D. May 11, 2011, Page 16, paragraph 2



have not increased in a corresponding manner, meaning that utility bills now pose an even greater challenge for low-income households.”¹²

Consequently, efficiency programs that help reduce energy costs benefit low-income individuals to a greater degree than non low-income participants. In addition, low-income programs create additional societal benefits such as improving housing development economics, reducing customer non-payments to utilities, reducing homelessness, improving housing maintenance, reducing housing abandonments, and reducing moving costs¹³. These benefits are unique low-income program benefits and are in addition to those that accrue to non-low-income programs.

This additional adder will address a portion of the issues raised in the discussions regarding energy affordability as a design parameter. That is, VEIC believes that a low-income NEB adder, combined with a revised real discount rate calculation (recommended later in this document), adequately addresses the concerns raised in year 2009 by affordable housing advocates.

In summary, VEIC recommends that Vermont adopt Colorado’s model and establish a two tier NEB benefit adder with the low-income adder set, at a minimum, fifteen percentage points higher than that adopted for non-low-income programs. Although the exact low-income NEB increment increase may be impossible to precisely determine, VEIC believes that it is reasonable that the increment be significant and that the recommended fifteen percent point increase is a conservative minimum estimate.

3. Discount Rate

The National Action Plan for Energy Efficiency¹⁴ establishes a standard methodology for the determination of an appropriate discount rate for an energy efficiency program. The Plan provides a brief review of discount rate theory, and develops a methodology to formulate a discount rate for each cost-effectiveness test. The recommended discount rate for the Societal Cost Test is defined as:

¹² Direct Testimony of Christine R. Keyser on Behalf of the Utah Committee Of Consumer Services, In the Matter of HELP, Electric Lifeline Program Evaluation, Docket No. 04-035-21. September 15, 2006.
http://www.swenergy.org/publications/documents/UT_Energy_Efficiency_Strategy.pdf

¹³ A comprehensive list of values for unique NEB components for low-income programs around the Country appears in Appendix A of the Sempra Utility report.

¹⁴ National Action Plan for Energy Efficiency (2008). *Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers*. Energy and Environmental Economics, Inc. and Regulatory Assistance Project. <www.epa.gov/eeactionplan>



For the SCT, the social discount rate is used. The social discount rate reflects the benefit to society over the long term, and takes into account the reduced risk of an investment that is spread across all of society, such as the entire state or region. This is typically the lowest discount rate. For example, California uses a 3 percent real discount rate (~5 percent nominal) in evaluating the cost-effectiveness of the Title 24 Building Standards¹⁵.

VEIC recommends the same approach used by the Massachusetts Department of Public Utilities¹⁶ to determine the precise value of the discount rate:

The Energy Efficiency Guidelines use a discount rate equal to the yield on 30-year United States Treasury Bonds at the close of trading on the first business day each year. Energy Efficiency Guidelines § 3.4.

The approach taken by Massachusetts is administratively efficient. If the discount rate is pegged to the 30-year Treasury yield on January 1st of each program year, there would be no risk of the discount rate becoming outdated. This approach would also avoid any surveys or annual evaluations, as the information is publically available and virtually cost-free to obtain or calculate (if a 12-month average is used). Therefore, VEIC recommends using a 12-month weighted average of 30-year Treasury bond yields as the discount rate for the societal screening test.

VEIC is also concerned about the administrative inefficiencies and logical inconsistencies that would result from the need to use different discount rates for the screening of EEC funded efficiency measures and HPF measures. Consequently, if the Board agrees to modify the calculation of the discount rate, we urge them to make the change universal in respect to all Energy Efficiency Utility screening tools. Finally, we note that Efficiency Vermont prepares the 2012 screening tool in December of 2011 and any screening tool assumption changes would be most efficiently incorporated at that time.

¹⁵ Ibid, page 4-8.

¹⁶ Massachusetts Department of Public Utilities. "Energy Efficiency Guidelines." D.P.U. 08-50. August 22, 2008.



4. Risk Adjustment

In the December 9, 2009 joint party memorandum to the Board, VEIC supported the extension of a 10% risk adjustment to heating and process fuel because it represented a reasonable interim approach. A basis for this recommendation was the recognition of the higher volatility of unregulated fuel prices compared with regulated energy supplies. Subsequent international events and the resulting effects on heating and process fuel price changes has strengthened our belief that the Board should consider a risk adjustment in excess of 10% .

5. Cost-effectiveness Screening Rationale and Practices at the Portfolio, Program, Project and Measure level.

The EEU scope of services calls for the portfolio administrator to maximize the amount of cost-effective electric and heating and process fuel efficiency savings achieved with the ratepayer funds with which it is entrusted. As noted in the VEIC Order of Appointment, *"VEIC shall design and implement demand-side services and initiatives to comprehensively address cost-effective opportunities associated with electric and Heating-and-Process-Fuels energy efficiency"*, and that in doing so, it shall *"Maximize the acquisition of net benefits for all customers"*. (VEIC Order of Appointment, section II.1)

The Vermont Public Service Board recognizes three "tests" for the cost-effectiveness or value of ratepayer-funded energy-efficiency investments from three perspectives:

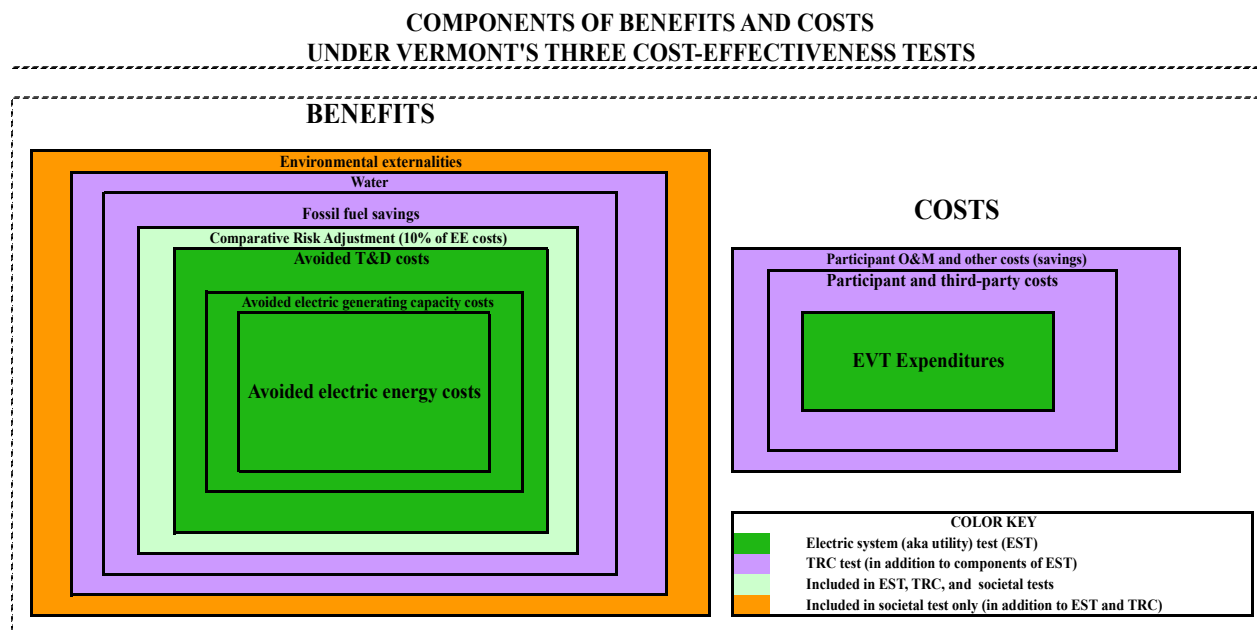
1. The economic welfare of society as a whole -- the Societal test;
2. Confining benefits and cost only to resources priced in the marketplace – the Total Resource Cost (TRC) test; and
3. Focusing exclusively on efficiency investment benefits realized and costs incurred by utility ratepayers – the Energy System (a/k/a the utility) test.

All three tests calculate and compare the present worth of benefits and costs over the entire life cycle of the efficiency investments involved. Table 1 depicts the components of benefits and costs under each of the three perspectives as a series of concentric boxes.

Societal cost-effectiveness indicates the extent to which an energy-efficiency investment lowers the costs of energy service for the end uses involved, including unmonetized externalities as well as resource costs priced in the marketplace. **The Societal test is the primary indicator of energy-efficiency investment cost-effectiveness for the EEU.** (Process & Administration of an EEU Order of Appointment, section V.14; Docket 5270, June 1, 1990)



Table 1



EEU economic performance is also currently judged according to two additional cost-effectiveness tests.

1. Total Resource Benefits (TRB) are the projected market value of electricity, fossil fuel, and water savings from EEU investment, and constitute the “benefits” side of the Total Resource Cost test. **TRB is the current economic performance indicator for the EEU.**
2. Electric Resource Benefits (ERB) are defined as the present value of lifetime net electricity savings, valued at current projections of avoided electric energy and capacity costs. This calculation excludes fossil fuel and water savings from the value of EEU investment. ERB constitutes the “benefits” side of the Energy System test and **is currently the primary minimum performance requirement for the EEU.**

Efficiency Vermont uses all three cost-effectiveness tests recognized by the Board for two distinct yet inter-related purposes: for making decisions about efficiency investments prospectively; and for reporting the results of those decisions retrospectively.

1. Planning and Budgeting: Periodically (from annually to triennially), Efficiency Vermont prospectively assesses program and portfolio cost-effectiveness using all three tests over the near term (3 years or less) and longer term (3-20 years). Prospective cost-effectiveness analysis informs decisions about how best to budget available EEU funds between programs serving residential and business customers in annual plans and as



part of long-range forecasts of achievable efficiency savings in Demand-Resource Plan (DRP) proceedings.

2. **Reporting:** Efficiency Vermont also routinely reports on benefits and costs of efficiency investments made after the fact. Retrospective reporting of benefits and costs allows the EEU and other parties to judge EEU progress towards performance period economic goals, VEIC's ultimate success in achieving them, and thus its eligibility for additional compensation after each three-year performance period.

For both purposes, Efficiency Vermont assesses cost-effectiveness using one or more of the three tests, depending on the level of analysis: the entire portfolio (or sector subset); a program (or program component); or an individual customer project or measure.

Since the Board's stated goal of efficiency investment is to maximize net benefits, the decisive "test" under each perspective is the size of the net benefits – that is, the difference between the present worth of benefits and the present worth of costs. The benefit/cost ratio is not decisive because seeking to maximize it would be a prescription for "cream-skimming," i.e., systematic forfeiture of cost-effective savings opportunities.

Efficiency Vermont conducts cost-effectiveness analysis at the measure, project, program, and portfolio level. Because cost-effectiveness of the portfolio is the primary objective, cost-effectiveness of any one component of the portfolio is secondary. The relative importance of cost-effectiveness of each component is hierarchical:

1. measure-level cost-effectiveness is subordinate to project-level cost-effectiveness;
2. Individual measure- and project-level cost-effectiveness are subordinate to program cost-effectiveness; and
3. Individual program cost-effectiveness is subordinate to overall portfolio cost-effectiveness.

Therefore, VEIC finds it acceptable to provide prescriptive or custom financial incentives for efficiency measures which do not pass individual societal cost-effectiveness analysis at current measure costs and savings if the EEU concludes that doing so will increase program and/or portfolio cost-effectiveness in support of one or more of these general principles:

1. By increasing the likelihood that customers will implement other cost-effective measures; and/or
2. By providing electric and/or heating and process fuel resource benefits in excess of the incentive or other incremental program expenditures associated with them; and/or
3. By stimulating demand for and supply of emerging technologies and thereby lowering future measure costs.



Table 2 summarizes the applicability of the three tests at the portfolio, program, project, and measure level of analysis.

TABLE 2: COST-EFFECTIVENESS TEST APPLICABILITY IN VERMONT

TEST	SCOPE			
	Portfolio	Program	Project	Measure
Societal	✓	✓	✓	✓
Total Resource	✓	✓	(✓)	
Electric System	✓	✓	(✓)	

Cost-effectiveness at the program and portfolio level is assessed over time using all three cost-effectiveness tests. Measure costs and savings are subject to change in the future due to program market effects, natural market forces, codes and standards, and technological change. Cost-effectiveness of measures or programs in individual years is subordinate to the multi-year cost-effectiveness of the program or portfolio. Initial years can produce negative net benefits as long as that present worth of net benefits over the investment period is positive.

Project and measure cost-effectiveness is generally determined at the customer level during the course of implementing residential and business custom projects. This assessment helps Efficiency Vermont identify and promote with custom financial incentives the combination of measures expected to yield the maximum net societal benefits. Projects can involve packages of efficiency measures applicable to a single end use or multiple measure sets applicable to different end uses.

