Synapse
Energy Economics, Inc.

# Energy Efficiency Cost-Effectiveness Screening in the Northeast and Mid-Atlantic States

**A Survey of Issues and Practices,**
**With Recommendations for Developing Guidance to the**
**Regional Evaluation, Measurement & Verification (EM&V) Forum**

**Prepared for the Regional EM&V Forum**
**A Project of Northeast Energy Efficiency Partnerships, Inc.**

**October 2, 2013**


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# 1. Introduction

The Northeast Energy Efficiency Partnerships (NEEP) Regional Evaluation, Measurement, & Verification Forum (Forum) supports the development and use of consistent protocols to evaluate, measure, verify, and report the savings, costs, and emission impacts of energy efficiency and other demand-side resources. The Forum recently initiated the Cost-Effectiveness Testing Guidance and Research project, which aims to document current state practices and underlying policies, inform Forum members of key issues and challenges with current practices, and collectively address best practices for cost-effectiveness testing so that the region can apply consistent tools in making decisions on program designs and plans.

This report has two primary goals. The first goal is to ensure that Forum members collectively understand key differences and issues with current cost-effectiveness testing practices across the Forum region. The second goal of this report is to identify the key topics and issues that the Forum should consider for developing guidance on cost-effectiveness testing.

***We offer recommendations on where the Forum can provide guidance that could help improve state cost-effectiveness testing to better align with intended state goals and increase consistency across the region.***

In Section 2 we provide an overview of the general practices and methodologies used for energy efficiency screening. This provides an important foundation for understanding the practices used across the Forum states.

In Section 3 we provide the results of our survey of current Forum state practices. This includes a table summarizing the results of the survey, indicating the current cost-effectiveness tests, primary policies, and key assumptions used across the Forum states (see Table 2). It also includes a description of the policy contexts in each state that have resulted in the specific practices used by that state, based upon interviews with commission staff and reviews of relevant legislation and commission orders. This policy context provides useful information regarding the reasons why each state has chosen its specific screening practices.

In Section 4 we offer recommendations on where the Forum can provide guidance that could help improve state cost-effectiveness testing to better align with intended state goals and increase consistency across the region. This includes general methodological recommendations, as well as recommendations for further research.

The eight specific states surveyed in this report include: Connecticut, District of Columbia, Delaware, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. Appendix A provides detail on each state's survey results.

Much of this report refers to the practices and the assumptions used for screening electric utility efficiency programs. However, the concepts discussed and the recommendations made generally apply to gas utility efficiency programs as well.

# 2. Overview of Energy Efficiency Screening Practices

## 2.1 The Increasing Importance of Screening for Cost-Effectiveness

Since the inception of ratepayer-funded energy efficiency programs, cost-effectiveness screening practices have been employed to ensure that the use of ratepayer funds results in sufficient benefits. Screening practices have allowed regulators to promote investments in energy efficiency resources that benefit customers, utility systems, and society. In general, historical energy efficiency programs have proven successful with strong cost-effective results, leading to additional investment in energy efficiency resources.

Increasingly, energy efficiency resources are viewed as a means to curb expensive power supply, mitigate the need for increasing transmission and distribution (T&D) investments, and reduce environmental impacts, particularly with regard to climate change. Consequently, many states have adopted increasingly aggressive energy efficiency standards, or requirements that program administrators procure all available cost-effective energy efficiency.

In response, energy efficiency programs are evolving in order to meet increasingly aggressive savings goals. For example, program administrators are implementing more comprehensive programs (e.g., whole house retrofits) that may incur higher up-front costs than other more traditional energy efficiency programs (e.g., lighting), but that produce larger, longer-term benefits. These developments in efficiency goals and efficiency program designs warrant increased scrutiny of the practices and methodologies used to screen energy efficiency for cost-effectiveness.

## 2.2 Overview of the Tests Used for Efficiency Screening

There are three tests used most often in the Forum region and across the country to determine the cost-effectiveness of energy efficiency programs: the Program Administrator Cost (PAC) test, the Total Resource Cost (TRC) test, and the Societal Cost test. Each of these tests combines the various costs and benefits of energy efficiency programs in different ways, depending upon which costs and which benefits pertain to different parties. The costs and benefits of these tests are summarized in Table 1, below.

It is important to recognize that the different tests provide different types of information. Each test is designed to present the costs and benefits from different perspectives. While all of these different perspectives may be considered relevant and important, and warrant consideration, states typically use one of these tests as the primary test to determine whether to invest ratepayer funds in energy efficiency programs.

- The Societal Cost test includes all impacts to all members of society.[1] It includes all the costs and benefits of the TRC test, but also includes societal impacts. These impacts typically fall within the following categories: environmental impacts; reduced health care costs; economic development impacts; reduced tax burdens; and national security impacts.

[1] The Societal Cost test can be defined using different boundaries, e.g., the societal impacts within the state, the country, or the world. Since greenhouse gas emissions from the electricity industry have global impacts, we recommend that the Societal Cost test include global costs and benefits.

- The TRC test includes all the costs and benefits to the program administrator and the program participants. It includes all of the costs and benefits of the PAC test, but also includes participant costs and participant benefits. It offers the advantage of including the full incremental cost of the efficiency measure, regardless of which portion of that cost is paid for by the utility and which portion is paid for by the participating customer.
- The PAC test includes all of the costs and benefits associated with the utility system. It includes all the costs incurred by the utility to implement efficiency programs, and all the benefits associated with avoided generation, transmission and distribution costs. This test is limited to the impacts that would eventually be charged to all customers through the revenue requirements; the costs being those costs passed on to ratepayers for implementing the efficiency programs, and the benefits being the supply-side costs that are avoided and not passed on to ratepayers as a result of the efficiency programs. This test provides an indication of the extent to which utility costs, and therefore average customer bills, will be reduced by energy efficiency.

**Table 1: Components of the Energy Efficiency Cost-Effectiveness Tests**

| | PAC Test | TRC Test | Societal Cost Test |
|---|---|---|---|
| **Energy Efficiency Program Benefits:** | | | |
| Avoided Energy Costs | Yes | Yes | Yes |
| Avoided Capacity Costs | Yes | Yes | Yes |
| Avoided Transmission and Distribution Costs | Yes | Yes | Yes |
| Wholesale Market Price Suppression Effects | Yes | Yes | Yes |
| Avoided Cost of Environmental Compliance | Yes | Yes | Yes |
| Reduced Risk | Yes | Yes | Yes |
| Other Program Impacts (utility-perspective) | Yes | Yes | Yes |
| Other Program Impacts (participant-perspective) | --- | Yes | Yes |
| Other Program Impacts (societal-perspective) | --- | --- | Yes |
| **Energy Efficiency Program Costs:** | | | |
| Program Administrator Costs | Yes | Yes | Yes |
| EE Measure Cost: Program Financial Incentive | Yes | Yes | Yes |
| EE Measure Cost: Participant Contribution | --- | Yes | Yes |
| Other Program Impacts (participant costs) | --- | Yes | Yes |

Ever since ratepayer-funded energy efficiency programs have been in place, there has been considerable debate about which test is best to use for screening energy efficiency. However, it should be noted that – while the choice of test is important – it is even more important to ensure that states are properly applying their respective cost-effectiveness tests. Properly applying the tests means they are applied in a way that: achieves its underlying objectives; is internally consistent; accounts for the full value of energy efficiency resources; and uses appropriate planning methodologies and assumptions.

## 2.3 Accounting for Other Program Impacts

One of the more challenging aspects of applying cost-effectiveness tests is properly accounting for "other program impacts" (OPIs). This term is used to describe two important types of impacts of energy efficiency programs. First, it includes non-energy benefits (NEBs), which cover those benefits that are not part of the costs, or the avoided costs, of the energy efficiency provided by the utility. Second, OPIs also include "other fuel savings," which are the savings of fuels that are not provided by the utility that funds the efficiency program. (Synapse 2012b).

There is a wide range of OPIs associated with energy efficiency programs. OPIs are categorized by the perspective of the party that experiences the impact: the utility, the participant, or society at large:

- Utility-perspective OPIs include financial benefits to the utility from reducing customer bills, including for example, reduced arrearages and bad debt, and improved customer services.
- Participant-perspective OPIs include a variety of NEBs to the program participants, including for example, reduced operation and maintenance (O&M) costs, improved comfort, improved health and safety, increased worker and student productivity, and utility-related benefits (e.g., reduced termination and reconnection). Some of these NEBs can be particularly significant for low-income program participants. Participant perspective OPIs also includes reduced water use and other fuel savings.
- Societal-perspective OPIs include those non-energy benefits that accrue to society, including for example, environmental benefits, reduced health care costs, economic development impacts, reduced tax burdens, and national security impacts.

OPIs should technically be included in cost-effectiveness tests for which the relevant costs and benefits are applicable:

- When using the Societal Cost test, the utility-perspective, participant-perspective, and societal-perspective OPIs should be included.
- When using the TRC test, the utility-perspective and participant-perspective OPIs should be included to the greatest extent possible.
- When using the PAC test, the utility-perspective OPIs should be included to the greatest extent possible.

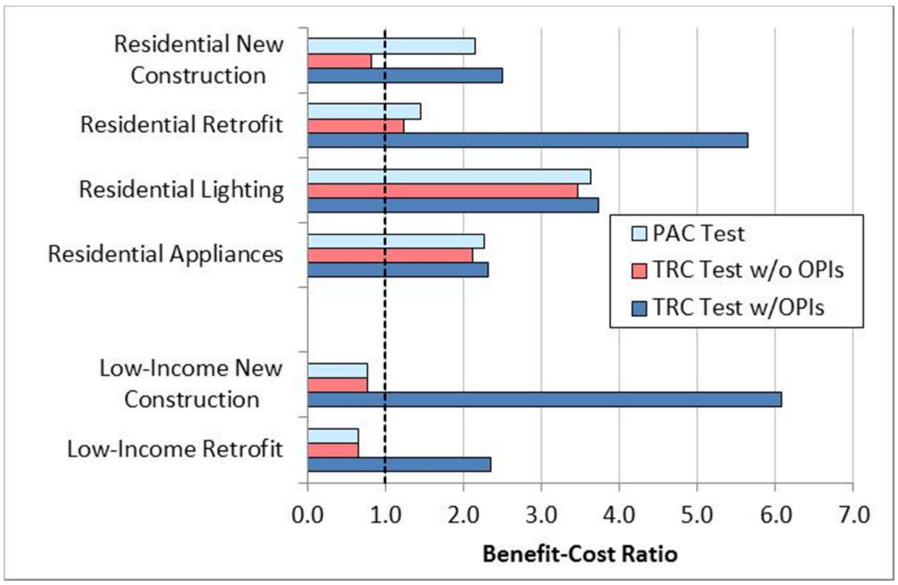
***The TRC test includes the impacts to both the utility and the program participant, and therefore should account for all of the costs and all the benefits that are experienced by the utility and the participants. This requires including all of the participant-perspective OPIs.***

If any one test includes some of the costs (or benefits) from one perspective, but excludes some of the costs (or benefits) from that same perspective, then the test results will be skewed, i.e., they will not provide an accurate indication of cost-effectiveness from that perspective. This concern has been particularly problematic with regard to the TRC test. The TRC test includes the impacts to both the utility and the program participant, and therefore should account for all of the costs and all the benefits that are experienced by the utility and the participants. This requires including all of the participant-perspective OPIs, to the extent possible. (Synapse 2012b; Neme and Kushler 2010).