Individual measure cost-effectiveness is analyzed using the Societal cost-effectiveness test exclusively.¹⁷ Project analysis uses the Societal test as the primary determinant of cost-effectiveness. The Total Resource and Electric System cost-effectiveness tests may be used as secondary indicators of the extent to which an individual project contributes sufficiently toward

¹⁷ The energy system test does not apply because financial incentives are transfers, not real resource costs, it does not accurately represent the economic value of the measure.



meeting Efficiency Vermont's TRB performance goal and the electric system minimum performance requirements, respectively.

Efficiency Vermont tracks the results of this customized societal cost-effectiveness analysis and summarizes it in annual reports submitted after the first year of each performance period.

For prescriptive and semi-prescriptive programs, measure cost-effectiveness is determined using standardized assumptions as documented in the Technical Reference Manual.

- (a) Individual measure cost-effectiveness is analyzed using the Societal cost-effectiveness test. The Total Resource and Electric System cost-effectiveness tests may be used as secondary indicators of the extent to which an individual measure contributes sufficiently toward meeting the EEU's TRB performance goal and the electric system minimum performance requirements, respectively, and thus whether it should be included in the program offerings.
- (b) Efficiency Vermont tracks the results of this standardized measure-level societal cost-effectiveness analysis and summarizes it in annual reports submitted after the first year of each performance period.

VEIC appreciates the opportunity to submit additional comments regarding heating and process fuel cost-effectiveness screening. As always, please contact me should you have any questions on the above matter. Thank you.

Sincerely,

A handwritten signature in blue ink that reads "Michael J. Wickenden".

Michael Wickenden
Planning Manager, Policy and Public Affairs
Vermont Energy Investment Corporation
128 Lakeside Avenue, Suite 401
Burlington, VT 05401
(802) 540-7650
mwickenden@veic.org

cc: E-mail Service List for Workshop Process Regarding Cost-Effectiveness Screening of Heating and Process-Fuel Efficiency Measures

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Request IR-03:

Ref: Attachment 4.

(a) Please confirm the author(s) of the VEIC report.

(b) Please provide the curriculum vitae for each of the authors of the VEIC report.

(c) Please provide any copies of any testimony or reports submitted by VEIC or the authors of the VEIC report in any regulatory proceedings respecting NEBs in any other jurisdictions?

Response IR-03:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

a) Ingrid Malmgren.

b) Please refer to Attachment 1 of this IR response.

c) Please refer to Attachment 2 of this IR response.

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Request IR-04:

Please provide a list of all North American jurisdictions that have electricity efficiency programs and identify within that list which, if any, have NEBs that are quantified and provide a description of how the NEBs in those jurisdictions are quantified and the benefit they are attempting to simulate.

Response IR-04:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

A list of U.S. jurisdictions that account for NEBs can be found on page 22, Table 11 of NEEP's [Non-Energy Impacts Approaches and Values: an Examination of the Northeast, Mid-Atlantic, and Beyond report](#). A description of how and why the NEBs are quantified can be found beginning on page 20 of the same report.

A list of Canadian jurisdictions that account for NEBs can be found in the chart below:

Province	Primary CE Test	Secondary CE Test	NEB Adder	Description	Description source
British Columbia	*TRC	-	15%	In accordance with the DSM Regulation, the avoided cost of natural gas is valued at BC Hydro's LRMC of acquiring electricity generated from clean or renewable resources in B.C converted to \$/gigajoule	2018_07_11 BC Hydro Demand Side Management Activities Annual Report in compliance with D_36

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Province	Primary CE Test	Secondary CE Test	NEB Adder	Description	Description source
				(GJ) in all time periods. Non-energy benefits are valued at 15 per cent of the energy and capacity benefits of electricity and natural gas.	
Manitoba	*TRC	*RIM, PCT, SCT	10%	Benefits actually included in Manitoba Hydro's TRC are limited to measurable non-energy benefits (i.e. water savings). For its SCT, Hydro uses a 10% adder on energy benefits to account for unquantified societal benefits.	Manitoba Hydro 2014/15 & 2015/16 General Rate Application
Ontario	*TRC	*PAC	15%	IESO is currently conducting a Mid-Term Review of their 2015-2020 Conservation Framework that employed DNV GL to conduct an analysis of IESO Non-Energy Impacts 2016 Results and Next Steps. Options IESO are considering include:	IESO Non-Energy Impacts 2016 Results and Next Steps (PDF Download)

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Province	Primary CE Test	Secondary CE Test	NEB Adder	Description	Description source
				1. Retain the existing 15% adder 2. Increase the existing adder to account for current NEI and GHG research 3. Move to a bottom-up measure-level approach to NEI and GHG 4. Adopt a hybrid approach, using bottom-up values from #3, but add another global percentage to account for unknowns	

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Request IR-05:

Ref: Attachment 4.

(a) Please confirm if average home energy use was adjusted for by VEIC in its report and, if not, why not?

(b) What is the difference in the average home energy use in Massachusetts compared to Nova Scotia?

Response IR-05:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

a) Differences in average home energy consumption were not quantified because they are not clearly associated with any particular category of NEBs adapted as part of this study. Instead, other more relevant information types were used to adapt values, specific to each type of NEB analyzed.

b) Average home energy use in Massachusetts versus Nova Scotia was not relevant to VEIC's research (see response (a) above). As a result, these calculations were not made. On a nation by nation basis, U.S. and Canadian residential electricity use per capita is comparable.

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Request IR-06:

Ref: Attachment 1, page 17-18 of 27.

Please confirm that the DSMAG has not reached consensus that the “TRC test, as currently applied in Nova Scotia, is flawed” due to it not including non-energy benefits.

Response IR-06:

Please refer to EfficiencyOne’s response to IG IR-01.

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Request IR-07:

Ref: Attachment 4, page 4 of 64, paragraph 1.

Please provide a list of all Canadian jurisdictions that have “statutes and regulations requiring that electricity efficiency is the least cost energy procurement option”.

Response IR-07:

The intention of Attachment 4, page 4 of 64, paragraph 1 was to highlight that the majority of efficiency programs are subject to cost effectiveness testing. In fact, 85 percent of ratepayer funded efficiency programs in the U.S. are required by either statute or regulation to use benefit-cost tests.¹

Furthermore, according to Synapse Energy Economics², two of the top ten policies for ratepayer funded efficiency programs should be:

- A mandate to implement all cost-effective energy efficiency; and
- Proper cost-effectiveness test(s) for screening programs.

In Canada, a number of jurisdictions require efficiency programs be “cost effective”, either explicitly or inherently, where such factors as affordability are to be considered in approving efficiency programs.

NOVA SCOTIA

¹ ACEEE. “A National Survey of State Policies and Practices for the Evaluation of Ratepayer Funded Energy Efficiency Programs,” Kushler, Nowak, and Witte, Report Number U122, February 2012.

² Synapse Energy Economics. In Pursuit of All Cost-Effective Energy Efficiency. October 23, 2012. Tim Woolf. <http://www.synapse-energy.com/sites/default/files/In%20Pursuit%20of%20All%20Cost-Effective%20Energy%20Efficiency%20S0106.pdf>

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The *Public Utilities Act* makes numerous references to the requirement that delivery of electricity efficiency and conservation activities be cost effective for Nova Scotia Power ratepayers. These provisions also obligate, *inter alia*, that Nova Scotia Power Incorporated to “undertake cost-effective electricity efficiency and conservation activities that are reasonably available in an effort to reduce costs for its customers”³.

In addition, the Public Utilities Act requires that any proposed electricity efficiency and conservation activities be in the best interests of ratepayers⁴, and that the Board consider affordability, and “any other matters considered appropriate by the Board⁵” when assessing proposed such activities.

PRINCE EDWARD ISLAND

The Preamble to the *Electric Power Act* states that “public utilities *should* utilize energy efficiency and demand-side resource measures whenever it is cost-effective to do so”⁶.

ONTARIO

The *Ontario Energy Board Act* directs the Board be guided by objectives which include protection of the interests of consumers with respect to prices, promotion of economic efficiency and cost effectiveness in the demand management of electricity, and promotion of economic efficiency and demand management having regard to the consumer’s economic circumstances.⁷

MANITOBA

The *Efficiency Manitoba Act* states that the mandate of Efficiency Manitoba is to “achieve additional reductions in the consumption of electrical energy or natural gas - including resulting

³ Public Utilities Act, RSNS 1989, c 380, ss.79I(1)

⁴ Supra 79L(8) and 79L(9)

⁵ Supra, above

⁶ Electric Power Act, RSPEI 1988, c E-4, Preamble.

⁷ Ontario Energy Board Act, 1998, SO 1998, c 15, Sch B, s. 1(1), (2) and (3)

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reductions in the demand for electrical power - if the reductions can be achieved in a cost-effective manner”.⁸

BRITISH COLUMBIA

Regulations pursuant to Utilities Commission Act⁹, R.S.B.C. 1996, c. 473, s. 1 establish **explicit** cost-effectiveness testing guidelines, which includes the application of the total resource cost test¹⁰ and a requirement that the Commission must make a determination of cost effectiveness by using avoided electricity costs respecting a demand measure if the commission is satisfied the cost represents the long-run marginal cost of acquiring electricity.

Cost effectiveness

4 (1) Subject to subsections (1.5), (4) and (5), the commission, in determining for the purposes of section 44.1 (8) (c) or 44.2 (5) (d) of the Act the cost-effectiveness of a demand-side measure proposed in an expenditure portfolio or a plan portfolio, may compare the costs and benefits of (a) the demand-side measure individually,

(b) the demand-side measure and other demand-side measures in the portfolio, or

(c) the portfolio as a whole.

(1.1) Subject to subsection (2), the commission must make determinations of cost effectiveness by applying the total resource cost test as follows and in the order set out:

(a) subject to subsections (1.2) and (1.3), the avoided natural gas cost, if any, respecting a demand-side measure, in addition to the avoided capacity cost, is the amount that the commission is satisfied represents the authority's long-run marginal cost of acquiring electricity generated from clean or renewable resources in British Columbia;

(b) subject to subsection (1.3), the avoided electricity cost, if any, respecting a demand-side measure, in addition to the avoided capacity cost, is

⁸ The Efficiency Manitoba Act, CCSM c E15, s. 4

⁹ Utilities Commission Act, RSBC 1996, c 473

¹⁰ Demand-Side Measures Regulations, BC Reg 326/2008, s. 4

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(i) in the case of a demand-side measure of FortisBC Inc., an amount that the commission is satisfied represents FortisBC Inc.'s long-run marginal cost of acquiring electricity generated from clean or renewable resources in British Columbia, and

(ii) in the case of a demand-side measure not referred to in subparagraph (i), an amount that the commission is satisfied represents the authority's long-run marginal cost of acquiring electricity generated from clean or renewable resources in British Columbia;

(c) with respect to a demand-side measure that is not referred to in section 3 (1) (a) and that is not a charity program, do the following:

(i) increase the benefits of the demand-side measure by an amount that does not exceed an amount proposed by the public utility for this purpose, if the commission is satisfied that the amount represents the participant or utility non-energy benefits of the demand-side measure;

(ii) if the benefits of a demand-side measure have not been increased under subparagraph (i) or if the benefits of the expenditure portfolio of which the demand-side measure is a part has not been increased by 15% or more as a result of an increase under subparagraph (i), increase the benefit of the demand-side measure by an amount that

(A) increases by 15% the benefits of the expenditure portfolio of which the demand-side measure is a part, and

(B) is equal to the increase made under this subparagraph for all the other demand-side measures that are part of the expenditure portfolio;

(d) the benefit of the demand-side measure is what it would have been had no step code been adopted in the Province.

(1.2) Subsection (1.1) (a) does not apply to a demand-side measure that reduces the use of natural gas but does not reduce greenhouse gas emissions associated with that use of natural gas.

(1.3) Subsection (1.1) (a) and (b) does not apply to a demand-side measure that encourages a switch from the use of oil or propane to the use of natural gas or electricity such that the switch would decrease greenhouse gas emissions in British Columbia.