The importance of fully accounting for OPIs is apparent in many program administrators' energy efficiency screening results. Figure 1, below, presents the planned cost-effectiveness results for an electric utility in Massachusetts for energy efficiency programs planned for implementation in 2012. The figure presents the benefit-cost ratios under the PAC test, the TRC test with OPIs included, and the TRC test without OPIs included. Appendix C provides a more detailed list of OPI examples, some of which are included in Massachusetts and Rhode Island.

Note that if the OPIs are not included in the TRC test, then the low-income, residential new construction and residential retrofit programs are all at risk of being inaccurately deemed not cost-effective. These energy efficiency programs are especially important because they help to support more comprehensive efficiency services to a more diverse set of residential customers, which promotes greater customer equity, both within the residential sector and between the residential and other sectors. Promoting customer equity is clearly an important objective underlying the energy efficiency programs.

**Figure 1: Cost-Effectiveness Analysis Implications of OPIs; PAC and TRC Tests**




*Source: Synapse 2012a.*

# 3. Cost-Effectiveness Practices in Forum States

## 3.1 Attributes Surveyed in Each State

For each state, we researched three primary attributes regarding cost-effectiveness screening: cost-effectiveness test(s) and their application, the avoided costs included in the primary cost-effectiveness test, and the OPIs included in the primary cost-effectiveness test. The specific attributes we identified for each state are defined and discussed below.

Cost-Effectiveness Test(s) and Methodologies

- *Primary test*: the primary test, as identified in Section 2.2 above, the state relies on to screen for cost-effectiveness.
- *Secondary test*: the secondary tests or combination of tests that the state uses to inform the cost-effectiveness review process, as applicable.

- *Screening level*: the level at which the primary test is applied to determine cost-effectiveness: the portfolio, program, or measure level. In some instances, a state may screen for cost-effectiveness at multiple levels to inform the review process.
- *Discount rate*: an interest rate applied to a stream of future costs and/or monetized benefits to convert those values to a common period, typically the current or near-term year, to reflect the time value of money. It is used in benefit-cost analysis to determine the economic merits of proceeding with a proposed project, and in cost-effectiveness analysis, it is used to compare the value of projects. (NEEP 2011, p 15).
- *Study period*: the length of time over which benefits from energy efficiency measures are included in benefit-cost analysis. The study period typically corresponds to measures that have the longest measure life, but not always.

Avoided Costs Included in the Primary Cost-Effectiveness Test

- *NEEP Definition of Avoided Costs*: In the context of energy efficiency, avoided costs are the costs that are avoided by the implementation of an energy efficiency measure, program, or practice. Such costs are used in benefit-cost analyses of energy efficiency measures and programs. Because efficiency activity reduces the need for electric generation, these costs include those associated with the cost of electric generation, transmission, distribution, and reliability. Typically, costs associated with avoided energy and capacity is calculated. Other costs avoided by the efficiency activity can also be included, among them the value of avoided emissions not already embedded in the generation cost, impact of the demand reduction on the overall market price for electricity, avoided fuel or water, etc. (NEEP 2011, p 8).
- *Avoided Costs in the Survey*: Our survey specifically reviewed whether the following avoided costs are included in a state's energy efficiency benefit-cost analyses: capacity costs, energy costs, transmission and distribution (T&D) costs, environmental compliance costs, price suppression, reduced line losses, reduced risk, and any other avoided costs. Other avoided costs were not specifically defined; rather this category provided an opportunity to account for state-specific avoided costs that may not be captured in the previous avoided costs.
- *Avoided Costs of Environmental Compliance*: It is now common practice to include the cost of complying with some environmental regulations within the costs avoided by energy efficiency resources (e.g., the cost of purchasing $SO_2$ and $NO_X$ allowances and the cost of purchasing $CO_2$ allowances to comply with the Regional Greenhouse Gas Initiative). However, it is less common to fully account for the costs of complying with forthcoming or anticipated environmental regulations, particularly regulations related to climate change. The costs of environmental compliance will eventually be borne by the utility and passed on to ratepayers, and therefore should be included in the PAC, the TRC and the Societal Cost tests. These costs are different from non-embedded environmental costs, which include the environmental impacts beyond the environmental compliance costs that are included in the avoided costs (Synapse 2012)
- *Price Suppression Effect*: In regions of the country with organized wholesale energy and capacity markets, reduced energy and capacity demands from energy efficiency savings lead to reduced wholesale energy and capacity prices. Because wholesale energy and capacity markets provide a single clearing price to all wholesale suppliers, and therefore

all customers purchasing power in the relevant time period, the reductions in wholesale energy and capacity clearing prices represent a benefit experienced by all customers of those markets. Over time, price suppression benefits dissipate as market participants respond to the lower clearing price, thereby shifting the supply curve and causing prices to raise back towards initial market prices.[2]

- *Reduced Risk*: Energy efficiency can mitigate the various risks associated with conventional power plants, including risks associated with fuel prices, construction costs, planning, reliability, new regulations, wholesale market operations, T&D constraints, and water constraints (Ceres 2012). Risk mitigation benefits of energy efficiency resources can be recognized either through system modeling when calculating avoided costs; through risk adjustments to the energy efficiency benefits; or through risk adjustments to the discount rate used in the cost-effectiveness analysis. Risk mitigation benefits will eventually impact utility costs and be passed on to ratepayers, therefore they should be included in the PAC, the TRC and the Societal Cost tests. (Synapse 2012a.)

Other Program Impacts Included in the Primary Cost-Effectiveness Test

- *Other Program Impacts*. The survey identified whether each state accounts for OPIs in the primary cost-effectiveness tests. For each category of OPIs, we also identified how the OPIs are accounted for (i.e., whether OPIs are quantified directly, accounted for through an adder, or considered qualitatively).
- *Utility-Perspective OPIs*: Utility-perspective OPIs are indirect costs or savings to the utility, and eventually its ratepayers. Such OPIs include benefits and costs associated with arrearages and bad debt, and improved customer service.
- *Participant-Perspective OPIs*: Participants in both low-income and non-low-income programs can realize a variety of OPIs from energy efficiency programs. The specific categories of OPIs that were surveyed are: resource savings, low-income benefits, equipment and operation and maintenance benefits, improved comfort, increased health and safety, increased property value, and utility-related benefits. While this categorization could be further divided, we found this breakout appropriate for the survey's purposes.
- *Societal-Perspective OPIs:* Societal-Perspective OPIs are indirect program effects beyond those realized by utilities, their ratepayers, or program participants, but accrue to society at large. Such OPIs include benefits and costs associated with environmental impacts, economic development, national security, and healthcare.

## 3.2 Summary of Survey Results

The results of the state surveys are summarized in Table 2. We provide additional detail in Section 3.3 and the tables in Appendix A.

To summarize, our survey indicates that:

[2] In the New England Avoided Energy Supply Costs study (AESC), the forecast of price suppression effects accounts for this dissipation (Synapse 2013, p 7-2).

1. Cost-effectiveness practices are largely driven by key policy objectives specific to each state. We summarize these objectives in the first row of Table 2.
2. Most states screen for cost-effectiveness using the TRC as the primary test, while a few states rely on the Societal Cost test or the PAC test as the primary test.
3. Most states determine cost-effectiveness at either the portfolio or program level with one state screening at the measure level, while a couple of states consider results from several screening levels.
4. All states apply a study period that includes the full useful life of the measures.
5. All states account for energy, capacity, transmission and distribution avoided costs. However, we did not investigate the extent to which the methodologies, assumptions and results are appropriate or consistent across the states.
6. All states account for the avoided costs of complying with environmental regulations. However, we did not investigate the extent to which the methodologies, assumptions and results are appropriate or consistent across the states.
7. Several states do not account for price suppression effects.
8. Several states do not account for risk mitigation benefits.
9. Several different discount rates are used across the Forum states. We note that different discount rates can have significant impacts on the results of the cost-effectiveness screening.
10. All states that use the TRC test or the Societal Cost test account for the participant-perspective resource benefits: water savings, oil savings, gas savings (for electric utilities), and electric savings (for gas utilities).
11. States treat the participant-perspective non-energy benefits very differently:
    - Two states use quantified values for non-energy benefits.
    - Two states use adders to represent non-energy benefits.
    - Several states include few or no non-energy benefits, despite using the TRC test as the primary test.

## Table 2: State Cost-Effectiveness Summary

| Cost-Effectiveness Metric | | Connecticut | Delaware | District of Columbia | Massachusetts | New Hampshire | New York | Rhode Island | Vermont |
|---|---|---|---|---|---|---|---|---|---|
| **Primary Policy Driver** | | Focus on electric system impacts only | Still under development | Energy efficiency programs must meet the Societal Cost test | All available cost-effective energy efficiency | Reduce market barriers to investments in cost-effective energy efficiency | Maximize cost-effectiveness given limited funding | All cost-effective energy efficiency | Least cost planning including environmental costs |
| **Cost-Effectiveness Test(s) & Application** | **Primary Test** | PAC | TRC | Societal | TRC | TRC | TRC | TRC | Societal |
| | **Secondary Test** | TRC | Societal; RIM | | | | | | TRB; PAC |
| | **Primary Screening Level** | Program | Portfolio | Portfolio | Program | Program | Measure | Portfolio | Portfolio |
| | **Additional Screening Level(s)** | | Program | Program, Project, Measure | | | Project, Program | | Program, Project, Measure |
| | **Discount rate used in Test (Real)** | Utility WACC (currently 7.43%) | Societal Treasury Rate (rate TBD) | Societal 10Yr Treasury (currently 1.87%) | Low-Risk 10Yr Treasury (currently 0.55%) | Prime Rate (currently 2.46%) | Utility WACC (currently 5.5%) | Low-Risk 10Yr Treasury (currently 1.15%) | Societal (currently 3%) |
| | **Study period over which Test is applied** | Measure Life | Measure Life | Measure Life | Measure Life | Measure Life | Measure Life | Measure Life | Measure Life |
| **Avoided Costs Included in Primary Cost-Effectiveness Test** | **Capacity Costs** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **Energy Costs** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **T&D Costs** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **Environmental Compliance** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **Price Suppression** | Yes | Yes | Yes | Yes | No | No | Yes | No |
| | **Line Loss Costs** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | **Reduced Risk** | No | Yes | Yes | No | No | No | No | Yes |
| **OPIs/NEBs Included in Primary Cost-Effectiveness Test** | **Utility OPIs** | No | No | No | Quantified | No | No | Quantified | Part of 15% Adder |
| | **Participant OPIs** | | | | | | | | |
| | **Resource** | No | Yes - Calculation TBD | Quantified | Quantified | Quantified | Quantified | Quantified | Quantified |
| | **Low-Income** | Qualitative | No | Part of 10% Adder | Quantified | Qualitative | Qualitative | Quantified | Additional 15% Adder |
| | **Equipment** | No | No | O&M Quantified | Quantified | No | Qualitative | Quantified | O&M Quantified |
| | **Comfort** | No | No | Part of 10% Adder | Quantified | No | No | Quantified | Part of 15% Adder |
| | **Health & Safety** | No | No | Part of 10% Adder | Quantified | No | No | Quantified | Part of 15% Adder |
| | **Property Value** | No | No | Part of 10% Adder | Quantified | No | No | Quantified | Part of 15% Adder |
| | **Utility Related** | No | No | Part of 10% Adder | Quantified | No | No | Quantified | Part of 15% Adder |
| | **Societal OPIs** | No | No | Part of 10% Adder | No | No | No | Quantified | Part of 15% Adder |

## 3.3 State Policy Contexts

To provide context for each state's energy efficiency practices, we conducted interviews with state public utility commission. The goal of the interviews was for commission staff to provide the anecdotal background on how its state developed the energy efficiency screening policies and practices currently in place, focusing on areas where states differ from each other. We also aimed to get a sense of the bigger picture policy context that influences energy efficiency screening policy decisions and practices within each state. Each state's section, below, provides a historical overview of the state's energy efficiency cost-effectiveness policy, followed by a summary of a few specific aspects of the state's screening practices that differ from other Forum state practices.

### *Connecticut*

The Program Administrator Cost test[3] has been the primary cost-effectiveness test in Connecticut for many years. As far back as 1998, the Connecticut Department of Public Utility Control (CT DPUC)[4] stated that it "has repeatedly endorsed the utility cost test as the preferred method to evaluating conservation programs. Its logic is sound, its priorities are straightforward, and it will result in more conservation for lower cost to electric customers" (CT DPUC 1999, pp 18-20). Specifically to this last point, the CT DPUC has relied on the PAC test due to the test's focus on the electric system's cost and benefits, which is the driving energy efficiency policy in the state.

For instance, in 2003, southwestern Connecticut experienced capacity system constraints due to generation comprised of older, inefficient, fossil fueled units, and to strain on the system during periods of peak demand. To help mitigate increases in electricity demand, the CT DPUC stated that it would look much more closely at the value that each energy efficiency program provides. The CT DPUC directed the utilities to undertake efforts to maximize electric savings in all programs. The most cost-effective programs were expanded while those that were less cost-effective were phased out, reduced, or eliminated. (CT DPUC 1999, p 4).

***To date Connecticut's policies have focused on the impacts to electric utility customers only.***

The CT DPUC has also focused on electric system benefits due to the desire to avoid cross-subsidization from electric or gas customers to oil customers. The CT DPUC previously stated that program administrators should "continually strive to reduce inter fuel subsidies and match the funding sources to those receiving the benefits." (Personal Communication with CT DEEP Staff; CT PUC 2011, p 14). Recent legislation may alter the CT DPUC's focus on the electricity system, as the state's statute for assessment of conservation and load management programs now requires that utilities provide programs that offer "similar efficiency measures that save more than

[3] The PAC test or Utility Cost test is referred to as the Electric System test in Connecticut.

[4] The Connecticut Department of Energy and Environmental Protection (DEEP) was established on July 1, 2011 with the consolidation of the Department of Environmental Protection, the Department of Public Utility Control, and energy policy staff from other areas of state government. The Public Utilities Regulatory Authority (PURA) replaces the former Department of Public Utility Control along with the Bureau of Energy and Technology Policy. PURA is part of the Energy Branch of DEEP, and is statutorily charged with regulating the rates and services of Connecticut's investor owned electricity, natural gas, water and telecommunication companies and is the franchising authority for the state's cable television companies. (DEEP 2013; PURA 2013).

one fuel resource or otherwise coordinate programs targeted at saving more than one fuel resource." CT G.L. 16-245m (d)(1), (d)(5).

The CT DPUC has addressed risk associated with energy efficiency programs in the context of discount rates. The CT DPUC stated that a 5 percent discount rate is extremely low because conservation is not a risk free investment. The CT DPUC directed that the discount rate be no lower than 7 percent for benefit-cost analysis to reflect the risk associated with energy efficiency programs. (CT DPUC 2010, p 59). Connecticut does not associate risk benefits with energy efficiency investments, and therefore does not include such benefits in cost-effectiveness testing (Personal Communication with CT DEEP Staff).

Other program impacts have been addressed by the CT DPUC on a limited basis in that it has repeatedly approved non-cost-effective low-income programs. For example, in 1999, the CT DPUC recognized "the benefits of energy conservation to low-income customers, such as a reduction in hardship customers and a reduction in uncollectible bills, which are not included in the benefit/cost ratios" (CT DPUC 1999, p 3). More recently, the CT DPUC stated that it continues to believe there are significant opportunities to improve energy efficiency for low-income customers, despite the fact that the low-income program is an all fuels program whereby electric customers subsidize oil measures (CT DPUC 2010, p 15).

### *Delaware*

Compared to many of the other Forum states that have had energy efficiency programs since the 1980's, Delaware's energy efficiency cost-effectiveness policy and program implementation are in their early stages of development, and are therefore still in flux. Nevertheless, the state has recognized the importance of energy efficiency as a resource for the past decade. In its 2003 assessment, the Governor's Energy Task Force found that "energy efficiency is Delaware's largest potential energy resource" (DE Task Force 2003, p 46). In 2007, an act created the Delaware Sustainable Energy Utility (DE SEU) for the purpose of promoting the sustainable use of energy in Delaware (Title 29, Chapter 80, § 8059). Finally, in 2009, the Energy Efficiency Resource Standards Act (EERS Act) was passed, mandating that "cost-effective energy efficiency shall be considered as an energy supply source before any increase or expansion of traditional energy supplies" (Title 26, Chapter 15, § 1500 (a)).

***Delaware is still developing its policies on energy efficiency cost-effectiveness.***

The 2009 EERS Act initiated Delaware's energy efficiency cost-effectiveness policy. However, the EERS Act did not guarantee energy efficiency program cost recovery through utility rates, nor did it include binding stipulations such as penalty provisions for non-compliance (see Title 26, Chapter 15, §1505). Therefore, without cost recovery, utility administered energy efficiency program implementation has stalled in Delaware. The only energy efficiency programs implemented have been administered by the Delaware Department of Natural Resources and Environmental Control (DNREC) and the DE SEU, and have been supported through state funds, ARRA funding, and RGGI revenue. A legislative amendment to allow cost recovery was introduced in the state's legislature in 2013, but was not approved by the senate and therefore was not enacted. A similar legislative amendment is expected to be introduced in the 2014 legislature. (Personal Communication with DE DNREC Staff).

Notwithstanding minimal program experience, DNREC established an EM&V stakeholder group that developed a draft evaluation framework, which outlines the state's potential energy efficiency cost-effectiveness structure. This draft report is expected to eventually be adopted by DNREC.[5] While the framework establishes central cost-effectiveness policies, such as using the TRC test as the primary screening test, some of the finer details have not been fully identified. This is partly due to not having the benefit of existing energy efficiency program on which to model the cost-effectiveness policy details, and due to the level of engagement by the stakeholders given the non-binding nature of the EERS Act. (Personal Communication with DE DNREC Staff; see Opinion Dynamics 2012a).

The relative lack of discussions regarding the cost-effectiveness policy details explains why some of Delaware's proposed screening practices differ from those used in other Forum states. The discount rate and other program impacts to include in the primary cost-effectiveness screening are not fully defined in the draft framework because the stakeholder discussions did not have the opportunity to delve into such requirements. The framework is expected to be honed over time, once ratepayer funded energy efficiency programs are implemented and knowledge is gained. Further, while the draft framework is expected to be adopted, it has yet to be incorporated into state policy. Depending on the outcome of the anticipated legislative amendments, all of the cost-effectiveness policy decisions within the framework, including the resolution to use the RIM test as a secondary cost-effectiveness test, could be revisited by the stakeholder group.

### *District of Columbia*

In 2008, the Clean and Affordable Energy Act of 2008 CAEA) was enacted in the District of Columbia, establishing the current energy efficiency structure for the district. While cost-effective energy efficiency programs had been implemented in the District of Columbia prior to 2008, the CAEA created the sustainable energy utility (DC SEU) to develop, coordinate, and provide programs for the purpose of promoting the sustainable use of energy in the District of Columbia (DC CAEA, §101(19)). The CAEA requires that the DC SEU's programs, when taken as a whole, meet the Societal Cost test on an annual and contract-term basis (DC CAEA, §202(d)).

In December 2010, the District Department of the Environment (DDOE) and the Vermont Energy Investment Corporation (VEIC) entered into a contract establishing VEIC as the prime contractor of the Sustainable Energy Partnership (SEP) that manages the DC SEU. This contract specifies the details for the District of Columbia's Societal Cost test, including identification of the costs and benefits to include in the cost-effectiveness screening. Difficult-to-calculate benefits are expressed in percentage adders until greater refinement in calculating those benefits is achieved by the DC SEU (DC SEU Contract 2010, B.10.4). As such, the DC SEU uses a 10 percent adder above benefits to recognize the benefits of energy efficiency and conservation in

***DC's policies are driven by the Clean and Affordable Energy Act, which promotes the sustainable use of energy.***

[5] DNREC is the state agency responsible for implementing the EERS Act and regulating compliance with the act's requirements (see Title 26, Chapter 15). The Delaware Public Service Commission is responsible for regulation of the state's public utilities, including the rates charged to customers. This dual responsibility contributes to the difficulty in allowing cost recovery through ratepayers for energy efficiency programs. (Personal Communication with DNREC Staff).

addressing risk and uncertainty (DC SEU Contract 2010, B.10.4.1.5).

The District of Columbia quantifies as many OPIs as can be readily calculated, including operation and maintenance benefits, water savings, and other fuel savings. A 10 percent adder is applied to program benefits to account for additional non-energy benefits 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 (DC SEU Contract 2010, B.10.4). The District of Columbia uses an adder to account for OPIs as a cost-saving mechanism, instead of conducting a study to determine specific values for each OPI. The DC SEU does not include non-energy benefits that accrue to the utility, as the current savings levels likely would not significantly alter the utilities' operations or provide additional benefits to the utility (Personal Communication with DDOE Staff).

### *Massachusetts*

Massachusetts' has been evaluating energy efficiency cost-effectiveness since the late 1980s. However, its fundamental energy efficiency policy was advanced in 1997 with the state's electricity restructuring act, which required the Massachusetts Department of Public Utilities (MA DPU) to ensure that energy efficiency programs are delivered in a cost-effective manner (MA Restructuring Act). In response, the MA DPU opened an investigation to establish the methods and procedures to evaluate and approve energy efficiency programs (MA DTE 1999a). The end result of this investigation was a set of energy efficiency guidelines that address the energy efficiency topics for which the MA DPU has primary responsibility, including energy efficiency program cost-effectiveness (MA DTE 1999b; MA DTE 2000).

***Massachusetts policies are driven by the Green Communities Act, which requires the program administrators to implement all cost-effective energy efficiency.***

In 2008, the An Act Relative to Green Communities (MA GCA) significantly advanced energy efficiency in Massachusetts by requiring that energy efficiency programs capture all available cost-effective efficiency opportunities, which has become the state's  driving energy efficiency policy (MA G.L. c 25 § 21(a)). Again in response to the act, the MA DPU opened an investigation to update the previously established energy efficiency guidelines to account for the new legislation (MA DPU 2008). In 2012, the MA DPU again revisited the energy efficiency guidelines to address specific issues associated with energy efficiency program benefits and regulatory filings (MA DPU 2011a; MA DPU 2012).