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1
2 *(1.4) In considering a demand-side measure that, in the commission's opinion, will increase the*
3 *use of a regulated item with respect to which there is either*

4 *(a) a specified standard that has not yet commenced, or*
5 *(b) a specified proposal,*
6

7 *the commission, after applying subsection (1.1), may increase the benefit of the demand-side*
8 *measure by an amount that represents a portion of the avoided capacity and energy costs that, in*
9 *the commission's opinion, will result from the commencement and application of the specified*
10 *standard, amendment or new bylaw proposed by the specified proposal, assuming that the*
11 *standard, amendment or new bylaw comes into force.*
12

13 *(1.5) Despite subsection (1.1) and subject to subsections (1.9), (4) and (5), the commission must*
14 *determine that a demand-side measure, other than a demand-side measure referred to in section*
15 *3 (1) (a) or a charity program, that is part of an expenditure portfolio and that is cost effective*
16 *when applying subsection (1.1) is not cost effective if*

17 *(a) the demand-side measure is not cost-effective without applying subsection (1.1), and*
18 *(b) the total expenditures respecting*

19 *(i) the demand-side measure, and*

20 *(ii) all other demand-side measures that are part of the expenditure portfolio, that are not cost*
21 *effective without applying subsection (1.1) and that are cost effective when applying subsection*
22 *(1.1),*

23 *are more than*

24 *(iii) 40% of the total expenditures for the expenditure portfolio, in the case of a utility that*
25 *recovers the expenditures in gas rates, or*

26 *(iv) 10% of the total expenditures for the expenditure portfolio, in the case of a utility that*
27 *recovers the expenditures in electricity rates.*
28

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(1.6) For greater certainty, if the commission determines under subsection (1.5) that a demand-side measure that is part of an expenditure portfolio is not cost effective, the commission must exclude that demand-side measure from consideration when determining under that subsection whether another demand-side measure that is part of the expenditure portfolio is cost effective.

(1.7) For the purposes of subsections (1.1) (c) and (1.5), the commission, when considering the benefits or expenditures respecting a public utility's expenditure portfolio, may consider a demand-side measure of the public utility that is not included in the expenditure portfolio to be a part of the expenditure portfolio.

(1.8) Despite subsection (1.1), the commission may determine that a demand-side measure, other than

(a) a specified demand-side measure,

(a.1) a charity program,

(b) a public awareness program,

(c) a demand-side measure referred to in section 3 (1) (a), or

(d) a demand-side measure that is cost effective without applying subsection (1.1) but after applying subsection (1.4)

is not cost effective if the demand-side measure would not be considered cost effective under the utility cost test.

(1.9) The references in subsections (1.5) and (1.8) to subsection (1.1) must be read as references (a) to subsection (1.1) (a), (b) and (c) for the purposes of a demand-side measure that is part of an expenditure portfolio for any period before January 1, 2015, and

(b) to subsection (1.1) (a) and (c) for the purposes of a demand-side measure that is part of an expenditure portfolio for any period after December 31, 2014.

(2) In determining whether a demand-side measure referred to in section 3 (1) (a) or a charity program is cost effective, the commission must,

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1 *(a) in addition to conducting any other analysis the commission considers appropriate, use the*
2 *total resource cost test, and*

3 *(b) in using the total resource cost test, make the adjustments referred to in subsection (1.1) (a)*
4 *and (b) and then increase the value of the benefit of the demand-side measure by 40%.*

5
6 *(3) Repealed. [B.C. Reg. 228/2011, Sched., s. 2(d), effective December 8, 2011 (B.C. Regs. Bull.*
7 *43/2011).]*

8
9 *(4) The commission must determine the cost-effectiveness of a specified demand-side measure*
10 *proposed in a plan portfolio or an expenditure portfolio by determining whether the portfolio is*
11 *cost effective as a whole.*

12
13 *(5) If the commission is satisfied that a public awareness program proposed in a plan portfolio*
14 *or an expenditure portfolio is likely to accomplish the goals set out in paragraph (a) or (b) of the*
15 *definition of "public awareness program", the commission must determine the cost-effectiveness*
16 *of the program by determining whether the portfolio is cost-effective as a whole.*

17
18 *(6) The commission may not determine that a proposed demand-side measure is not cost effective*
19 *on the basis of the result obtained by using a ratepayer impact measure test to assess the*
20 *demand-side measure.*

21
22 *(7) Repealed. [B.C. Reg. 228/2011, Sched., s. 2(d), effective December 8, 2011 (B.C. Regs. Bull.*
23 *43/2011).]*

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Request IR-08:

Ref: Attachment 4, page 4 of 64, paragraph 3.

Please provide the referenced “research review.”

Response IR-08:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

The research review findings are found in Attachment 4, Section 2 and Appendix A.

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Request IR-09:

Ref: Attachment 4, page 11 of 64, last paragraph.

Please provide a list of benefits included in the NEBs by jurisdiction for the states listed.

Response IR-09:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

The jurisdictions listed do not have NEBs by category. These jurisdictions are referenced because they use a percentage adder.

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Request IR-10:

Ref: Attachment 4, page 13 of 64, last paragraph.

Please list all “local insights” provided by the project subcontractor and used in the study.

Response IR-10:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

Ramzi Kavar served as a subcontractor to VEIC on this project. He provided high-level Nova Scotia and Canadian context for factors affecting energy use, costs, health, and poverty in Nova Scotia relative to the reference jurisdictions, such as: general information on comparative levels and quality of housing stock; general levels of health costs to participants and society; general levels of local labor costs; and other information about the local economy as relevant. His input was primarily in the form of review of analyses and source materials rather than incremental/additional information. Given the decision to focus this NEBs effort on the measures included in the 2016-2018 DSM Resource Plan, input on low-income issues and health-related benefits was limited within this study.

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Request IR-11:

Ref: Attachment 4, page 14 of 64.

Please provide a table listing all measures that fall in categories 4, 5 and 6.

Response IR-11:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

Measure Name	Technology Type	Target Market
Category 4		
Zero Energy Doors for Reach-In Coolers and Freezers	COM-Refrigeration	Other Commercial
Zero Energy Doors for Reach-In Coolers and Freezers	COM-Refrigeration	Retail
Zero Energy Doors for Reach-In Coolers and Freezers	COM-Refrigeration	School
Strip Curtains for 3' Open Refrigerated Display Cases	COM-Refrigeration	Other Commercial
Strip Curtains for 3' Open Refrigerated Display Cases	COM-Refrigeration	Retail
Strip Curtains for 3' Open Refrigerated Display Cases	COM-Refrigeration	School
Air-Entraining Air Nozzles (up to 14CFM at 100 psi)	COM-Process	School
Air Tanks for Load / No-Load Screw Compressors (10 – 40 hp)	IND	Industrial

EfficiencyOne – Application for approval of the use of Non-Energy Benefits within Cost-Effectiveness Testing M08888 (E-ENS-G-18)
E1 Responses to Nova Scotia Power Incorporated Information Requests

NON-CONFIDENTIAL

Measure Name	Technology Type	Target Market
Air Tanks for Load / No-Load Screw Compressors (10 – 40 hp)	COM-Process	Other Commercial
Air Tanks for Load / No-Load Screw Compressors (10 – 40 hp)	COM-Process	School
DHW Tank Wrap	COM-Other	Office
DHW Tank Wrap	COM-Other	Retail
Hardwired Dimmer Switch	RES-Lighting	RES-SF
Power bar with integrated timer	RES-Plug Load	RES-SF
Smartstrip	RES-Plug Load	RES-SF
Heavy Duty Outdoor Timer	RES-Plug Load	RES-SF
DHW Tank Wrap	RES-Water Heat	RES-SF
DHW Tank Wrap	RES-Water Heat	MURB
Certified Wood Stove	RES-HVAC/Shell	RES-SF
Certified Wood Boiler or Furnace	RES-HVAC/Shell	RES-SF
Certified Pellet Stove	RES-HVAC/Shell	RES-SF
Category 5		
High-Efficiency Air Source Heat Pumps: Air Source Heat Pumps (1-11) Tons, Baseline	COM-HVAC	Office

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Measure Name	Technology Type	Target Market
High-Efficiency Air Source Heat Pumps: Air Source Heat Pumps (1-11) Tons, Baseline	COM-HVAC	Other Commercial
High-Efficiency Air Source Heat Pumps: Air Source Heat Pumps (1-11) Tons, Baseline	COM-HVAC	Retail
High-Efficiency Air Source Heat Pumps: Air Source Heat Pumps (1-11) Tons, Baseline	COM-HVAC	School
High-Efficiency Air Source Heat Pumps: Electric Baseboards	COM-HVAC	Office
High-Efficiency Air Source Heat Pumps: Electric Baseboards	COM-HVAC	Other Commercial
High-Efficiency Air Source Heat Pumps: Electric Baseboards	COM-HVAC	Retail
High-Efficiency Air Source Heat Pumps: Electric Baseboards	COM-HVAC	School
Ground Source Heat Pump	COM-HVAC	Office
Ground Source Heat Pump	COM-HVAC	Other Commercial
Ground Source Heat Pump	COM-HVAC	Retail
Ground Source Heat Pump	COM-HVAC	School
Ground/Water Source Heat Pumps	COM-HVAC	Office
Ground/Water Source Heat Pumps	COM-HVAC	Other Commercial
Ground/Water Source Heat Pumps	COM-HVAC	Retail
Ground/Water Source Heat Pumps	COM-HVAC	School
Room A/C Retirement	RES-HVAC/Shell	RES-SF

EfficiencyOne – Application for approval of the use of Non-Energy Benefits within Cost-Effectiveness Testing M08888 (E-ENS-G-18)
E1 Responses to Nova Scotia Power Incorporated Information Requests

NON-CONFIDENTIAL

Measure Name	Technology Type	Target Market
ENERGY STAR® Windows (Replace Single Pane)	RES-HVAC/Shell	RES-SF
ENERGY STAR® Windows (300 ft2) (Replace Double Pane)	RES-HVAC/Shell	RES-SF
ENERGY STAR® Refrigerator (Replacement)	RES-Appliance	MURB
EnerGuide 83 New Home	RES-Package	RES-NC
EnerGuide 85 New Home	RES-Package	RES-NC
EnerGuide 86 New Home	RES-Package	RES-NC
EnerGuide 87 New Home	RES-Package	RES-NC
EnerGuide 88 New Home	RES-Package	RES-NC
EnerGuide 88+ New Home	RES-Package	RES-NC
Category 6		
Custom Efficiency	COM-Other	COM
Custom Efficiency	IND	Industrial
Whole Building 20% Over Baseline	COM-Other	New Construction - BNI
Whole Building 40% Over Baseline	COM-Other	New Construction - BNI

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Request IR-12:

Ref: Attachment 4, Table 1, page 5 of 64.

Please describe how water and waste water savings were previously included in E1's cost effectiveness testing and how VEIC's current proposal to included water and waste water savings compares or differs.

Response IR-12:

Please refer to EfficiencyOne's response to UARB-Synapse IR-02.

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Request IR-13:

Ref: Attachment 4, page 15 of 64, para 3.

Please provide a table showing the water savings that were removed compared to those that were added using the Massachusetts methodology.

Response IR-13:

Please refer to EfficiencyOne's response to UARB-Synapse IR-02.

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Request IR-14:

Ref: Attachment 4, page 17 of 64, table 4.

Please provide the definitions and specific activities that make up “air sealing”, “insulation” and “weatherization”.

Response IR-14:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

Please see EfficiencyOne’s response to UARB-Synapse IR-08.

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Request IR-15:

**Ref: Attachment 4, page 26 of 64, Table 10 – Energy Star CEE Tier 2 or CEE Tier 3
Commercial clothes washer.**

Does the negative value referenced indicate that this measure has a non-energy cost?

Response IR-15:

Please refer to EfficiencyOne's response to UARB-Synapse IR-09.

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Request IR-16:

Ref: Attachment 4, page 6 of 64.

Please provide all supporting information, data and research on which VEIC relied for assessing the regional differences between Massachusetts and Nova Scotia.

Response IR-16:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

NEBs were examined for parity across the two jurisdictions and then adjusted as necessary based on exchange rates, climate, labor rates, fuel costs, and housing prices. Details on how this was done can be found in Attachment 4, Sections 3.1 through 3.3. Additional details can be found in the Appendix C of Attachment D of the application, titled “Adaptation”.

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Request IR-17:

Ref: Attachment 4, page 13 of 64.

“Both of the other jurisdictions currently incorporating measure-level NEBs in their cost-effectiveness screening relied (at least in part) on Massachusetts’ research to inform their values.”

VEIC is requested to provide responses to the following:

- (a) What Massachusetts research did these other jurisdictions rely upon and how is it reflected in their respective methodologies?**
- (b) What other research did these two jurisdictions rely upon?**
- (c) Have these jurisdictions carried out their own review of NEB values?**
- (d) Prior to adopting its methodology did Massachusetts carry out its own review or did they adapt data from another jurisdiction?**
- (e) Please identify other jurisdictions that have adopted NEB values based on native data adapted from another jurisdiction in the manner currently being proposed by E1.**

Response IR-17:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

- a) This was outside of the scope of VEIC’s engagement with EfficiencyOne.
- b) Please refer to a).
- c) Please refer to a).

NON-CONFIDENTIAL

- 1 d) Massachusetts researchers used a number of methods to develop NEB recommendations.
2 Those included literature reviews, creating algorithms derived from the literature, creating
3 algorithms based on Massachusetts Program Administrator data, conducting
4 Massachusetts participant surveys, and by running Massachusetts TRM reports.
5
6 e) Please refer to EfficiencyOne's response to NSPI IR-02 b).