Risk benefits are not explicitly taken into account in the Massachusetts cost-effectiveness screening, as it has never explicitly been addressed by the MA DPU. However, the MA DPU has acknowledged that energy efficiency resources are a low-risk investment. In both of the MA DPU's investigations following the restructuring act and MA GCA, the MA DPU found that a low-risk discount rate is most appropriate for calculating the present value of the costs and benefits in the TRC test because it reflects the low-risk nature of energy efficiency investments. (MA DPU 2009a, pp 21-23).

Massachusetts explicitly requires that the avoided cost of complying with current and reasonably anticipated future environmental regulations be included when screening energy efficiency resources.  The DPU also requires that these avoided costs account for the relatively stringent requirements to reduce greenhouse gas emissions included in the Global Warming Solutions Act

(GWSA).[6] (MA DPU 2009a.) The Massachusetts efficiency program administrators do account for the costs of purchasing Regional Greenhouse Gas Initiative allowances, as well as the cost of purchasing greenhouse gas allowances under future federal climate change requirements. However, the DPU has yet to determine a methodology to estimate the value of the avoided costs of complying with the more stringent requirements of the GWSA (MA DPU 2012). Therefore, these potentially significant avoided costs are not currently accounted for when screening energy efficiency in Massachusetts.

Massachusetts' energy efficiency guidelines have always required that participant-perspective OPIs be quantified to the extent reasonably possible. The MA DPU specifically rejected the use of an adder to account for participant-specific economic benefits, and instead required that any known, quantifiable, and significant end-use benefits to program participants be included in cost-effectiveness analyses. (MA DTE 1999b, p 14).

### *New Hampshire*

New Hampshire utilities have been implementing energy efficiency programs since the late 1980's. In 2000, the state's electricity restructuring act stipulated that "restructuring should be designed to reduce market barriers to investments in energy efficiency and provide incentives for appropriate demand-side management and not reduce cost-effective customer conservation. Utility sponsored energy efficiency programs should target cost-effective opportunities that may otherwise be lost due to market barriers." (NH RSA 374-F:3, X). As part of its order addressing restructuring, the New Hampshire Public Utilities Commission (NH PUC) created a working group to help the NH PUC develop standards for evaluating energy efficiency programs and to assist in designing an appropriate cost-effectiveness test to apply to programs.

***New Hampshire's policies are driven by the goal of reducing market barriers to cost-effective energy efficiency.***

The working group's subsequent report forms the basis of New Hampshire's energy efficiency policy details (see NH PUC 2000; NHEEWG 1999). The report contains the working group's recommendations to the NH PUC on the topics the NH PUC required the working group to address, including: the development of a market framework, program design, cost-effectiveness testing, program administration, financial remuneration for utilities, and funding levels. The working group recommended a version of the TRC test for screening energy efficiency programs for cost-effectiveness. The test "compares the total resource costs for an energy efficiency program to the total resource benefits, including quantifiable costs and benefits associated with saving electricity and other resources (e.g., water, gas, or oil), market effects of energy efficiency programs (e.g., spillover and post program participation)[7] and additional non-quantified benefits" (NHEEWG 1999, p 15). The NH PUC approved the working group's report,

[6] The GWSA requires that the state reduce statewide $CO_2$ emissions from 1990 levels by 25 percent by 2020 and by 80 percent by 2050, with additional targets to be set for the intervening decades.

[7] "Although working group members agree that program designs should attempt to minimize free-riders, the working group concluded that the methodological challenges and associated costs of accurately assessing free-riders no longer justifies the effort required to net these out of cost-effectiveness analyses." (NHEEWG 1999, p 16, fn. 10).

and continues to monitor the energy efficiency programs, making changes to the state's energy efficiency policies over time.

Regarding the quantifiable benefits, New Hampshire relies on the Avoided Energy Supply Cost (AESC) study for its avoided cost of electricity, capacity, environmental compliance,[8] other fuels, and water. The state's avoided T&D costs are based on the weighted average of the utilities' costs, escalated for inflation, while avoided line losses are also based on utility estimates (NH Utilities 2012, 82-83).

Regarding non-quantifiable benefits, the NH PUC recognizes low-income benefits and allows for water-sewer benefits in benefit-cost calculations. The NH PUC expects all programs to surpass a 1.0 benefit-cost ratio. However, the NH PUC recognizes that low-income programs that do not screen with benefit-cost ratios greater than 1.0 may still be approved if the programs are otherwise well-designed. While the NH PUC has adopted this recommendation, the low-income programs have consistently demonstrated benefit-cost ratios greater than 1.0. Other non-low-income non-energy benefits, such as utility-perspective OPIs, improved comfort for residential participants, or increased health and safety benefits, have not been explicitly addressed by the NH PUC. Considering the working group recommended not assessing free-riders due to methodological challenges and associated costs, it is possible the NH PUC has not addressed such other non-energy benefits for similar reasons. All benefits are discounted using the prime rate, which is adjusted annually, with inflation rates based on the gross domestic product implicit price deflator (NH Utilities 2012, p 65).

While the NH PUC has continually monitored the use of the cost-effectiveness test, including periodically updating avoided cost factors and discount rates, it has not found it appropriate to expand the scope of the specific benefits included in the state's cost-effectiveness test since the working group's report was approved in 2000. For example, the NH PUC has not adopted price suppression benefits, likely because this benefit was not included in the working group's report, and possibly due to concerns about price suppression's dissipation effect. Additionally, neither the working group report nor the AESC address benefits associated with reduced risk, and therefore it has never been formally addressed by the NH PUC.

### *New York*

New York's primary energy efficiency policy was founded in its current form on June 23, 2008 through a New York Public Service Commission (NY PSC) order that adopts energy efficiency targets and establishes a process for approval of energy efficiency programs administered by the state's electric utilities and New York State Energy Research and Development Authority

[8] The working group report initially agreed that 15 percent should be added to avoided energy costs as a proxy for environmental and other benefits that are not otherwise captured in the direct avoided costs (NHEEWG, p 16). The working group noted that adequate market-based price proxies for some these benefits existed at the time the report was written, but that uncertainty in market prices due to the impacts of restructuring justified the use of the 15 percent adder. The 2007 AESC study included market-based proxies for power plant emissions of $NO_X$, $SO_2$, Mercury, and $CO_2$. Therefore, beginning with the 2008 energy efficiency plans, the 15 percent adder for environmental and other benefits was no longer applied because the avoided costs included market-based price proxies for emissions. (NH Utilities 2007, p 60; NH PUC 2007).

(NYSERDA). Among other findings, the order requires the use of the TRC test for cost-effectiveness screening.

As stated in this initial order, the overarching policy that drives New York's energy efficiency practices focuses on maximizing the cost-effective use of limited funding. In attaining New York's Energy Efficiency Portfolio Standard's (EEPS) objectives, the NY PSC stated that "careful attention to program benefit-cost ratios is very important as there is a need to achieve the maximum return on each incremental energy efficiency investment in the context of also achieving other public interest policy objectives and to reduce rate impacts on customers" (NY PSC 2008, p 2).

This policy explains New York's decision to screen programs at the measure level: "The requirement that all measures have a TRC score of at least 1.0 except for some promotional extremely low cost or incidental measures is an important safeguard that ensures that ratepayer funds are spent wisely and efficiently" (NY PSC 2009, p 15).

The NY PSC continued to refine the state's energy efficiency policy through subsequent orders, while the NY PSC Staff defined the technical practices associated with the commission's policies. For example, the NY PSC Staff instructed program administrators to use the utility weighted average cost of capital (WACC) to discount energy efficiency benefits. This is likely because the utility WACC is used for supply side investments, and the NY PSC Staff felt energy efficiency resources are the alternative to supply side resources. (Personal Communication with NY DPS Staff).

***New York's policies are driven by the goal of maximizing cost-effectiveness given limited funding for energy efficiency.***

The NY PSC has never included wholesale market price suppression as a benefit of energy efficiency programs for cost-effectiveness screening. It was not mentioned or intended in the 2008 order promulgating the TRC with carbon adder as the chief screening test. It was discussed in a 2011 NY PSC Staff white paper that reviewed energy efficiency programs and issues. NY PSC Staff noted briefly that any price suppression would be a transfer payment and not a resource savings. NY PSC Staff noted "the countervailing effect that occurs on the part of the supply side" – leading to only moderate and temporary effects. Lower current and prospective market prices could cause "potential new supply entrants to be dissuaded from entering a market" and "retirements of existing generators may be accelerated." Over the long-term, "a new supply/demand equilibrium is reached, and the price reduction is completely eliminated" (NY DPS 2011, p 31). In the NY PSC's response to the NY PSC Staff white paper, the Commission noted that various TRC test changes discussed in the paper or comments would raise or lower TRC test benefit-cost ratios, and concluded that they would not consider revisions to the TRC test at that time (NY PSC 2011c, p 6).

Similarly, the NY PSC and NY PSC Staff have never included energy efficiency benefits associated with reduced risk as a benefit of energy efficiency programs for cost-effectiveness screening. It was not mentioned or intended in the 2008 order promulgating the TRC with carbon adder as the chief screening test. The order responding to the white paper, however, at length discussed reduced risk of supply disruptions or gas price jumps as a major reason to continue the programs despite current low natural gas prices (NY PSC 2011c, p 5).

The NY PSC has placed emphasis on the benefits associated with avoided costs; therefore, many non-energy benefits have not been explicitly addressed by the NY PSC. However, the NY PSC has generally recognized and considered low-income specific benefits in deciding on funding for utility low-income programs. Specifically, the NY PSC has previously approved non-cost-effective low-income programs, indicating that low-income energy efficiency programs are a beneficial use of energy efficiency funding. (NY DPS 2011, p 37; NY PSC 2010, pp 64-65). Additionally, in TRC screening, the NY PSC Staff will sometimes subtract reduced O&M costs from upfront measure costs as appropriate. For example, reduced O&M costs associated from long-life lighting measures and savings from oil and water may be subtracted from measure costs.

### *Rhode Island*

In 2006, the Rhode Island General Assembly passed legislation regarding least-cost procurement of energy by distribution utilities in Rhode Island. The legislation required that "least-cost procurement shall comprise system reliability and energy efficiency and conservation procurement… in a manner that is optimally cost-effective, reliable, prudent and environmentally responsible" (RI G.L. c, 39-1, § 39-1-27.7). The act requires the Rhode Island Public Utilities Commission (RI PUC) to approve all energy efficiency measures that are cost-effective. (RI G.L. c, 39-1, § 39-1-27.7(c)(5); RI PUC 2012, p 20). The act's requirement that the RI PUC must approve all cost-effective energy efficiency measures is the state's determinative energy efficiency cost-effectiveness policy.

***Rhode Island's policies are driven by legislation requiring the implementation of all cost-effective energy efficiency.***

Consistent with the requirements of the least cost procurement act, in 2008, the RI PUC approved Standards for Energy Efficiency and Conservation Procurement and System Reliability (RI Standards) (RI PUC 2008, App. A). the cost-effectiveness requirements within the RI Standards stipulate that the utility "shall assess measure, program and portfolio cost-effectiveness according to the Total Resource Cost test. The Utility shall, after consultation with the Council,[9] propose the specific benefits and costs to be reported and factors to be included in the Rhode Island TRC test." (RI PUC 2008, App. A, p 13). To date, the utility has proposed, and the RI PUC has approved, quantified measureable other program impacts, including societal benefits. However, Rhode Island does not include benefits associated with risk, as the utility has not proposed to include such benefits, nor has the RI PUC ever specifically addressed energy efficiency risk benefits.

### *Vermont*

Vermont's energy efficiency policy is centered on the state's least cost integrated planning mandate, which stipulates that utilities must plan to meet "the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency,

[9] The council referenced in the RI Standards Energy Efficiency and Resources Management Council, the purpose of which is to evaluate and make recommendations for energy plans and programs; provide stakeholder involvement in energy planning; monitor and evaluate the effectiveness of energy programs; and promote public awareness, understanding, and action in response to energy issues. (RI EERMC 2013).

and comprehensive energy efficiency programs" (30 VSA § 218c). The requirement to include environmental costs led the Vermont Public Service Board (VT PSB) to its decision to use the Societal Cost test in evaluating energy efficiency programs, because costs in the Societal Cost test include environmental impact, changes in customer satisfaction, local economic impact and risk exposure (VT PSB 1990a, Volume II, Module 4, paragraphs 560, 564). Specifically, the VT PSB concluded that "economic efficiency and environmental integrity are benefits that society values, and evaluation of any DSM program must consider the net change in these benefits to assure that such a program is in society's best interest" (VT PSB 1990a, Volume II, Module 4, paragraph 587).

Vermont has explicitly chosen to not include price suppression effects as one of the benefits of its energy efficiency programs. The VT PSB stated that the Societal Cost test "ignores transfer payments, i.e., the distribution of impacts within society. Rather, the test focuses on the sum total of resources devoted to providing a given energy service." (VT PSB 1990a, Volume II, Module 4, paragraph 562). Vermont considers price suppression a transfer payment from electricity generators to ratepayers at the global societal level, and therefore it is not included in Societal Cost test analyses.

***Vermont's policies are driven by its least-cost planning mandate, including the requirement to account for environmental impacts.***

The use of the Societal Cost test also explains Vermont's approach to including other program impacts. Vermont quantifies as many OPIs as can be readily calculated, including operation and maintenance benefits, water savings, and other fuel savings. To account for additional non-energy benefits, a 15 percent adder is applied to program benefits, and an additional 15 percent adder is applied to low-income program benefits. The decision to use adders of 15 percent was based on a literature review conducted by the Vermont Department of Public Service (VT DPS 2011, pp 3-5). In adopting the adders, the VT PSB stated that "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" (VT PSB 2012b, p 26).

# 4. Synapse Recommendations

Several recent studies address issues surrounding energy efficiency cost-effectiveness screening across the country. These studies discuss the challenges of properly applying cost-effectiveness tests, characterize the factors that regulatory bodies should consider when reviewing energy efficiency resources, and recommend best practices for properly applying cost-effectiveness tests. Combined, these studies identify the differences across the US in the ways that cost-effectiveness tests are applied. Appendix B provides a summary of some of the recent studies' findings. (Neme and Kushler 2010; Eckman 2011; ACEEE 2012; Synapse 2012a; Synapse 2012b; Daykin et al. 2012; Haeri and Khawaja 2013).

***We focus our recommendations on those practices where states differ, as these practices indicate topics that the Forum may wish to focus on for developing guidance.***

The results of our survey indicate that the eight Forum states are no different from the rest of the country, in that they each apply cost-effectiveness tests in different ways. The Forum states are consistent with each other in a number of areas. However, we focus our recommendations on those practices where states differ, as these practices indicate topics that the Forum may wish to focus on for developing guidance on cost-effectiveness testing.

Below are Synapse's recommendations for the Forum to consider in providing guidance on cost-effectiveness testing in the region. These recommendations are based on (a) our experience working on these issues in many states and contexts, (b) our review of recent literature on these issues, and (c) our survey of Forum state practices. We also provide recommendations on possible future Forum research that would help advance and improve its guidance on state practices.

## 4.1 Recommendations on Screening Practices and Methodology

### *Underlying Premise for Our Recommendations*

As a fundamental principle, the costs and benefits included in a state's energy efficiency screening test should be consistent with the state's policy objectives, because these objectives provide guidance on the value that a state might place on energy resources. The list of relevant policy objectives to use for efficiency screening may be unique to each state. Some of the key policy objectives that have been established in the Forum states include, for example, reduce costs to electric customers, achieve all cost-effective energy efficiency, reduce market barriers to energy efficiency, promote economic development, and reduce environmental impacts.

Our survey indicates that the public policy goals in each Forum state have a large impact on the states' decisions with regard to cost-effectiveness screening details. For example, Vermont has an explicitly stated goal of reducing the cost of electricity generation, including environmental costs, and therefore has chosen to use the Societal Cost test. As another example, New York's primary public policy goal appears to have been to maximize cost-effectiveness given limited funding available from ratepayers. These different policy objectives apparently explain some of the key differences between the practices across the Forum states.

***Our recommendations are based on the premise that sound screening practices should generally meet the state's energy policy goals; be internally consistent; use appropriate methodologies; and account for all the relevant costs and benefits.***

We recognize that each state should have the flexibility to choose the cost-effectiveness screening test that best meets it public policy objectives and its historical policy context. Accordingly, we do not recommend that all states adopt the same test for efficiency screening, or that all states use all the same practices and methodologies for efficiency screening.

However, there are certain key energy efficiency screening practices that may be appropriate for all states, or that may be appropriate for all those states that have chosen to utilize a particular test. These are the practices that we focus on in our recommendations below. Our recommendations are based on the premise that sound screening practices should (a) generally meet the state's energy policy goals, (b) use a screening test that is consistent with the state's energy policy goals, (c) apply the chosen screening test in a way that is internally consistent, (d) use methodologies that are consistent with the perspective of the chosen test, and (e) account for all the costs and benefits that are relevant to the chosen test.

### *Other Program Impacts*

OPIs should be included in cost-effectiveness tests for which the relevant costs and benefits are applicable. If any one test includes some of the costs (or benefits) from one perspective, but excludes some of the costs (or benefits) from that same perspective, then the test results will be skewed; i.e., they will not provide an accurate indication of cost-effectiveness from that perspective. (Synapse 2012b; Neme and Kushler 2010).

***If a state uses the TRC test as the primary screening test, then the cost-effectiveness analysis should account for utility- and participant-perspective OPIs. Otherwise, the test results will be inherently skewed against energy efficiency.***

Therefore, if a state has chosen to use the TRC test as the primary screening test, then the cost-effectiveness analysis should include utility- and participant-perspective OPIs. The TRC test should not be used to screen energy efficiency resources if participant-perspective OPIs are not fully accounted for. The TRC test includes all the costs to program participants, and therefore it must also include all the benefits to program participants in order to maintain internal consistency. Otherwise the test results will be inherently skewed against energy efficiency.

For similar reasons, if a state has chosen to use the Societal Cost test as the primary screening test, then it should include utility-, participant-, and societal-perspective OPIs.

If a state chooses not to account for OPIs, then it should screen for cost-effectiveness using the PAC test. Otherwise the test will be internally inconsistent, will undervalue energy efficiency, and will result in customers paying higher costs than necessary for energy services.

***If a state chooses not to account for OPIs, then it should screen for cost-effectiveness using the PAC test.***

Ideally, states should establish quantitative, monetary values for all relevant OPIs. There are, however, several challenges and uncertainties associated with developing monetary estimates of some OPIs. Some of the OPIs may be unique to certain customer types, and some of the OPIs may depend upon the unique preferences or conditions of different customers. Under even the best of circumstances it is difficult to ensure that all relevant OPIs are accounted for, and that their magnitudes are properly assessed. These challenges can be one of the biggest barriers that hinder states' willingness and ability to account for OPIs.

Given the large number of OPIs, and the difficulty in measuring and accounting for all of them, it may be helpful for regulators to prioritize the impacts to identify those that are most likely to affect the outcome of the energy efficiency cost-effectiveness screening. For example,

- Utility-perspective OPIs are generally considered to be small relative to other OPIs. However, some studies have identified significant benefits associated with reduced shutoffs and reconnect, as well as bad debt write offs and carrying costs on arrearages. In addition, utility-perspective OPIs can be significantly larger for low-income customers, particularly in states where low-income customers are offered discounted rates or shutoff protection provisions that can sometimes result in large arrearages.
- Participant-perspective OPIs have been found to be particularly significant and thus have important implications for screening efficiency resources with the TRC test. While there is a wide range of potential participant-perspective OPIs, the ones that are used most frequently in energy efficiency screening can be categorized as follows: resource benefits (e.g., water or other fuel savings), low-income benefits; equipment operations and maintenance costs; health and safety; comfort; property value; and utility related benefits.
- Many of these participant-perspective OPIs are particularly large for low-income customers, because of the conditions of their dwellings, the other demands on their limited

resources, and other hardships they may face. In addition, low-income energy efficiency programs are often less cost-effective than other efficiency programs because the customers are harder to reach and the barriers are more difficult to overcome. Consequently, regulators frequently place a higher priority on the participant-perspective OPIs that apply to low-income efficiency programs.

- Societal-perspective OPIs can be quite large and also can be challenging to develop quantitative estimates for. The reduction of greenhouse gases from the electricity industry is frequently considered among the more significant societal benefits, and there are studies available to provide guidance as to their magnitude (see Synapse 2013). The economic development benefits of energy efficiency resources are also considered to be significant, and there are studies available to provide guidance as to their magnitude (see ENE 2009).

It is important to avoid giving greater priority to those impacts that are readily measurable and quantifiable simply because they are easier to obtain. The utility-perspective OPIs tend to be relatively easy to quantify, but they also tend to be low in value. Conversely, some participant-perspective NEIs can be difficult to quantify, but are expected to be quite large.

Appendix C provides examples of utility- and participant-perspective OPI values, some of which are used in Massachusetts and/or Rhode Island. This appendix is intended to provide examples of the types of OPIs included in cost-effectiveness testing, and to provide a sense of the values associated with each type of OPI. As noted above, apart from resource benefits, these are the only two states that directly quantify utility- and participant-perspective OPIs, while Vermont and the District of Columbia apply a 15% or 10% adder to their benefits, respectively.

States that do not currently have estimates of quantitative monetary values for OPIs could take the following steps to develop such estimates:

1. Identify all of the OPIs that are likely to have a significant impact on the costs and benefits of the energy efficiency programs, based upon the energy efficiency programs offered, and the screening test used, in the state.
2. Develop quantitative estimates for all OPIs that can be readily quantified. At a minimum, this should include the other fuel and resource savings, because these savings can be relatively easily quantified using forecasts of the prices for those fuels.
3. Develop some methodology for addressing those OPIs that are not quantified, e.g., by using an adder to the benefits as a proxy for the OPIs. For example, if the state does not develop quantitative estimates for the low-income NEBs, then at a minimum these benefits should be addressed through some proxy approach.[10]

[10] One way to determine an adder to apply to program benefits is to review the benefits used in neighboring states that quantify OPIs. For example, in Massachusetts, the non-resource benefits on a statewide basis make up approximately 17% of total benefits in 2013. Another way to account for OPIs without knowing the exact value of the benefits is to allow programs to be implemented even if they do not have a benefit-cost ratio greater than 1.0, with the understanding that there are benefits that would make the program cost-effective if they could be quantified more easily.