NON-CONFIDENTIAL

Request IR-18:

Ref: Attachment 4, page 8 of 64.

VEIC states:

“A jurisdiction’s primary cost-effectiveness test should account for its energy and other applicable policy goals and objectives. These goals and objectives may be articulated in legislation, commission orders, regulations, advisory board decisions, guidelines, etc. and are often dynamic and evolving.”

Please provide the enabling legislation applicable to the regulator’s authority to approve cost effectiveness testing for electricity energy efficiency programs for each of the three jurisdictions (Massachusetts, Rhode Island, and Maryland) referenced in the VEIC report at Section 3.

Response IR-18:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

Massachusetts - General Laws, Part I, Title II, Chapter 25, Section 21

<https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter25/Section21>

Rhode Island – TITLE 39 Public Utilities and Carriers, CHAPTER 39-1 Public Utilities Commission, SECTION 39-1-27.7

<http://webserver.rilin.state.ri.us/Statutes/TITLE39/39-1/39-1-27.7.HTM>

Maryland - Maryland Code, Public Utilities § 7-211

<http://mgaleg.maryland.gov/webmga/frmStatutesText.aspx?article=gpu§ion=7-211&ext=html&session=2018RS&tab=subject5>

NON-CONFIDENTIAL

Request IR-19:

Please describe how non-energy benefits as described in E1’s application fall within the definition of ‘electricity efficiency and conservation activities’ in section 79A(b) of the *Public Utilities Act*.

Response IR-19:

The proposed inclusion of non-energy benefits (NEB’s) in the TRC screening process is consistent with both the Public Utilities Act and developing best practices. Section 79A(b) defines “electricity efficiency and conservation activities” as relating to “activities, programs or plans....”. The inclusion of NEB’s is but one factor to be used in the development and assessment of a well- balanced DSM Plan. The legislation is not prescriptive with regard to how DSM programs are developed or evaluated with the exception of the over-arching requirements that the Nova Scotia Utility and Review Board (NSUARB) must take into account whether such a plan is in the best interests of the NS Power ratepayers and its “affordability”.¹

The legislation places the obligation on the DSM franchise holder to provide “information and evidence to the Board to justify the electricity efficiency and conservation activities that it proposes to undertake for Nova Scotia Power Incorporated...”.² The legislation goes on to state that NS Power is entitled to rely upon the “expertise of the franchise holder in respect of the delivery of the electricity efficiency and conservation activities...”³ The legislation places no restriction on the nature of the evidence that can presented by the franchise holder in support of the DSM plan or that which can be considered by the NSUARB.

¹ 79L(9) Public Utilities Act

² 79L(6) Public Utilities Act

³ Supra note 2

NON-CONFIDENTIAL

Request IR-20:

Preamble – Section 79I of the *Public Utilities Act* states that:

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 and that it may meet this obligation by, among other things, entering into an agreement with a franchise holder for the supply of electricity efficiency and conservation activities, if there is a franchise holder, that is approved by the Board.

Please provide VEIC’s opinion as to how the benefits “Recommended for Inclusion in ENS Market Rate Programs” on page 5 of 64 of the VEIC report such as reduced labour costs, increased sales revenue, increased rent revenue, noise reduction, and home durability property value increases in the assessment of the cost effectiveness of electricity efficiency and conservation activities, reflect a reduction of electricity costs for NS Power’s customers.

Response IR-20:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

NEBs represent inputs to be used in the proper use of, in the case of Nova Scotia, the TRC screening test. These screening tests are intended to inform the structure and design of DSM programs. NEBs are intended to account for and quantify the benefits to customers (and in many jurisdictions, society) outside of energy-related impacts. The intention of utilizing NEBs is to allow regulators and other stakeholders to make an informed decision on whether or not a measure or program is cost-effective.

NON-CONFIDENTIAL

- 1 Pursuant to the Public Utilities Act, when reviewing an application for approval of a DSM Plan,
2 the Board must satisfy itself that the proposed application is in the best interests of Nova Scotia
3 Power Incorporated's customers.¹ The legislation also specifically grants the Board general
4 authority to consider any "other matters considered appropriate by the Board" ²

¹ Public Utilities Act, RSNS 1989, c 380, ss. 79L(8)

² Supra 1

NON-CONFIDENTIAL

Request IR-21:

Preamble – Section 79J of the *Public Utilities Act* states that:

...in order to purchase electricity efficiency and conservation activities from a franchise holder to meet its obligation pursuant to clause 79I(2)(a), Nova Scotia Power Incorporated shall enter into agreements with a franchise holder that meet the requirements of this Section. Each agreement must (a) be for a term of three years, ending on December 31st of the third year of the agreement; (b) not be terminable or terminated unless the franchise holder's franchise is terminated or the termination is approved by the Board pursuant to Section 79N; (c) describe the electricity efficiency and conservation activities that the franchise holder will provide to Nova Scotia Power Incorporated; and (d) identify the amount that Nova Scotia Power Incorporated will pay to the franchise holder for the supply of electricity efficiency and conservation activities.

Please provide the authority for NS Power's customers to bear the responsibility to pay for activities justified based on societal benefits.

Response IR-21:

Please refer to EfficiencyOne's response to UARB IR-09. Please note that no societal benefits have been included as part of VEIC's work (all benefits are directly participant-related).

NON-CONFIDENTIAL

Request IR-22:

Preamble – Table 2 on page 8 of 64 of Appendix 4 states:

“EE is one of many resources that can be deployed to meet customers’ needs, and therefore should be compared with other energy resources (both supply-side and demand-side) in a consistent and comprehensive manner.”

Please describe how VEIC’s recommendation for inclusion of non-energy benefits in cost effectiveness testing compares to the regulatory practice and approach to the UARB-approved Capital Expenditure Justification Criteria’s Economic Analysis Model for evaluation of economically justified supply-side electricity investments in Nova Scotia.

Response IR-22:

EfficiencyOne does not have the expertise to comment on the NSUARB approved Capital Expenditure Justification Criteria’s Economic Analysis Model and how it compares to the inclusion of non-energy benefits in cost-effectiveness testing.

NON-CONFIDENTIAL

Request IR-23:

Ref: Attachment 4, page 39 of 64:

One W LED nightlight one-time NEB is \$3.78.

Please provide a breakdown of NEBs for this measure.

Response IR-23:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

As found in Appendix C of Attachment D of the application, Worksheet "Measure Tables," \$3.78 is attributed to lighting quality.

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Request IR-24:

Ref: Application, page 4, lines 26-30.

E1 states that:

“The membership of the DSMAG agreed that a NEBs quantification methodology that balanced expediency and cost efficiency with accuracy and precision would be preferable. A minority of members emphasized that a simple multiplier-based approach would suffice, while many advocated for enhanced precision of a measure-based approach, using existing data from another jurisdiction.”

Please provide all materials used by both majority and minority members, supporting their respective preferences.

Response IR-24:

Discussions held with the Demand Side Management Advisory Group (DSMAG) members on the NEB’s quantification methodology were used by EfficiencyOne for consideration on their respective preferences for cost-effectiveness testing. Presentation and stakeholder response materials developed by EfficiencyOne are included as Attachments 1, 2 and 3 to the Application.

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Request IR-25:

Ref: Application, page 15, lines 17-22.

E1 states that:

“EfficiencyOne has engaged in extensive discussions and consultation with the DSMAG on this topic... While not every point of discussion has full agreement amongst the DSMAG, EfficiencyOne has endeavoured to find consensus where possible, and fully endorses the Final VEIC Report and its conclusions and recommendations.”

- (a) Please explain the approach used by E1 to facilitate consensus.**
- (b) Did the DSMAG vote on each element of the proposed NEBs inclusion methodology? If no, why not?**
- (c) As some elements of the proposed VEIC methodology did not receive the support of every member of the DSMAG, please explain E1’s foundation for fully endorsing the Final VEIC Report.**

Response IR-25:

- a) EfficiencyOne’s Settlement Agreement filed July 22, 2016, on 2016-2018 DSM Deferred Matters, Section 7 a) stated that “the parties agreed to work collaboratively with the DSM Advisory Group to pursue the nature and quantification of estimates associated with participant non-energy benefits to improve the TRC test in future Applications.”¹. EfficiencyOne facilitated discussions with the DSMAG throughout the process.

¹ See M06733, *The Public Utilities Act, RSNS, 1989, c 380 and the order of the Nova Scotia Utility and Review Board in Matter M06733 directing the parties to pursue resolution of certain matters set out in settlement agreements therein within the DSM Advisory Group and The Application of EfficiencyOne for approval of the matters agreed upon within the DSM Advisory Group and for determination of unresolved issues* [Settlement Agreement], [22 July 2016], item 7(a).

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- 1 b) No. The DSM Advisory Group is a forum to provide strategic or directional advice and
2 stakeholder perspectives on current or emerging DSM issues. It is not a voting body
3 granting approval.
4
5 c) Please refer to b).



Request for Quote: 2017-0077

Non-Energy Benefits Study

1 List of Terms, Definitions, Symbols, and Acronyms

Terms, Symbols, Acronyms	Definition / Description
AT	Atlantic Time (standard/daylight savings time as applicable)
DSM	Demand-Side Management
DSMAG	DSM Advisory Group
EfficiencyOne	The franchise holder of Efficiency Nova Scotia and the administrator of the Efficiency Nova Scotia programs and services
HST	Harmonized Sales Tax
Must - or - Mandatory Requirement	A requirement that must be met in order for a submitted response to receive full consideration. Failure to meet a mandatory requirement may result in the Proponent's submission not being considered.
NEBs	Non-Energy Benefits
Proponent	Each lead company submitting a Proposal in response to this Request for Quotes is referred to as a "Proponent".
Proposal	A Proponent's submission in response to this Request for Quotes is referred to as a "Proposal".
RFQ	Request for Quotes
Should	A requirement having a significant degree of importance to the objectives of the RFQ
TRC	Total Resource Cost

2 Purpose/Context

EfficiencyOne provides electricity efficiency and conservation activities to residential, commercial and industrial clients within Nova Scotia through the provincial franchise, Efficiency Nova Scotia. Like many Demand-Side Management (DSM) administrators, EfficiencyOne relies extensively on cost-effectiveness testing for development and approval of its DSM Resource Plans. DSM Resource Plans in Nova Scotia are negotiated between EfficiencyOne and the province's main electricity utility, Nova Scotia Power Inc., and subsequently approved by the Nova Scotia Utility and Review Board.

The primary cost-effectiveness test (for decision-making) in Nova Scotia is the Total Resource Cost (TRC) test. All proposed Efficiency Nova Scotia programs are required to meet a TRC test of one or greater for regulatory approval.

Over the past several years, EfficiencyOne and its stakeholder advisory group, the DSM Advisory Group (DSMAG) have held numerous discussions regarding the appropriateness of the TRC test, as currently implemented in Nova Scotia. The DSMAG has agreed to pursue the nature and quantification of estimates associated with participant non-energy benefits to improve the TRC test for future applications to approve DSM supply agreements.

The TRC is intended to consider the costs and benefits¹ of both the customer and the program administrator. There has been a growing recognition in North America as a whole, that the TRC test is often applied in a manner that fully recognizes both customer and program administrator costs, but does not fully recognize utility and customer benefits.² Currently the TRC test as applied in Nova Scotia incorporates the following benefits:

- Avoided capacity costs;
- Avoided energy costs;
- Avoided customer operations and maintenance costs (if applicable);
- Water-related resource benefits (if applicable); and
- Other fuels' (non-electricity) impacts (if applicable).

On December 2nd, 2016, the DSMAG held a technical symposium to discuss the general approach for the quantification of Non-Energy Benefits (NEBs) within the Nova Scotian TRC test. Key themes of discussion and points raised included:

- The DSMAG generally favoured a lower-cost, lower-effort methodology, at least in terms of initial activities.
- Substantial debate occurred on the notion of uniform application of NEBs across measures and programs, or whether to prioritize quantification for certain measures or programs.
- Some stakeholders favoured a simple “adder” approach, while many stakeholders shared concerns about the imprecision and lack of basis of this approach.
- Many stakeholders saw initial activities as forming part of a broader long-term plan for updating key inputs of the TRC test.

The above discussions have informed the following requested activities and deliverables associated with this project.

3 Outcomes/End Results Required

Completion of an analysis that provides a full suite of non-energy benefits to be quantified for Efficiency Nova Scotia's portfolio of measures. These non-energy benefits are to be provided through adoption of previous studies conducted by other jurisdictions. Massachusetts (or another relevant jurisdiction that has engaged in explicit quantification efforts) should serve as the basis for source data for this work.