4. Undertake independent analyses to develop the best state-specific OPI estimates possible. The money required for this type of research could come from program administrator's evaluation, monitoring and verification budgets.

While it may be difficult to quantify or otherwise prioritize values for OPIs when applying the Societal Cost test or the TRC test, using the best estimates available is a significant improvement over using no estimates at all. Again, states that are unwilling or unable to account for a reasonable range of OPIs should use the PAC test to screen efficiency resources instead of the TRC test.

### *Avoided Costs of Energy and Capacity*

As one would expect, all of the states we surveyed account for the avoided costs of energy and capacity. However, there are many different methodologies and assumptions that are used in estimating avoided energy and capacity costs. It is beyond the scope of this study to survey and analyze the methodologies and assumptions of each of the Forum states. Thus, while the summary results presented in Table 2 suggest that the states are consistent in their treatment of avoided costs, there may be some significant differences in the methodologies and assumptions used, and therefore in the avoided costs themselves.[11]

This is not true across the New England states that we surveyed. All six New England states have established a collaborative approach to developing avoided costs, because the avoided energy and capacity costs are all driven by the New England wholesale electricity markets. The New England Avoided Energy Supply Component (AESC) Study Group is composed of various parties from each of the six states, including commission staff, consumer advocates, energy offices, efficiency advocates, utilities and other stakeholders. Every two years this group hires an independent contractor to conduct a detailed study of the avoided costs of energy efficiency programs in the region (Synapse 2013). The analysis is based on the regional markets, but the results are presented for each state, accounting for the differences within each state. As a result of this study, there is a great deal of consistency in the avoided cost methodologies and results in New England, as well as general confidence among the various stakeholders that the avoided costs estimates are appropriate to use for efficiency planning purposes.

We recommend that other states in the NEEP Forum region consider a similar process for estimating avoided energy and capacity costs. This would provide a forum for those states to develop consistent avoided costs, to obtain input and support from a variety of stakeholders in the methodologies and assumptions used for avoided costs, and to update avoided cost estimates on a regular basis with sufficient frequency. At a minimum, all states should ensure that their avoided cost estimates are sufficiently up to date, not only for inflation but to reflect market conditions (e.g., fossil fuel prices).

### *Avoided Transmission and Distribution Costs*

Similarly, all of the states we surveyed account for the avoided transmission and distribution costs. We did not survey or analyze the methodologies or assumptions used in estimating these avoided

[11] For an overview of methodologies for estimating avoided costs, see US DOE & US EPA 2008.

costs, so we are not able to draw conclusions about the consistency or the appropriateness of the methodologies and assumptions used.

We note, however, that T&D costs are steadily increasing, and that energy efficiency can play a significant role in deferring or avoiding some of those costs. Given the importance of these avoided costs, and the changing landscape for T&D needs, we recommend that each Forum state review their program administrators' estimates for avoided T&D costs on a periodic and frequent basis to ensure that the methodologies and assumptions are appropriate and up to date. A regional study of avoided T&D costs would be valuable as well, as this could account for the regional nature of transmission planning and could promote consistent approaches across the region.

### *Price Suppression Effects*

Wholesale market price suppression effects should be included as a benefit of energy efficiency in regions with competitive wholesale electric markets. Even a small reduction in a market clearing price can result in significant cost reductions across the entire market. States should include price suppression effects as a benefit of energy efficiency because it represents a reduction in costs to wholesale electric customers, which are passed on to retail electric customers. This benefit should be included in the PAC test, the TRC test, and the Societal Cost test.

Some states do not account for the price suppression effects on the grounds that these effects will dissipate over time as the wholesale electricity market naturally adjusts to the new level of demand on the system. While it is true that the wholesale electricity market will naturally adjust in this way, it will take several years to do so. During that time there will be real reductions in wholesale electricity market prices as a result of the energy efficiency savings, and those reductions will represent real savings to electricity customers. We note that the avoided cost study prepared for New England efficiency program administrators accounts for this effect of natural market adjustment and the dissipation of the price suppression effect (Synapse 2013). States should ensure that estimates of the price suppression effect properly account for the dissipation of this effect, rather than simply excluding the effect altogether.

***States should ensure that estimates of the price suppression effect properly account for the dissipation of this effect, rather than simply excluding the effect altogether.***

It is sometimes argued that the price suppression effect should not be considered a benefit to energy efficiency programs because it is a "transfer payment" from generators to electricity customers. As such, the benefit to electricity customers is equally offset by a cost to the generators. While it is true that the effect results in reduced profits to generators, this does not mean that the reduced profits should be netted out against the reduced cost to customers. Profits are not considered a transfer payment. Instead, they are a part of the cost of a resource; in the same way that the cost of capital, which includes an element of profit, is typically considered a part of the cost of a supply-side resource. The reduction in generator profits is simply the equivalent of a reduction in cost for the resource. Therefore, the price suppression effect should be included in the PAC test, the TRC test, and the Societal Cost test.

### *Avoided Costs of Compliance With Environmental Regulations*

In order to fully account for the cost of complying with current and anticipated environmental regulations, it is important to consider federal requirements, regional requirements, and state requirements. This is especially important for climate change requirements, as these requirements have increased in recent years, and several states in the Northeast region have relatively stringent climate change requirements.

***We recommend that the Forum investigate the extent to which states currently account for the costs of environmental compliance.***

Reviewing the details of each state's environmental requirements was beyond the scope of this study, and therefore we were unable to draw many conclusions regarding the extent to which the avoided costs of environmental compliance are being fully addressed in each state. Nonetheless, we expect that there is room for improvement in the ways that Forum states estimate and account for the cost of complying with environmental regulations, particularly climate change regulations. (For example, see the discussion in Section 3.3 regarding Massachusetts.) We recommend that the Forum investigate the extent to which states currently account for these costs, and consider options for making policies, methodologies and assumptions better aligned with environmental requirements and more consistent across the region.

### *Reduced Risk*

Many Forum states do not recognize all of the ways that energy efficiency will reduce risks on the utility system. We recommend that states consider explicitly accounting for the risk benefits of energy efficiency, given the potential value of reduced risk and the many ways that energy efficiency can reduce utility system risks.[12] There are three types of risks related to utility system resource planning: financial risk, project risk and portfolio risk.

*Financial risk* refers to the risk associated with the funding (i.e., the cost of capital) used to invest in the supply-side or demand-side resource. When an energy efficiency program administrator uses a system benefit charge, or some other fully-reconciling charge, to fund energy efficiency there is a very low financial risk (i.e., low cost of capital) to the utility or the program administrator. In these cases, energy efficiency resources have a lower financial risk than supply-side resources.

*Project risk* refers to the risks associated with planning, constructing and operating the resource, or, project. Efficiency resources are typically much less risky than supply-side resources that have risks associated with construction costs, fuel price volatility, swings in electricity demands, market volatility and other market risks (Ceres 2012). While energy efficiency resources have project risks of their own, these tend to be significantly lower than those associated with supply-side resources, particularly for those states that have been operating efficiency programs for a sufficient period of time to establish stable programs and develop enough historical data to be able to make reasonable predictions of program participation and results. Therefore, energy efficiency resources typically have lower overall project risk than supply-side resources.

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[12] See, for example, Ceres 2012, which includes a detailed discussion of risks associated with electricity resources, and explains why energy efficiency has lower risks than all other electricity resources.

*Portfolio risk* refers to the risk experienced by an investor from the total portfolio of investments, projects, or resources. Different combinations of investments, projects or resources will result in different types of risks for the investor. One common practice for reducing portfolio risk is to diversify investments. Energy efficiency can help diversify a utility system resource mix. Therefore, energy efficiency resources can generally help reduce portfolio risk.

Risk benefits can be accounted for in several ways when screening energy efficiency resources. For example:

- A risk adder can be applied to the energy efficiency benefits, as a proxy for the risk benefits. This approach is used by Vermont and Washington DC.
- The discount rate can be selected, or adjusted, to account for the risk benefits of energy efficiency. Several states in our survey apparently use this approach.
- In states that use integrated resource planning (IRP) to determine the appropriate level of energy efficiency resources to implement, risk assessment modeling techniques can be used to assess risks associated with different resources and resource portfolios.[13]

We recommend that the choice of discount rate (addressed in the next section) be used to reflect the risk benefits of energy efficiency for the NEEP Forum states. The discount rate is the best way to address *financial* risks, because the discount rate is intended to account for the time value of money. The discount rate is also better suited to reflect *project* risk and *planning* risk than a proxy benefits adder. A proxy adder for risk benefits simply increases the avoided costs equally across all years, while a risk-adjusted discount rate will affect the value of costs and benefits over time commensurate with the risks associated with time.

***We believe that the choice of discount rate is a better option for reflecting the risk benefits of energy efficiency than a risk benefits adder.***

While a proxy adder for risk benefits is a reasonable way to approximate the risk benefits of energy efficiency, we believe that the choice of discount rate provides a better option for accounting for risk. This option is discussed in more detail in the following section.

It is important to ensure that risk benefits are neither undervalued nor double-counted. For this reason, we recommend that when states apply risk benefit adders and/or risk-adjusted discount rates they explicitly identify the extent to which each mechanism is meant to address financial risk, project risk, portfolio risk, or some combination of these risks.

(Note that for New England states, the avoided energy and capacity costs calculated in the AESC study include an increase to the energy and capacity market prices referred to as the "wholesale risk premium." This premium is attributable to various costs that retail electricity suppliers incur in addition to the costs of acquiring wholesale energy, capacity, and ancillary service. They include costs associated with risks, operating costs and profits. The largest component of these costs is risks, in particular the risks associated with the difference between projected and actual energy requirements under the contract, driven by unpredictable variations in weather, economic activity,

[13] The NEEP Forum states surveyed here do not use IRP techniques for screening energy efficiency, so we do not address this option further.

and/or customer migration (Synapse 2013). Across New England on average this wholesale risk premium is on the order of eight percent, but different states use different premiums to reflect the conditions in their states. Accordingly, New England states should recognize that some of the risks associated with supply-side resources, especially generation project risks, are already being accounted for in their avoided energy and capacity costs. Financial risk and portfolio risk, however, are not accounted for in these avoided costs.

### *Discount Rate*

Discount rates are commonly used to compare future streams of costs in a consistent way, by estimating the present value of the costs and expressing them in a common reference year. The choice of discount rate will have a significant impact on the present value of costs and benefits; relatively high discount rates will significantly reduce the value of costs and benefits in the later years of the study period, while relatively low discount rates will reduce that value by much less. A discount rate of zero means that costs and benefits in future years are valued as much as costs and benefits today. The choice of discount rates is especially important for energy efficiency resources, whose costs are typically incurred in early years while benefits are experienced in later years.

Discount rates are used to account for two concepts: the time value of money and the riskiness of the investment (Synapse 2012b).[14] The time value of money is captured in the cost of capital that an investor uses to finance an investment; and the cost of capital is one of the key determinants of the discount rate. The riskiness of an investment is an indication of the project risk and or portfolio risk; and those investments that are expected to have a low project risk or portfolio risk can be discounted using a relatively low discount rate to reflect that risk.

***We recommend that the discount rate reflect the relatively low financial risk of energy efficiency programs, by using a low-risk rate such as US Treasury bonds.***

We recommend that the discount rate used for efficiency screening should reflect the relatively low financial risk of the energy efficiency programs. Energy efficiency programs financed by a system benefits charge, or a similar fully-reconciling charge, should use a low-risk discount rate to reflect the low financial risk of the funding source. A low-risk discount rate could, for example, be based on a general indicator of low-risk investments, such as US Treasury bonds. This is the approach used by Massachusetts, New Hampshire and Rhode Island.

We also recommend that when screening energy efficiency resources states consider using risk-adjusted discount rates to reflect the low project and portfolio risks associated with energy efficiency. This would mean reducing the discount rates, to a level below the discount rate that is chosen solely on the basis of the cost of capital. Therefore, a state that uses a system benefits charge, or similarly reconciling charge, should start with a low-risk discount rate based on the cost of capital, and then adjust it downward to reflect the project and portfolio risk reduction benefits.

[14] Discount rates can also be used to account for inflation. In this report, we refer to "real" discount rates, which should be applied to "real" or "constant" dollars.

As indicated in Table 2, Delaware, Vermont and Washington DC use a societal discount rate. In the case of Vermont and Washington DC, the societal discount rate is chosen because the state has chosen to use the Societal Cost test to screen energy efficiency. While there is sound logic in applying a societal discount rate when using the Societal Cost test, it is not entirely clear what the societal discount rate represents in these cases. First, there is a range of discount rates that could be used to reflect society's perspective. Second, it is not clear to what extent this choice of discount rate is intended to account for reduced financial, project and/or portfolio risk.

***We also recommend that the discount rate reflect the relatively low project and portfolio risk of energy efficiency programs, by adjusting the rate even further downward.***

As also indicated in Table 2, there is a wide range of discount rates used, both in terms of the rationale for the discount rate and the values chosen for a given rationale. Even states that use the same rationale for choosing a discount rate have very different values for the actual rates used.

Finally, it is important to note that the choice of discount rate is essentially a policy decision. In addition to the considerations described above, the choice should be informed by the weight that regulators wish to give to the future benefits of energy efficiency programs.

There is clearly room for more clarity and perhaps consistency on this issue across the NEEP Forum states. We recommend that, at a minimum, each state should explicitly identify what objectives it is trying to achieve with its choice of discount rate, and ensure that the choice of discount rate is consistent with these objectives.

### *Screening Level*

We recommend that energy efficiency resources be screened at the program level, but not at the measure level.[15] Screening at the program level is important to ensure that the economies of scale across measures and within programs are accounted for.[16] It is also important to account for the interrelationships between different measures, and the fact that some high-cost measures might help customers adopt lower-cost measures, resulting in greater overall benefits. Also, combining several measures into a total program can allow for whole-building programs and thereby help mitigate cream-skimming and help avoid lost opportunities. (Synapse 2012a).

We note one particular example where it may be helpful to screen efficiency programs at two different levels. Those states that screen efficiency at the *program* level using the TRC test, (including all relevant quantified OPIs), may want to also apply a screen at the *portfolio* level using the PAC test. The PAC test provides a clear indication of the extent to which efficiency programs will lower utility revenue requirements and reduce average customer bills. If an energy efficiency portfolio passes the PAC test, then the commission and other stakeholders can be assured that

[15] When screening energy efficiency projects or measures, the Participants test can be used to ensure that the project or measure is in the participating customer's interest.

[16] An analogy to supply-side resources is helpful here. When a utility purchases power from a wind farm with multiple turbines, it does not consider the cost of each turbine; only the total cost from the farm, which might be considerably lower (on a cost per kWh basis) than the cost of each turbine due to economies of scale.

the entire portfolio will provide net benefits to customers in terms of lower bills – regardless of all the assumptions and practices applied in the TRC test at the program level.

## 4.2 Recommendations for Possible Forum Research

The following are suggestions for where Forum research could help address gaps or data needs to support states' cost-effectiveness screening practices.

- *Identify Transferable Information:* Some benefits and savings, including NEBs, are transferable from state to state. For example, Rhode Island relies on the Massachusetts' OPI studies for some of the NEBs included in its cost-effectiveness testing. The Forum could identify areas where NEBs and other benefits are transferable among states so as to expedite the increased adoption of readily quantified NEBs.
- *Develop Better Estimates of Non-Energy Benefits*: For states that have not quantified NEBs, the Forum could assist the states in developing NEB estimates, possibly through regional NEB studies or other sharing of information with states that have developed estimates or methods for estimating NEBs.
- *Investigate and Update the Estimates of Avoided Transmission and Distribution Costs*: While all the Forum states account for avoided T&D costs in some fashion, we expect that there are opportunities to share information, methodologies and assumptions around the region to improve those cost estimates. The Forum could conduct a study to investigate the assumptions, methodologies and results used in each state; identify opportunities for improved estimation practices; identify opportunities for using common methodologies or assumptions; and perhaps develop new estimates of avoided T&D costs where appropriate.
- *Develop a Common Method for Addressing Risk Mitigation Benefits:* Not many of the Forum states explicitly account for risk mitigation benefits. Those that do account for risk may not necessarily account for all of the risk benefits of energy efficiency, or may benefit from improved methodologies for accounting for risk. As our discussion above indicates, the proper treatment of risk benefits is complicated and needs to be done in an explicit and thoughtful way. The Forum could conduct a study to further investigate the issues raised in this report, and to develop a method or set of methods for accounting for avoided risk benefits that could be readily adopted by each state.
- *Develop Common Methods for Selecting Discount Rates:* Discount rates clearly have a large impact on the outcome of the energy efficiency screening results. Forum states use a variety of different discount rates, and it is not clear whether and how they address both the cost of capital and the riskiness of energy resources. The Forum could conduct research to provide guidance on the theoretical rationales for choosing different discount rates. The research could also help identify which discount rates are appropriate for which states, given the specific conditions in each state including the short-term versus long-term policy goals of the state, the state's choice of screening test, the financial risk associated with that state's efficiency cost recovery practice, and the extent to which the state wishes to account for project or portfolio risk.

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# Appendix A – State Cost-Effectiveness Survey Results

**Table A.1: State Survey Summary**

| Cost-Effectiveness Metrics | | Policies & Practices |
|---|---|---|
| **Cost-Effectiveness Test(s) & Application** | Primary Test used by state | Societal Cost Test: DC, VT<br>Total Resource Cost Test: DE, MA, NH, NY, RI<br>Program Administrator Cost Test: CT |
| | Other Test(s) considered (if applicable) | CT: Total Resource Cost Test<br>DE: Societal Cost Test; Ratepayer Impact Measure Test<br>VT: Program Administrator Cost Test; Total Resource Benefits Test |
| | Level at which Test(s) is applied | Portfolio as Primary Screening: DE, DC, RI, VT<br>Program as Primary Screening: CT, MA, NH<br>Measure and/or Project as Primary Screening: NY<br>Considers additional screening levels: DE, DC, VT |
| | Discount rate used in Test(s) | Societal Discount Rate: DE, VT<br>10 year Treasury Note: DC, MA, RI<br>Prime Rate: NH<br>Utility Cost of Capital: CT, NY |
| | Study period over which Test(s) is applied | Measure Lifetime (25-32 years): CT, DE, DC, MA, RI, NH, NY, VT |
| **Avoided Costs Included in Cost-Effectiveness Test(s)** | Capacity Costs | Yes: CT, DE, DC, MA, NH, NY, RI, VT |
| | Energy Costs | Yes: CT, DE, DC, MA, NH, NY, RI, VT |
| | T&D Costs | Yes: CT, DE, DC, MA, NH, NY, RI, VT |
| | Environmental Compliance | Yes: CT, DE, DC, MA, NH, NY, RI, VT |
| | Price Suppression | Yes: CT, DE, DC, MA, RI<br>No: NH, NY, VT |
| | Line Loss Costs | Yes: CT, DE, DC, MA, NH, NY, RI, VT |
| | Reduced Risk | Yes: DE, DC, VT<br>No: CT, MA, NH, NY, RI |
| | Other Avoided Costs | Yes: DE<br>No: CT, DC, MA, NH, NY, RI, VT |
| **OPIs/NEBs Included in Primary Cost-Effectiveness Test** | Program Administrator or Utility OPIs | Yes: MA, RI, VT<br>No: CT, DE, DC, NH, NY |
| | Participant or Customer OPIs: | |
| | Resource | Yes: DE, DC, MA, NH, NY, RI, VT<br>No: CT |
| | Low-Income | Yes: CT, MA, NH, NY, RI, VT<br>No: DE, DC |
| | Equipment | Yes: DC, MA, NY, RI, VT<br>No: CT, DE, NH |
| | Comfort | Yes: DC, MA, RI, VT<br>No: CT, DE, NH, NY |
| | Health & Safety | Yes: DC, MA, RI, VT<br>No: CT, DE, NH, NY |
| | Property Value | Yes: DC, MA, RI, VT<br>No: CT, DE, NH, NY |
| | Utility Related | Yes: MA, RI, VT<br>No: CT, DE, DC, NH, NY |
| | Societal OPIs | Yes: DC, RI, VT<br>No: CT, DE, MA, NH, NY |
| | General Method for Quantifying Applicable OPIs | Quantify each OPI: MA, RI<br>Quantify certain OPIs: DC, NH, NY, VT<br>Adder: DC (10%), VT (15% for all benefits; additional 15% for low-income benefits)<br>Allow low-income programs with BCRs less than 1.0: CT, NH, NY |

## Table A.2: Connecticut

| Cost-Effectiveness Metrics | | Policies & Practices | Notes & Sources |
|---|---|---|---|
| Cost-Effectiveness Test(s) & Application | Primary Test used by state | Program Administrator Cost Test | **Source**: DEEP 2012, pp 19-20. **Note**: Also referred to as the Utility Cost Test, Electric System Test, or Gas System Test. |
| | Other Test(s) considered (if applicable) | Total Resource Cost Test | **Source**: DEEP 2012, pp 19-20. |
| | Level at which Test(s) is applied | Program | **Source:** CT G.S. §16-245m (d)(1). |
| | Discount rate used in Test(s) | Cost of Capital | **Source**: Connecticut Utilities 2011, pp 331. **Note**: Each CT utilities' after-tax cost of capital is weighted by utility, and the weighted average cost of capital is used by all utilities. The average is compared to 7%, and the higher value is used. The current rate is 7.43% for electric programs. The inflation rate of 2 percent based on the 2011 AESC. |
| | Study period over which Test(s) is applied | Measure Lifetime | **Source**: Connecticut Utilities 2011, p 323. |
| Avoided Costs Included in Primary Cost-Effectiveness Test | Capacity Costs | Yes | **Source**: Connecticut Utilities 2011, pp 320-322. **Note**: Values from Synapse 2011. |
| | Energy Costs | Yes | **Source**: Connecticut Utilities 2011, pp 320-324. **Note**: Values from Synapse 2011. |
| | T&D Costs | Yes | **Source**: Connecticut Utilities 2011, pp 320-323, 326-328. **Note**: Values from independent consultant quantifications. |
| | Environmental Compliance | Yes | **Source**: Connecticut Utilities 2011, pp 320-322, 329. **Note**: Values from Synapse 2011. |
| | Price Suppression | Yes | **Source**: Connecticut Utilities 2011, pp 320-322, 327-328. **Note**: Values from Synapse 2011. |
| | Line Loss Costs | Yes | **Source**: Connecticut Utilities 2011, pp 320-322, 327-328; Personal Communication with CT DEEP Staff. **Note**: Values from Synapse 2011. |
| | Reduced Risk | No | |
| | Other Avoided Costs | No | |
| OPIs/NEBs Included in Primary Cost-Effectiveness Test | Are OPIs included in Test(s)? | No | |
| | Program Administrator or Utility OPIs | No | |
| | Participant or Customer OPIs: | | |
| | Resource | No | |
| | Low-Income | Yes | **Source**: CT DPUC 1999; CT DPUC 2010. **Note**: Low-income programs that do not pass the cost-effectiveness test are still approved due to additional benefits that accrue to low-income customers. |
| | Equipment | No | |
| | Comfort | No | |
| | Health & Safety | No | |
| | Property Value | No | |
| | Utility Related | No | |
| | Societal OPIs | No | |