¹ Robin LeBaron, *Measure it Right: Best Practices in the Selection and Implementation of Cost-Effectiveness Tests* (National Home Performance Council, June 2012).

² Some North American jurisdictions (e.g. Massachusetts) do attempt to fully quantify customer and utility benefits.

4 Scope of Work

EfficiencyOne would like to quantify the NEBs of its efficiency measures in a simplified manner. Through consultation with the DSMAG, the rationale for this preference is based on more expeditious and cost-efficient implementation.

Based on this preference, EfficiencyOne is seeking assistance in adapting measure-specific factors that estimate customer NEBs (both positive and negative if applicable, beyond those already quantified in Nova Scotia) for each of EfficiencyOne's current measures. These factors should be in the form of a percentage, a per unit benefit value, or on a per kWh basis.

Attachment A to this RFQ provides Efficiency Nova Scotia's 2016-2018 DSM Resource Plan technical tables, which details the number of measures as well as their planned impacts. More detailed program evaluations, including data points such as measure types installed by program component, as well as annual impacts for each measure, are available upon request via procurement@efficiencyns.ca.

EfficiencyOne's preference is for the successful Proponent to adapt publically-available NEB data from research performed in Massachusetts to Nova Scotia's efficiency measures used within its portfolio. This entails the application of Massachusetts NEB factors to EfficiencyOne's portfolio of measures. Key Massachusetts research studies are included as Attachments B and C. A respondent may propose to adapt additional NEBs from a different North American jurisdiction, so long as that jurisdiction has studied the **explicit** quantification of measure-level NEBs. This adaptation work should account for the full measure mix within Efficiency Nova Scotia's program components, as well as account for jurisdictional differences for those NEBs as appropriate (for NEBs which are able to be adjusted without the need of primary research).

EfficiencyOne intends that the successful Proponent for this project will work in a collaborative manner with researchers within Academia (Research Team). EfficiencyOne is developing a relationship with the Research Team to provide assistance in developing innovative quantification methods and primary research techniques for difficult-to-quantify measures and benefits, or those measures and/or benefits that have challenges in their adaption from other jurisdictions. The Proponent is expected to identify difficult-to-quantify measures and/or benefits that or cannot or should not be adapted directly from other jurisdictions, discuss potential research methods with the Research Team, and identify interim NEB values for these measures and/or benefits that can be used until research is completed. Once the three organizations agree that a specific measure and/or benefit requires further research and interim solutions are identified, the responsibilities of the Proponent will have been satisfied for that measure and/or benefit.

The structure of this collaborative relationship will have both the successful Proponent and the Research Team reporting to EfficiencyOne, as opposed to one party entering into a subcontracting relationship with the other party.

This scope of work and the associated general elements of effort are likely to form part of a broader long-term strategy for updating the TRC test in Nova Scotia. Further possible enhancements include conducting primary research within Nova Scotia to further refine the quantification of NEBs included in Nova Scotia's TRC test, namely for the difficult-to-quantify measures identified through the activities in this scope of work. In addition, future work will likely include updating NEB values used in Nova Scotia in light of updated research that emerges from other jurisdictions.

EfficiencyOne currently intends to utilize NEB values for the purpose of cost-effectiveness testing, but certain NEB values may also be used in other aspects of EfficiencyOne's business, including communication materials, online savings calculators and business development activities. It is expected that, pending acceptance by the Nova Scotia Utility and Review Board (NSUARB), the NEB values quantified will be used in determining the cost-effectiveness of future DSM Resource Plans.

EfficiencyOne is not currently seeking assistance in updating or refining NEBs that are currently quantified in the TRC test in Nova Scotia, namely:

- Avoided customer operations and maintenance costs, and;
- Other resource benefits, consisting of other fuels and water benefits.

4.1 Mandatory Requirements:

Please refer to the Deliverables section (Section 4.5) of this RFQ for insight on mandatory requirements associated with deliverables. Please refer to the Scope of Work section (Section 4.0) for mandatory requirements associated with methodological considerations.

4.2 General Requirements:

- Single-vendor, fixed price agreement to perform scope of work and produce project deliverables.
- Willingness to work with the Research Team throughout the project duration to identify measures and/or benefit types that would benefit from additional research effort.
- Willingness to enter into a Professional Services Agreement and Non-Disclosure Agreement with EfficiencyOne.
- Ability for the successful Proponent to present draft findings to EfficiencyOne executives, the Research Team and/or other stakeholders in-person in Halifax, Nova Scotia.

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4.3 Performance Requirements & Project Schedule:

- Vendor must have at minimum one representative available throughout the project duration to serve as a point of contact for EfficiencyOne, with a maximum communication service standard of two business days.
- The successful Proponent will be able to comply with the following project schedule:

Action	Date (2017)
Kick-Off Meeting	June 5
Scoping Document Due	July 19
Draft Report Due	October 1
Final Report Due	November 15

4.4 Organizational Requirements

4.4.1 Occupational Health and Safety

The successful Proponent must accept responsibility for ensuring that all employees, sub-contractors, sub-suppliers, agents and representatives under its direction comply with all federal, provincial and municipal health, safety and environmental statutes, regulations, policies, and guidelines.

4.4.2 Building the Energy Efficiency Industry and Local Economy

Preference will be given to companies owned and/or managed in Nova Scotia that have energy efficiency business practices, behaviours, and initiatives imbedded into their organizational structure.

4.5 Deliverables

Project deliverables must include:

1. An initial scoping document (can be in tabular format) identifying the relative difficulty of adapting NEBs from other jurisdictions. This document will be reviewed by EfficiencyOne, the Proponent and the Research Team to determine which research activities should be carried out in Nova Scotia. This document should contain:
 - a. A list of all measures, by program, with an indication of the relative level of applicability and appropriateness of adapting NEBs from other jurisdictions to Nova Scotia.
 - b. For those measures that cannot be easily adapted from other jurisdictions, an indication of whether an interim NEB value can be provided by the Proponent for use until future research is completed.
2. A draft report for review by EfficiencyOne (and its DSM Advisory Group), which contains details on the adaptation methodology employed as well as the final calculations and complete listing of measure-level customer NEB values for each of EfficiencyOne's measures. In particular the draft report must include the following:
 - a. An executive summary;

- b. A key findings section;
 - c. Graphs that present key findings and facilitate comparison to other jurisdictions;
 - d. A section describing and categorizing the included NEBs, using a standard framework (This section should also be used to note any NEBs that were flagged for further research);
 - e. A comparison of TRC test results before and after the application of the NEBs studied. This shall occur at the measure, program and portfolio levels. Summary information displaying the amount of incentive spending and energy savings by measure shall be included in the results comparison (to be provided by EfficiencyOne);
 - f. Inclusion of a statistical summary graph displaying the mean, median, maximum and minimum changes to measure-level TRC test results in terms of percentage, after the application of NEBs;
 - g. Provision of justification for modifying (or importing as-is) NEBs imported from Massachusetts or other jurisdictions;
 - h. Provision of justification for applying a certain NEB to some measures, and not others;
 - i. Indication of which NEBs selected for importation have been approved by the Massachusetts regulator, along with citations;
 - j. Documentation of studies relied upon for the importation of NEBs; and
 - k. A section with recommendations for future research related to NEBs, including criteria for prioritizing the research.
3. A final report based on the above, with the incorporation of relevant feedback from EfficiencyOne.
 4. An in-person presentation to EfficiencyOne and the DSMAG following the preparation of the draft report.

5 Governance Process, Reporting, and Communications

- Mark Robertson will be the primary contact at EfficiencyOne
- Regular status updates to be provided by the contractor – appropriate frequency TBD
- Contractor agrees to inform EfficiencyOne of any issues that arise that have the potential to impact deliverables as described herein.

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6 RFQ Schedule & Project Schedule as applicable

For each due date or closing date below, the **deadline is 4:00 pm AT**. These dates are subject to change at EfficiencyOne's sole discretion.

RFP Activity / Milestone	Date (2017)
Request for quote date of issue	May 1
Question period (open – close)	May 1 – May 12
Quotes due	May 19
Anticipated notice of Decision	May 26

7 Questions

Inquiries, questions, and requests for clarification related to this RFQ process or to specific Proposal submissions must be submitted via email to procurement@efficiencyns.ca. **Please include "RFQ 2017-0077 - NEB Study" in the email subject line of all communications.**

8 Submission Content

Proposal submissions should clearly indicate the Proponent's contact information (i.e., firm name, address, contact information, including key contact person for the quote submission). Proponents must provide an indication of any potential conflicts of interest actual and perceived with a description of how these conflicts will be resolved. If an actual or perceived conflict cannot be mitigated to the satisfaction of EfficiencyOne, it may result in the Proposal being rejected without further consideration at the sole determination and discretion of EfficiencyOne.

In their submissions Proponents must demonstrate their experience conducting similar work, provide a description of their methodology and approach as related to the services outlined in the Scope of Work, and provide two references supporting this type of work.

Proposals must include the following details:

1. Total project cost;
2. Proposed project schedule;
3. List of project team members, as well as brief description of relevant experience;
4. Estimated hours of effort for each project team member;
5. Description of approach to the adaptation of measure-level NEBs; and
6. A listing of which specific NEBs will be targeted for adaption for the residential sector, as well as for the commercial and industrial sectors.

All costs to complete the work must be included in the Proposal submission, with pricing assumptions clearly stated, if applicable. If a price element is required but has not been specifically requested in this document, Proponents are required to include the element and clearly note it. Costs must be in Canadian dollars. HST is not to be included in the quoted prices but will be paid in addition to the contract price. The prices within the Proposal submissions shall be the full inclusive value of the work

described, including all costs and expenses which may be required for the work described together with all general risks, liabilities and obligations set forth or implied in this RFQ.

Proponents should include with their Proposal submission a description of:

- Their use of Nova Scotia talent and expertise;
- How they contribute to the Nova Scotia economy, through the delivery of this service (or otherwise);
- Any embedded energy efficiency business practices, behaviours, and initiatives within their organization;
- Proponents are also encouraged to identify additional value they can provide the EfficiencyOne in relation to its business, outside of traditional services; and
- Any innovative ways, ideas, or guidance to leverage our research study needs.

8.1 Submission Deadline

Proposals **MUST** be submitted via email to procurement@efficiencyns.ca, and received in full **on or before 4:00 pm AT, May 19th, 2017**. Proposals can be submitted in MS Word, MS Excel or PDF format. Please include “**RFQ 2017-0077 –NEB Study**” in the email subject line.

9 Proposal Evaluation Criteria

Responses will be evaluated according to the following evaluation Criteria:

Evaluation Criteria	Weight
Understanding of Scope of Work / Proposed Methodology	30%
Proponent's History/Experience Delivering Similar Projects	10%
Budget/Pricing/Value	30%
Proposed Innovation and Creativity	10%
Building the Energy Efficiency Industry and Growing the Local Economy	20%

10 General Information and Conditions

This RFQ is subject to the following terms and conditions:

- This is an invitation for Proposals and not a tender call.
- EfficiencyOne at its sole discretion may reject any or all Proposals submitted in response to this RFQ. Further, EfficiencyOne may cancel this RFQ at any time and may modify the RFQ including, without limitation, the Service, and/or scope of work.
- EfficiencyOne may select any Proposal considered by EfficiencyOne, at its sole discretion, to be in its best interests or the most satisfactory.
- EfficiencyOne shall be entitled at its sole discretion to waive any irregularity, informality, or any non- conformance with the requirements of this RFQ whatsoever with respect to any Proposal received by EfficiencyOne, or to reject any Proposal for any such irregularity, informality, or non-conformance.

- EfficiencyOne may enter into post-submission negotiations and discussions with any one or more Proponent(s) regarding price, scope of work, and/or any other term of a Proponent's submission, and such other terms as EfficiencyOne may require, at any time prior to any execution of an agreement. EfficiencyOne may, at its sole election, enter into simultaneous, competitive negotiations with multiple Proponents or negotiate with individual Proponents. Negotiations with Proponents may result in the enlargement or reduction of the scope of work, or changes in other terms that are material to the RFQ and the submitted Proposals. In such event, EfficiencyOne shall have no obligation to inform other Proponents of the changes, or to permit them to revise their Proposals in light thereof, although EfficiencyOne, at its sole discretion, may do so if EfficiencyOne determines such is in EfficiencyOne's best interest.
- EfficiencyOne may discontinue any negotiations at any time. EfficiencyOne may enter into or continue negotiations with firms that did not respond to this RFQ and/or solicit new Proposals from firms that did not respond to this RFQ, including but not limited to negotiations or Proposals for components of the scope, if any, that are not included in any successful Proposal or any executed contract.
- Proponents shall be solely and fully responsible for all costs associated with the development, preparation, transmittal, and submission of any Proposal or material submitted in response to this RFQ. EfficiencyOne may, in its sole discretion, ask Proponents to present their Proposal in person to Purchaser representatives at EfficiencyOne's offices, and the costs of such presentations shall be solely the responsibility of the Proponent. By submitting a Proposal, a Proponent agrees that there may be no claims whatsoever for reimbursement from EfficiencyOne for any such costs. All costs incurred by the Proponent during the selection process and during any negotiations will be solely the responsibility of the Proponent.
- EfficiencyOne assumes no contractual or other obligations as a result of the issuance of this RFQ, the preparation or submission of a Proposal by a Proponent, the evaluation of Proposals, the Proponent's conduct of presentations or the selection of any Proponent for further negotiations, or on any other basis whatsoever.
- No Proponent shall have any claim for any compensation of any kind whatsoever, as a result of participating in this RFQ process, and by submitting a Proposal each Proponent shall be deemed to have agreed that it has no claim.
- If EfficiencyOne chooses to enter into negotiations with a Proponent, the Proponent may be asked to provide, at its own expense, a bond guaranteeing that it is prepared to enter into a contractual agreement with EfficiencyOne.
- This RFQ and its resulting submitted Proposals shall be deemed to have been made in the Province of Nova Scotia and shall be construed and interpreted in accordance with the laws of the Province of Nova Scotia.
- EfficiencyOne has the right to extend/renew the contracts into additional years without issuing a new RFQ.

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Request IR-26:

Ref: Application, page 5, lines 12-14.

E1 states that “On May 1, 2017 EfficiencyOne began a competitive procurement process, and began working with Vermont Energy Investment Corporation on the project in June of 2017.”

(a) Please provide all documents related to the competitive procurement process, including the list of bidders.

(b) Please explain the bid evaluation process.

(c) Why was VEIC selected?

(d) Did E1 work with other contractors to support the design and implementation of a competitive procurement process? If yes, which other contractors provided commercial support in the present context? If yes, please summarize the general nature of the work performed by other contractors supporting E1’s design of a competitive procurement process.

Response IR-26:

- a) EfficiencyOne followed their Board of Directors’ approved Procurement Policy. The policy requires public notification for procurements over \$100,000. The policy also directs EfficiencyOne to seek competitive quotes on an invitational or targeted basis for procurements under \$100,000. Since this procurement was valued at under \$100,000 a Request for Quote (RFQ) was provided to potential vendors. EfficiencyOne’s practice is to invite at least three potential bidders. The RFQ included the scope of work, performance requirements, project schedule and the proposal evaluation criteria. The RFQ is included as Attachment 1 to this IR response.

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1 EfficiencyOne's practice is not to publicly disclose a list of bidders.

2
3 b) Please refer to Attachment 1 of this IR response for the evaluation criteria used.

4
5 c) VEIC was the highest scoring bidder.

6
7 d) No.

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Request IR-27:

Ref: Application, page 7, lines 7-9.

E1 states that:

“...many jurisdictions, in an effort to account for NEBs in CE testing, have examined NEBs to the degree of assigning an ‘add’ or multiplier to overall portfolio benefits...”

- (a) Please provide a list of the specific jurisdictions that have examined NEBs to the degree of assigning an “add” or multiplier to overall portfolio benefits.**
- (b) Please identify the pros and cons associated with the two methodologies, i.e., assigning the add or multiplier vs. developing a measure-based region-specific NEB methodology.**

Response IR-27:

- a) The following response has been provided by Vermont Energy Investment Corporation (VEIC).

U.S. jurisdictions that use a NEB add include Colorado, Illinois, Iowa, Maryland, New Mexico, New York, Oregon, Utah, Vermont, Washington, and Washington D.C.

- b) Please refer to the lists below.

“Adder/Multiplier” Method

Pros

- Very few resources required to develop

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- Potential to simplify discussion and debate – fewer points of discussion

- Easy implementation – typically adds or multiplies avoided cost values

Cons

- Provides no insight as to relative proportion of individual NEBs
- Essentially a negotiated “guess” at impacts
- Cannot easily capture relative NEBs of certain measures of program types
 - Changes to portfolio could have unknown effect on accuracy
- Little evidentiary basis

Measure-Based Method

Pros

- Measure-level detail easily handles changes to portfolio and program composition
- Takes into account varying levels of NEBs provided for by differing measures and programs
- Allows insight into different types of NEB components (e.g. home durability vs. fire safety)
- More sophisticated primary research methods possible
 - Increased accuracy possible
 - Targeted primary research possible (e.g. by measure)
- Higher degree of transparency possible

Cons

- More intensive management and update practices required
- More resource intensive to develop
- Communication of results more challenging due to added complexity

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Request IR-28:

Ref: Application, page 7, lines 10-11.

E1 states that “The three candidate jurisdictions were identified as Massachusetts, Maryland, and Rhode Island.” Also, page 8 of Attachment 4 includes Figure 1: Map of Cost/Benefit Tests and NEB incorporation by Jurisdiction.

(a) Did VEIC only examine resources available from Massachusetts, Maryland, and Rhode Island? If so, why? If other states or provinces were also examined, please identify which ones.

(b) Did VEIC examine the approach used in Vermont to account for NEBs in its CE test? If no, why not? Please provide a narrative on the extent NEBs are incorporated in each jurisdiction shown in Figure 1, the advantages and disadvantages of their Cost/Benefits tests, and the reasons for adopting their respective tests.

Response IR-28:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

- a) No. But in its RFQ (please refer to NSPI IR-26 Attachment 1), EfficiencyOne indicates its preference was “to adapt publicly-available NEB data from research performed in Massachusetts to Nova Scotia’s efficiency measures used within its portfolio.” Furthermore, in its research review, VEIC found that Massachusetts had the longest and deepest history of NEB research and use. VEIC did a general review of other NEB policies in the region, which is referenced in Attachment 4, Figure 1: Map of Cost/Benefit Tests and NEB incorporation by Jurisdiction.

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1 b) No. In its RFQ, EfficiencyOne explicitly asks for research on NEBs, “so long as that
2 jurisdiction has studied the **explicit** quantification of measure-level NEBs.” Vermont does
3 not use measure-level NEBs. Instead, Vermont applies a general adder of 15%.

4
5 Investigating the reasons jurisdictions in Figure 1 adopted their respective tests, as well as
6 the advantages and disadvantages of these tests was outside of the scope of VEIC’s
7 engagement with EfficiencyOne. EfficiencyOne requested an approach that balanced
8 accuracy with “expeditious and cost-efficient implementation”.

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Request IR-29:

Ref: Application, page 8, lines 23-26.

E1 states:

“In most cases, VEIC relied upon values contained within the Massachusetts TRM as a starting point for adaption, but in some cases the original Massachusetts Research base was used in cases where measures could not reliably be mapped from the Massachusetts TRM to EfficiencyOne’s modelled 2016-2018 Portfolio.”

- (a) Please describe the process of updating the MA TRM and the relevant Research base, and explain the reasons why data for individual measures were adjusted or not, for reasons other than currency exchange rates and inflation.**
- (b) Please provide all the revisions of the MA TRM and/or the relevant Research base since VEIC prepared its Report for E1.**
- (c) Please explain how E1/VEIC incorporated the changes in Massachusetts in the NEB values for NS. If changes were incorporated, please summarize how such revisions or refinements were performed.**

Response IR-29:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

- a) Massachusetts efficiency programs are administered through Mass Save®, a collaborative of Massachusetts' natural gas and electric utilities and energy efficiency service providers. In conjunction with the Energy Efficiency Advisory Council (EEAC), Mass Save® prepares a three-year, statewide energy efficiency plan. They submit their three-year plans to the

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1 Department of Public Utilities (DPU or the regulator) on or before October 31 of the
2 applicable planning year. The DPU must, within 90-days of the filing date, approve,
3 modify, or reject and require the resubmission of the three-year plans. These three-year
4 plans include the Program Administrators' use of NEBs. The process also includes
5 updating a corresponding TRM.

6
7 Once in place, the EEAC continues to report to the DPU and evaluate and monitor the
8 implementation of these plans. The EEAC is also charged with developing a long-term
9 vision for Massachusetts' energy future. In recommending and overseeing specific studies
10 and research, the EEAC works to "achieve energy efficiency savings and to maximize the
11 economic and environmental benefits of energy efficiency", including providing
12 recommendations on NEBs.

13
14 To find the reasons why data for individual measures were adjusted or not, please see
15 Attachment 4, Section 3 (Methodology of NEBs Application and Adaptation).

- 16
17 b) On October 31, 2018, the Massachusetts EEAC approved the 2019-2021 efficiency plans
18 and issued a new eTRM, which can be found here:

19 <http://masssavedata.com/Public/TechnicalReferenceLibrary>

20
21 Massachusetts released an updated non-energy impacts research framework in January
22 2018. That report can be found here:

23 <http://ma-eeac.org/wordpress/wp-content/uploads/NEI-Framework-Study-Report.pdf>

- 24
25 c) Please see Attachment 4, Section 3 (Methodology of NEBs Application and Adaptation)
26 and EfficiencyOne's response to UARB-Multeese IR-16.

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Request IR-30:

Ref: Application, page 15, lines 11-13.

E1 states:

“The method used by VEIC also provides sound NEB estimates from a jurisdiction climatically-similar to NS, with regulator-approved NEBs values at the measure level based on extensive primary research.”

- (a) Please define the term “climatically-similar” as used by E1 on page 15.**
- (b) What is the basis for the assertion that Massachusetts is “climatically-similar to NS”? Please provide all available information that supports this assertion.**
- (c) Nova Scotia’s peak electricity demand occurs during the peak heating season and is much lower during the summer. Massachusetts, Rhode Island, and Maryland experience peak electricity demand during the peak cooling season, and have lower demands during the winter. Are heating degree-day differentials between these states and Nova Scotia relevant for purposes of designing an NEB inclusion methodology? If no, why not?**
- (d) Please confirm that over 75% of Massachusetts homes have air conditioning (compared to approximately 30% in NS).**

Response IR-30:

- a) EfficiencyOne’s definition of ‘climatically-similar’ is regions having similar long-term patterns of weather and temperature.**
- b) Please refer to EfficiencyOne’s response to NSPI IR-33 c).**

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- 1 c) EfficiencyOne suggests that heating-degree days are relevant for this type of analysis, in
2 combination with cooling degree days, to yield the total number of conditioning degree
3 days. EfficiencyOne submits that the timing of system peaks on each system is largely
4 irrelevant, outside of the fact that this timing implies prevailing climatic conditions.
5
6 d) EfficiencyOne confirms the Massachusetts information.

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Request IR-31:

Ref: Attachment 1, Page 20 of 27, Attachment 4, page 14 of 64.

E1's answer A2 states that:

“If a proxy could be found of a very similar measure, that value was used. In many cases this value was zero. If not the measure was flagged for further research.”

Also, on page 14 of Attachment 4 to E1's Application, category 4 is described as:

“A measure offered in Nova Scotia was not offered in Massachusetts, but Massachusetts offered a similar measure (i.e., same technology type) that was used as a proxy for the Nova Scotia measure in question, and NEBs from the proxy were adapted to the Nova Scotia measure.”

- (a) Please clarify whether or not the statements in Attachments 1 and 4 address the same category? If no, how are the different categories reconciled for purposes of offering a similar measure for use in Nova Scotia?**
- (b) Please define the terms “same technology type” and “very similar measure” as used in the aforementioned excerpts.**
- (c) To the extent that both Attachments address the same category, confirm that category 4 specified in Attachment 4 has either zero value or is flagged for further research. If category 4 is flagged for further research, please explain what further research consists of for purposes of offering a similar measure for use in Nova Scotia.**

Response IR-31:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

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1
2 a) Yes.

3
4 b) Measures were considered “very similar” or the “same technology type” if they represented
5 the same end use and customer application type as the measure offered by Nova Scotia
6 programs and were thus likely to impart similar types of customer value.

7
8 c) Measures in category 4 specified in Attachment 4 may have had a proxy identified, in
9 which case the measure may have a zero NEBs value, or a non-zero NEBs value assigned,
10 or, if no proxy was identified, the measure was flagged for further research. If determined
11 to be warranted, further research for these measures and/or benefits which could not be
12 adapted from another jurisdiction would require some Nova Scotia-based research to
13 properly quantify them for use in a DSM context.

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Request IR-32:

Ref: Application, page 8, lines 5-6.

E1 states that:

“Water savings values were adjusted by using Halifax Water and Wastewater rates, as opposed to those found in Massachusetts.”

- (a) Why did VEIC assume that Halifax’s water rates are sufficient to represent water rates for all of Nova Scotia?**
- (b) Would using average Nova Scotia water rates be more accurate? If no, why not?**
- (c) How did VEIC account for households with private water supplies (i.e. wells)?**
- (d) Please provide the percent of Massachusetts households which have private water supplies.**
- (e) Please provide the water utility rate used in the Massachusetts TRM.**
- (f) Approximately 46 percent of Nova Scotians are on well water, which is primarily utilized by rural Nova Scotians and has significantly different parameters than those served by Halifax Water. Recognizing this difference, please explain how E1’s recommended approach takes into considerations significant differences within the province of Nova Scotia between urban and rural populations.**

Response IR-32:

- a) VEIC was provided with Halifax Water rates by EfficiencyOne for use in establishing monetary savings. This approach is consistent with that employed in the 2016-2018 DSM Resource Plan for the purposes of Cost-Effectiveness Testing.¹

¹ M06733, ENSC RIR(Synapse)-15 at Attachment 2.

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1 b) It is possible that using an average rate for NS would be more accurate on an aggregate
2 basis if an appropriate weighted-averaging method was used. A simple average would not
3 likely be more accurate.

4
5 c) Please refer to part a).

6
7 d) EfficiencyOne and VEIC did not investigate the percentage of Massachusetts households
8 with private water supplies and are not aware of this value. EfficiencyOne submits this is
9 not a consideration relevant to the adaptation exercise, as water pricing information was
10 not adapted from Massachusetts.

11
12 e) A water rate is not available from the Massachusetts TRM. VEIC used water savings values
13 from the Mass TRM, and applied Halifax Water's combined volumetric water and
14 wastewater rates.

15
16 f) EfficiencyOne's recommended approach did not involve detailed analysis of the
17 differences in monetary value of water between urban and rural populations.

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Request IR-33:

Ref: Application, page 8, lines 19-21.

E1 states that “In addition, labour rates, fuel costs and Heating Degree Days were also examined by VEIC, but no material differences between the two jurisdictions were found to support further adjustments.”

(a) Please provide all documents, reports, data sets, calculations and any other sources of information VEIC relied upon to determine that labour costs in Massachusetts and in Nova Scotia are not materially different.

(b) Please provide all documents, reports, data sets, calculations and any other sources of information VEIC relied upon to determine that fuel costs in Massachusetts and in Nova Scotia are not materially different.

(c) Please provide all documents, reports, data sets, calculations and any other sources of information VEIC relied upon to determine that Heating Degree Days in Massachusetts and in Nova Scotia are not materially different.

Response IR-33:

The following response has been provided by Energy Vermont Investment Corporation (VEIC).

- a) VEIC determined that labor rates were slightly higher in Nova Scotia (between 4.8% and 8.5% for similar jobs).¹ Consistent with a conservative approach, the Nova Scotia NEBs

¹ Labor rate data was captured by the U.S. Labor Rates are from the Bureau of Labor Statistics and reference Massachusetts specific data from May 2017 (https://www.bls.gov/OES/current/oes_ma.htm#49-0000) and Statistics Canada from May 2017 (<http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=2820151&pattern=&stByVal=1&p1=1&p2=37&tabMode=dataTable&csid=>)

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1 were not adjusted for labor rates because the data indicate that these NEBs would be higher
2 in Nova Scotia than in Massachusetts.

3
4 b) VEIC determined that transportation fuel prices were significantly higher in Nova Scotia
5 (16% higher for diesel and 37% higher for gasoline).² Consistent with a conservative
6 approach, the Nova Scotia NEBs were not adjusted for fuel because the data indicate that
7 these NEBs would be higher in Nova Scotia than in Massachusetts.

8
9 c) VEIC determined that heating and cooling degree days were very close between
10 Massachusetts and Nova Scotia (2.2% higher in Nova Scotia).³ The Nova Scotia NEBs
11 were not adjusted for these factors because these NEBs would be at approximately the
12 same values as those in Massachusetts.

² Massachusetts Fuel Prices from: <http://www.mass.gov/eea/energy-utilities-clean-tech/home-auto-fuel-price-info/gasoline-and-diesel-fuel-prices.html>. Data was collected from 8/16/2017-8/22/2017.

Nova Scotia Fuel Prices from: <https://nsuarb.novascotia.ca/mandates/gasoline-diesel-pricing/gasoline-prices-zone-map>. Data was collected on 8/25/2017.

³ VEIC used 5-year averages from <http://www.degreedays.net/>.

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Request IR-34:

Ref: Application, page 8, lines 8-1, and Attachment 4, Table 3.

E1 states that:

“NEBs relating to property valuation were adjusted for the relative difference in property values between NS and Massachusetts. This adjustment was based on the difference in median single-family house prices between the two jurisdictions.”

Also, Table 3 on page 15 of Attachment 4 to E1’s Application shows the median single-family house prices in Nova Scotia and Massachusetts and the multiplier used for adjustments.

- (a) Please provide the source of the data shown in Table 3.**
- (b) Please explain the rationale for relying solely on the single-family house category.**
- (c) Please explain whether the Massachusetts calculation of the change in property value is after deducting the present value of expected future energy cost savings.**
- (d) Please describe the statistical method used to infer the change in property values, over and above that represented by direct energy savings benefits. Provide references to any economic or finance journal articles that employ the method.**

Response IR-34:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

- a) Please refer to EfficiencyOne’s response to Multeese IR-16.**
- b) Please refer to EfficiencyOne’s response to Multeese IR-16.**

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1 c) Please refer to EfficiencyOne's response to Multeese IR-16.

2

3 d) Please refer to EfficiencyOne's response to Multeese IR-16.

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Request IR-35:

Ref: Attachment 4, Attachment 4, page 20 of 64.

VEIC states that:

“Assessing labour rates in Nova Scotia and Massachusetts proved to be difficult. While the minimum wage in Massachusetts is considerably higher than the minimum wage in Nova Scotia (\$13.86 CAD in MA and \$10.85 CAD in NS), the average hourly wage for material handlers and movers and maintenance workers was higher in Nova Scotia (see Table 8).”

(a) Why is the minimum wage relevant for the labour cost adjustment?

(b) Why are the average hourly wages in Table 8 provided for MA for one group of position description and for NS for another group? Is there any correlation between the two groups? If so, what is the correlation?

Response IR-35:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

a) Reviewing minimum wage in each jurisdiction provided one data point to examine the cost of labor.

b) The information provided in Table 8 is for illustrative purposes only. The U.S. and Canada do not use the same occupation terminology. The occupations listed are the close approximations. Given that EfficiencyOne requested an approach that balanced accuracy with “expeditious and cost-efficient implementation”, VEIC decided to adopt the labor

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1 costs component of the Massachusetts NEBs for Nova Scotia without making additional
2 adjustments.

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Request IR-36:

Ref: Attachment 4, page 20-21 of 64.

VEIC states that:

“...we decided to adopt the labour costs components of the Massachusetts NEBs for Nova Scotia BNI measures without making additional adjustments.”

If the wages for relevant positions are known, would it be more accurate to make labour cost adjustments on a measure basis rather than adopting the unadjusted labour costs components of the Massachusetts NEBs? If no, why not?

Response IR-36:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

VEIC did not take this approach because EfficiencyOne requested an approach that balanced accuracy with “expeditious and cost-efficient implementation”.

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Request IR-37:

Ref: Attachment 4, page 16 of 64.

VEIC indicates that it assumed that noise reduction and home durability in Nova Scotia and Massachusetts are comparable in value. Please explain the basis for this assumption and provide all documents, reports, data sets, calculations and any other sources of information used as a basis for this assumption.

Response IR-37:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

EfficiencyOne requested an approach that balanced accuracy with “expeditious and cost-efficient implementation”. Furthermore, VEIC saw no readily available evidence that would call for adapting noise reduction and home durability assumptions between Massachusetts and Nova Scotia.

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Request IR-38:

Ref: Attachment 4, Table 5, page 18 of 64.

Table 5 contains heating and cooling degree day data for three cities in Massachusetts and three cities in Nova Scotia.

(a) What criteria were considered in choosing these specific cities?

(b) Why was the measure of average total conditioning days used?

(c) Why was the simple average of degree-days over the three cities used?

Response IR-38:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

a) Proximity in geographic location.

b) "Thermal Comfort" is not specific to or valued differently between heating or cooling requirements and therefore conditioning days was selected as an appropriate metric for comparison.

c) A simple average was used to represent climate conditions over Nova Scotia's land area.

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Request IR-39:

Ref: Attachment 4, page 15 of 64.

VEIC states that “heating and cooling degree days were very close between Massachusetts and Nova Scotia (2.2% higher in Nova Scotia).” However, the data in Table 5 on page 17 shows that when the cooling degree days for each region are averaged, Massachusetts had 129% more than Nova Scotia. Performing this same analysis for heating degree days reveals that Nova Scotia had 18% more than Massachusetts.

- (a) Please provide the statistical rationale underlying the assertion that the heating and cooling degree days between Massachusetts and Nova Scotia are “very close.”**
- (b) How does E1 reconcile the significant differences in degree days between the two regions on a seasonal basis with VEIC’s conclusion made on page 14, that the degree-days between Massachusetts and Nova Scotia are “very close”?**
- (c) Does E1 agree that these percentages reveal potentially significant climatic differences between Massachusetts and Nova Scotia in regard to cooling degree days? If no, why not?**
- (d) Does E1 agree that any climatic differences are concealed in the VEIC report by combining heating and cooling degree days into one value? If no, why not?**
- (e) Do these seasonal percentages suggest that VEIC’s assumption that heating and cooling degree days can be combined for the adjustment purposes is flawed? If yes, should the use of a combined heating and cooling degree day metric be revisited? If no, why not?**
- (f) Does E1 believe that VEIC’s heating and cooling degree day adjustment methodology cannot be more granular (i.e., having heating and cooling separately) because the MA TRM does not have this level of granularity? If not, why not?**

Response IR-39:

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1
2 a) The following response has been provided by Vermont Energy Investment Corporation
3 (VEIC).

4
5 "Very close" is a descriptor of an observation in the data. No statistical rationale is
6 insinuated.

7
8 b) The following response has been provided by Vermont Energy Investment Corporation
9 (VEIC).

10
11 Because degree days are associated with equal value regardless of season, seasonality is
12 irrelevant.

13
14 c) While the data may suggest differences in heating and cooling seasons, seasonality is
15 irrelevant per the explanation provided in b).

16
17 d) It is possible, however seasonality is irrelevant per the explanation provided in b).

18
19 e) The following response has been provided by Vermont Energy Investment Corporation
20 (VEIC).

21
22 No, seasonality is irrelevant per the explanation provided in b).

23
24 f) No, the chosen methodology is appropriate per the concept described in b).

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Request IR-40:

Ref: Attachment 1, page 11 of 27; Attachment 2, page 7 of 8.

In its response to question Q2 from Synapse Energy Economics, E1 stated that:

“VEIC’s approach assumed that improvements in comfort within the cooling season are valued equally to those within the heating season.”

Also, on page 7 of 8 of Attachment 2, E1 further explains why this assumption is reasonable as follows:

“VEIC and EfficiencyOne agree that this assumption is reasonable. The comparison of total heating and cooling degree days was performed in an effort to adjust the comfort benefits associated with HVAC measures found in Massachusetts. The Massachusetts measure types examined were included in one “Heating and Cooling” category for heat pump systems, thus making a comparison of total HDD and CDD data reasonable. Since Massachusetts data cannot be readily broken into heating only and cooling only categories, the independent analysis of HDD and CDD data would be inconsistent with the resolution of the Massachusetts source data, and it is no clear how any such analysis would lead to an appropriate method of adaptation.”

(a) Does E1 or VEIC have any evidence to support the assumption that heating and cooling degree days are valued equally and can therefore be combined for comparison not just in MA, but also in NS? If yes, provide all documents, reports, data sets, calculations and any other sources of information used to support this assumption.

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- (b) If no NS-specific evidence is identified that would support the appropriateness of the HDD and CDD aggregation used in Massachusetts, why is it appropriate to use the aggregated Massachusetts values in Nova Scotia?**
- (c) Did Massachusetts’ underlying study contemplate demographic variables that contribute to the variation in magnitude of the NEBs associated with thermal comfort? If yes, did VEIC effectively assume the same demographic variables for Nova Scotia as for Massachusetts?**

Response IR-40:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

- a) The Massachusetts research did not differentiate between increased comfort due to cooling versus heating. In the residential survey, researchers asked:

In terms of the temperature and draftiness of your home, would you say that, because of the energy efficiency improvements, your home is MORE comfortable than it was before the improvements were made, LESS comfortable, or would you say there is no difference in the comfort level?¹

Furthermore, the study defined comfort in the following manner:

“ Participants in energy efficiency programs that include HVAC components and weatherization measures commonly experience greater perceived comfort, due to fewer drafts and more even temperatures throughout the home. The literature provides strong evidence that participants experience increased thermal comfort as a result of programs that affect the heating and cooling of the home, and that they consider these increased

¹ TetraTech and NMR Group. 2011. Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for the Massachusetts Program Administrators. Residential and Low Income (2011). Page F-4.

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1 comfort levels to be a very important program benefit, both in general terms and in
2 relation to other perception-based NEIs.”²

3
4 b) To assess thermal comfort, VEIC factored in both heating degree days and cooling degree
5 days to estimate the amount of time that some type of air conditioning (heating or cooling)
6 would be necessary to make the building comfortable. VEIC used 5-year averages from
7 <http://www.degreedays.net/> to determine that Nova Scotia had an average of 503 more
8 heating degree days than Massachusetts indicating a colder climate and the need for more
9 building heating. Massachusetts had an average of 426 more cooling degree days than
10 Nova Scotia indicating a warmer climate and more necessity for building cooling.
11 Efficiency retrofits will help reduce the need for both heating and cooling, which is why
12 VEIC incorporated both heating and cooling degree days. This is illustrated in Appendix
13 C – NEB Analysis Tool on the tab titled, “Adaptation”.

14
15 c) No.

² TetraTech and NMR Group. 2011. Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for the Massachusetts Program Administrators. Residential and Low Income (2011). Section 5.2.1.

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Request IR-41:

Ref: Attachment 4, Table 10, beginning at page 5 of 64.

- (a) Which measures listed in Table 10 will have their benefit-to-cost ratios (BCR) changed from a value smaller than 1.0 to a value greater than or equal to 1.0 after the inclusion of NEBs?**
- (b) Which measures listed in Table 10 will have their BCR changed from a value smaller than 1.0 to a value still smaller than 1.0 after the inclusion of NEBs?**
- (c) Are the measures listed in Table 10 that have their BCR changed from a value greater than 1.0 to an even greater value after the inclusion of NEBs included in NS's current CE test? If not, how are they currently treated?**
- (d) For the measures identified in (a) above, what would be their total benefits before the inclusion of NEBs by measure and year?**
- (e) For the measures identified in (a) above, what would be their total benefits after the inclusion of NEBs by measure and year?**
- (f) What would be the total additional benefits due to the inclusion of NEBs by measure and year for all measures in Table 10?**
- (g) What would be the total additional costs due to the inclusion of NEBs by measure and year for all measures in Table 10?**
- (h) What portion of these total additional costs due to the inclusion of NEBs would be supported by non-participants?**
- (i) Would E1 recommend implementing a measure which, after the inclusion of the NEB calculated under the proposed VEIC methodology, has a BCR of 1.01? If not, what would be the appropriate range of uncertainty for a measure not to be considered cost effective even if the calculated BCR is slightly above 1.0?**
- (j) What is E1's understanding of the sustainability and volatility of the NEB values as calculated by VEIC?**

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1 Response IR-41:

2
3 a) The following response has been provided by Vermont Energy Investment Corporation
4 (VEIC).

5
6 Please refer to Appendix C, worksheet ‘Measure Tables,’ columns Q and T. Alternatively,
7 Appendix B provides identical information.

8
9 b) The following response has been provided by Vermont Energy Investment Corporation
10 (VEIC).

11
12 Please refer to Appendix C, worksheet ‘Measure Tables,’ columns Q and T. Alternatively,
13 Appendix B provides identical information.

14
15 c) The following response has been provided by Vermont Energy Investment Corporation
16 (VEIC).

17
18 Yes.

19
20 d) The following response has been provided by Vermont Energy Investment Corporation
21 (VEIC).

22
23 Please refer to Appendix C, worksheet ‘Measure Tables,’ columns AU, BI and BW.

24
25 e) The following response has been provided by Vermont Energy Investment Corporation
26 (VEIC).

27
28 Please refer to Appendix C, worksheet ‘Measure Tables,’ columns AW, BK and BY.

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1 f) The following response has been provided by Vermont Energy Investment Corporation
2 (VEIC).

3
4 Please refer to Appendix C, worksheet ‘Measure Tables,’ columns AV, BJ and BX.
5

6 g) The following response has been provided by Vermont Energy Investment Corporation
7 (VEIC).

8
9 Zero.
10

11 h) The following response has been provided by Vermont Energy Investment Corporation
12 (VEIC).

13
14 Zero.
15

16 i) Please refer to EfficiencyOne’s response to UARB IR-07.
17

18 j) Please refer to EfficiencyOne’s response to Synapse IR-07.

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Request IR-42:

Ref: Attachment 4, Appendix B.

Please provide a table showing any measure contained in Appendix B that has a TRC between 0.5 and 1.5 without NEBs, and then compared to the measure with NEBs.

Response IR-42:

The following response has been provided by Vermont Energy Investment Corporation (VEIC).

The information requested is provided in the table below. Values with NEBs do not include property value-related (including rent revenue NEBs) NEBs, please refer to EfficiencyOne's response to Multeese IR-16.

		TRC Test Analysis		
Measure Name	Target Market	TRC Calculation	TRC With NEBs	TRC % Change
BNI - Efficient Product Rebates				
Zero Energy Doors for Reach-In Coolers and Freezers	Retail	1.48	1.48	0%
Zero Energy Doors for Reach-In Coolers and Freezers	Other Commercial	1.48	1.48	0%
Zero Energy Doors for Reach-In Coolers and Freezers	School	1.47	1.47	0%

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Measure Name	Target Market	TRC Test Analysis		TRC % Change
		TRC Calculation	TRC With NEBs	
Night Covers for 3' Refrigerated Display Cases	Other Commercial	1.43	1.43	0%
Lighting Controls - Occupancy Sensors	Office	1.41	1.99	41%
Half Size Commercial Hot Food Holding Cabinet	Retail	1.36	1.36	0%
ENERGY STAR®, CEE Tier 2 or CEE Tier 3 Commercial Clothes Washer	Other Commercial	1.34	1.21	-10%
Solid Door Commercial Refrigerator	Retail	1.32	2.18	65%
Integrated Dual Enthalpy Economizer Controls	Retail	1.31	1.31	0%
LED Lamps-End of Life	Office	1.30	1.79	38%
Variable Speed Drive for Kitchen exhaust fans (Demand Controlled Ventilation)	Retail	1.29	1.29	0%
T8 Dimmable Stairwell Lighting	School	1.27	1.87	47%
Integrated Dual Enthalpy Economizer Controls	School	1.25	1.25	0%
LED Lamps-End of Life	School	1.22	1.67	37%
Air Tanks for Load / No-Load Screw Compressors (10 – 40 hp)	School	1.18	1.18	0%
Variable Speed Drive Screw Compressors (10 - 40 hp)	School	1.15	1.15	0%
Night Covers for 3' Refrigerated Display Cases	Retail	1.13	1.13	0%
LED Linear Replacement Lamps	Industrial	1.13	1.51	34%
Lighting Controls - Occupancy Sensors	School	1.13	1.65	47%
LED Linear Replacement Lamps	Office	1.09	1.50	38%

EfficiencyOne – Application for approval of the use of Non-Energy Benefits within Cost-Effectiveness Testing M08888 (E-ENS-G-18)
E1 Responses to Nova Scotia Power Incorporated Information Requests

NON-CONFIDENTIAL

		TRC Test Analysis		
Measure Name	Target Market	TRC Calculation	TRC With NEBs	TRC % Change
LED Linear Replacement Lamps	School	1.07	1.47	37%
Glass Door Commercial Refrigerator	Retail	1.07	1.77	65%
LED Linear Replacement Lamps	Retail	1.07	1.46	37%
LED Low Bay Fixture	Industrial	1.05	1.38	31%
LED Refrigeration Strip Lighting-End of Life replacement	Retail	1.01	1.44	43%
Dairy Scroll Compressor	Other Commercial	1.01	1.01	0%
LED Linear Replacement Lamps	Other Commercial	1.01	1.39	37%
LED Low Bay Fixture	Office	1.01	1.35	34%
LED Refrigeration Strip Lighting-End of Life replacement	School	1.00	1.43	43%
LED Low Bay Fixture	School	1.00	1.34	34%
LED Low Bay Fixture	Retail	1.00	1.33	33%
LED Refrigeration Strip Lighting-End of Life replacement	Other Commercial	0.99	1.42	43%
LED Low Bay Fixture	Other Commercial	0.95	1.27	34%
ENERGY STAR® Self Contained Ice Maker	Retail	0.83	1.85	123%

EfficiencyOne – Application for approval of the use of Non-Energy Benefits within Cost-Effectiveness Testing M08888 (E-ENS-G-18)
E1 Responses to Nova Scotia Power Incorporated Information Requests

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		TRC Test Analysis		
Measure Name	Target Market	TRC Calculation	TRC With NEBs	TRC % Change
Daylighting Controls	Office	0.81	1.14	41%
Daylighting Controls	Retail	0.78	1.09	40%
Daylighting Controls	Other Commercial	0.76	1.07	40%
Daylighting Controls	School	0.71	1.04	47%
BNI- Direct Installation				
LED Lamps-End of Life-BES	Retail	1.50	2.05	37%
Relamp/Reballast-Retrofit (dual baseline)-BES	Retail	1.40	1.86	33%
Relamp/Reballast-Retrofit (dual baseline)-BES	Office	1.38	1.85	34%
Relamp/Reballast-Retrofit (dual baseline)-BES	Other Commercial	1.36	1.82	34%
High-Efficiency Air Source Heat Pumps: Electric Baseboards	Office	1.31	2.58	96%
High-Efficiency Air Source Heat Pumps: Electric Baseboards	Other Commercial	1.30	2.57	97%
High-Efficiency Air Source Heat Pumps: Electric Baseboards	Retail	1.28	2.54	99%
High-Efficiency Air Source Heat Pumps: Electric Baseboards	School	1.27	2.54	99%

EfficiencyOne – Application for approval of the use of Non-Energy Benefits within Cost-Effectiveness Testing M08888 (E-ENS-G-18)
E1 Responses to Nova Scotia Power Incorporated Information Requests

NON-CONFIDENTIAL

		TRC Test Analysis		
Measure Name	Target Market	TRC Calculation	TRC With NEBs	TRC % Change
Night Covers for 3' Refrigerated Display Cases-BES	Other Commercial	1.13	1.13	0%
LED Lamps-End of Life-BES	Office	1.06	1.46	38%
Night Covers for 3' Refrigerated Display Cases-BES	Retail	0.94	0.94	0%
Ground Source Heat Pump	Office	0.74	1.62	119%
Ground Source Heat Pump	Other Commercial	0.73	1.61	120%
Ground Source Heat Pump	Retail	0.72	1.60	122%
Ground Source Heat Pump	School	0.72	1.60	123%
Residential - Efficient Product Rebates				
Power bar with integrated timer	RES-SF	1.44	1.44	0%
Refrigerator Retirement	RES-SF	1.20	1.20	0%
Smartstrip	RES-SF	0.90	0.90	0%
Freezer Retirement	RES-SF	0.86	0.86	0%
Indoor Motion Sensor	RES-SF	0.72	0.83	15%
Hardwired Dimmer Switch	RES-SF	0.70	0.99	42%
Existing Residential				
Building Envelope Retrofits (Insulation, Draft Proofing, EnergyStar Windows and Doors)	RES-SF	1.24	1.44	16%
ENERGY STAR® Refrigerator (Replacement)	MURB	1.03	1.03	0%
12 W LED: 23 W CFL baseline	MURB	0.93	1.14	23%

EfficiencyOne – Application for approval of the use of Non-Energy Benefits within Cost-Effectiveness Testing M08888 (E-ENS-G-18)
E1 Responses to Nova Scotia Power Incorporated Information Requests

NON-CONFIDENTIAL

		TRC Test Analysis		
Measure Name	Target Market	TRC Calculation	TRC With NEBs	TRC % Change
ENERGY STAR® Air Source Heat Pump	RES-SF	0.81	0.82	1%
Ground Source Heat Pump	RES-SF	0.79	0.82	4%
ENERGY STAR® Windows (300 ft2) (Replace Double Pane)	RES-SF	0.51	0.53	4%
New Residential				
Solar Space Heating (Displacing Electricity)	RES-NC	0.51	0.51	0%

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Request IR-43:

Ref: Attachment 4, page 12 of 64.

Footnote 15 refers to the Massachusetts Technical Reference Manual (TRM) for Estimating Savings from Energy Efficiency Measures for the 2016-2018 plan years.

(a) Is this document the most current version of the Massachusetts TRM?

(b) Does E1 propose that new versions of the Massachusetts TRM be adopted in Nova Scotia when they are released?

Response IR-43:

a) No. A 2019-2021 Plan version of the TRM has been released. This version has moved to an electronic TRM approach, and is publicly available at:

<http://www.masssavedata.com/Public/TechnicalReferenceLibrary>

b) EfficiencyOne proposes that new versions of the Massachusetts TRM be considered as part of the review and updates procedures proposed in section 3.2 of the Application.