## Table A.3: Delaware[17]

| Cost-Effectiveness Metrics | | Policies & Practices | Notes & Sources |
|---|---|---|---|
| **Cost-Effectiveness Test(s) & Application** | Primary Test used by state | Total Resource Cost test | **Source:** Opinion Dynamics 2012a, pp 27 and 43. |
| | Other Test(s) considered (if applicable) | Societal Cost test; Ratepayer Impact Measure test | **Source:** Opinion Dynamics 2012a, p 27. **Note:** Used as advisory tests. |
| | Level at which Test(s) is applied | Portfolio level. Also reviews at program level. | **Source:** Opinion Dynamics 2012a, p 27. |
| | Discount rate used in Test(s) | Societal Discount Rate | **Source:** Opinion Dynamics 2012a, p 31. **Notes:** Set at the rate of the US Treasury's Government Bond rate for investment periods consistent with the Delaware program period. The rate will not change over the duration of the program period. |
| | Study period over which Test(s) is applied | Measure Lifetime | **Sources**: Title 26, Chapter 188, §1504, (a)3.c; Opinion Dynamics 2012a, pp 27, 31; Opinion Dynamics 2012b, p 329. **Note:** Full effective useful life of installed measures. 25 Years. |
| **Avoided Costs Included in Cost-Effectiveness Test(s)** | Capacity Costs | Yes | **Source:** Opinion Dynamics 2012a, p 50. |
| | Energy Costs | Yes | **Source:** Opinion Dynamics 2012a, p 50. |
| | T&D Costs | Yes | **Source:** Opinion Dynamics 2012a, p 50. |
| | Environmental Compliance | Yes | **Source:** Opinion Dynamics 2012a, p 50. |
| | Price Suppression | Yes | **Source:** Opinion Dynamics 2012a, pp 44, 50. **Notes:** Price Elasticity Adder is related to the benefit of a price reduction to all electricity consumers caused by a demand reduction. |
| | Line Loss Costs | Yes | **Source:** Opinion Dynamics 2012a, p 25. |
| | Reduced Risk | Yes | **Source:** Opinion Dynamics 2012a, pp 29, 50. **Note:** Reliability Adder reflects the reliability benefit of a demand reduction not already captured in the avoided cost of generation. |
| | Other Avoided Costs | Yes | **Source:** Opinion Dynamics 2012a, p 50. **Note:** Reduced SRECs and RECs requirements. |
| **OPIs/NEBs Included in Primary Cost-Effectiveness Test** | Are OPIs included in Primary Test(s)? | No OPIs are included in the TRC test. OPIs are included in the Societal Cost test. | **Source:** Opinion Dynamics 2012a, pp 27-30, 46. **Notes**: Procedures for calculating OPIs are still in development because Delaware is transitioning to an SEU-based program operation structure, and does not have rate-payer funded efficiency programs. Delaware has identified examples of OPIs to include in the Societal Cost test, but is purposely not limiting the list of OPIs that could be included in the test. |
| | Program Administrator or Utility OPIs | Not yet explicitly included in Societal Cost test. | |
| | Participant or Customer OPIs: | | |
| | Resource | Yes, in both the TRC and Societal Cost test. | **Source:** Opinion Dynamics 2012a, pp 27, 29. **Note**: Both the TRC and Societal Cost tests include benefits from natural gas, oil, wood, propane, water, and other resources. |
| | Low-Income | Not in TRC. Included in Societal Cost test. | **Source:** Opinion Dynamics 2012a, p 29. **Notes:** Societal Cost test includes benefits for low income programs including health and safety benefits. |
| | Equipment | Not in TRC. Included in Societal Cost test. | **Source:** Opinion Dynamics 2012a, p 29. **Note**: Societal Cost test includes benefits from improved productivity. |
| | Comfort | Not yet explicitly included in Societal Cost test. | |
| | Health & Safety | Not in TRC. Included in Societal Cost test. | **Source:** Opinion Dynamics 2012a, p 29. **Note**: Societal Cost test includes benefits from improved health and safety. |
| | Property Value | Not yet explicitly included in Societal Cost test. | |
| | Utility Related | Not yet explicitly included in Societal Cost test. | |
| | Societal OPIs | Not in TRC. Included in Societal Cost test. | **Source:** Opinion Dynamics 2012a, pp 28-30. **Notes:** Societal Cost test includes benefits from avoided environmental damage, economic stimulus, job creation, risk reductions, public health benefits. |

[17] It is important to note that Delaware's energy efficiency cost-effectiveness test policy is currently being finalized through the state regulatory process, and has not yet been formally accepted in regulations. Therefore, the results provided here for Delaware are subject to change.

## Table A.4: District of Columbia

| Cost-Effectiveness Metrics | | Policies & Practices | Notes & Sources |
|---|---|---|---|
| Cost-Effectiveness Test(s) & Application | Primary Test used by state | Societal Cost Test | **Source:** DC CAEA, § 202(d) |
| | Other Test(s) considered (if applicable) | n/a | |
| | Level at which Test(s) is applied | Portfolio level is primary screening level. Also reviews at measure, project, and program levels. | **Sources:** DC CAEA, § 202(d). DC SEU Contract. |
| | Discount rate used in Test(s) | Societal Discount Rate | **Source:** DC SEU Contract 2010, B.10.4. Personal Communication with DC DDOE Staff. **Note:** The societal discount rate is set each year at the 10 year treasury rate as posted in the Wall Street Journal on the first business day in October. The current real discount rate is 1.87%. |
| | Study period over which Test(s) is applied | Measure Lifetime | **Note:** Up to 30 years, but have had instances of longer measures lives. |
| Avoided Costs Included in Cost-Effectiveness Test(s) | Capacity Costs | Yes | **Source:** DC SEU Contract 2010, B.10.4. **Note:** Values from PEPCO filing. |
| | Energy Costs | Yes | **Source:** DC SEU Contract 2010, B.10.4. **Note:** Values from PEPCO filing (electricity), fuel costs based on Synapse's AESC report. |
| | T&D Costs | Yes | **Source:** DC SEU Contract 2010, B.10.4. **Note:** Values from PEPCO FERC filing. |
| | Environmental Compliance | Yes | **Source:** DC SEU Contract 2010, B.10.4. **Notes:** Values from Synapse's AESC report. A 10% adder could be applied to avoided demand and energy costs if additional research were required to calculate value. |
| | Price Suppression | Yes | **Source:** DC SEU Contract 2010, B.10.4. |
| | Line Loss Costs | Yes | **Source:** DC SEU Contract 2010, B.10.4. **Note:** Values determined in modeling exercises. |
| | Reduced Risk | Yes | **Source:** DC SEU Contract 2010, B.10.4. **Note:** 10% adder applied to benefits. |
| | Other Avoided Costs | No | |
| OPIs/NEBs Included in Primary Cost-Effectiveness Test | Are OPIs included in Primary Test(s)? | Yes | **Source:** DC SEU Contract 2010, B.10.4. **Note:** Difficult to calculate benefits are expressed in percent adders until greater refinement in calculating those benefits is achieved by the SEU. An adder equal to 10% of benefits (not including risk benefits) may be used to account for all identified OPIs if calculating the OPIs requires significant original research. DC currently relies on a 10% adder to account for OPIs. |
| | Program Administrator or Utility OPIs | No | |
| | Participant or Customer OPIs: | | **Note:** Included in 10% adder. |
| | Resource | Yes | **Notes:** Water and other fuels if applicable. Includes natural gas capacity and local delivery benefits. VEIC/SEU directly quantify these benefits, although a 5% adder could be applied if it is determined to be too costly to calculate natural gas values. |
| | Low-Income | No | |
| | Equipment | Yes | **Notes:** Changes in O&M expenses by measure are directly calculated, separate from the 10% adder. |
| | Comfort | Yes | **Notes:** Included in 10% adder. Includes comfort, noise reduction, aesthetics, improved productivity. |
| | Health & Safety | Yes | **Notes:** Included in 10% adder. Includes health and safety, reduced work absences due to reduced illnesses. |
| | Property Value | Yes | **Notes:** Included in 10% adder. Includes ease of selling/leasing home or building, ability to stay in home/avoided moves. |
| | Utility Related | No | |
| | Societal OPIs | Yes | **Notes:** Included in 10% adder. Includes macroeconomic benefits. |

## Table A.5: Massachusetts

| Cost-Effectiveness Metrics | | Policies & Practices | Notes & Sources |
|---|---|---|---|
| **Cost-Effectiveness Test(s) & Application** | Primary Test used by state | Total Resource Cost Test | **Source:** MA DPU 2013a, Guidelines § 3.4.3. |
| | Other Test(s) considered (if applicable) | n/a | |
| | Level at which Test(s) is applied | Program level | **Source:** MA DPU 2013a, Guideline § 3.4.3.1.<br>**Notes:** Hard-to-measure EE programs are screened at the customer sector level. MA EE Guidelines, § 3.4.3.2. |
| | Discount rate used in Test(s) | 10 year Treasury Note | **Source:** MA DPU 2013a, Guideline § 3.4.6.<br>**Note:** "A discount rate that is equal to a twelve-month average of the historic yields from the ten-year United States Treasury note, using the previous calendar year to determine the twelve-month average." In the 2013-2015 plans, the nominal discount rate was 2.78% and the real discount rate was 0.55%. |
| | Study period over which Test(s) is applied | Measure Lifetime | 25 years. |
| **Avoided Costs Included in Cost-Effectiveness Test(s)** | Capacity Costs | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(a)(i).<br>**Note:** Values from Synapse 2011. |
| | Energy Costs | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(a)(ii).<br>**Note:** Values from Synapse 2011. |
| | T&D Costs | Yes | **Source:** MA DPU 2013a, Guidelines § 3.4.4.1(a)(iii), (iv).<br>**Note:** Values developed individually by Program Administrators. |
| | Environmental Compliance | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(a)(v).<br>**Notes:** "Reasonably projected to be incurred in the future." Values from Synapse 2011. |
| | Price Suppression | Yes | **Source:** MA DPU 2013a, Guidelines § 3.4.4.1(a)(vi), (vii).<br>**Notes:** Both capacity and energy price suppression. Values from Synapse 2011. |
| | Line Loss Costs | Yes | **Note:** Values from Synapse 2011. |
| | Reduced Risk | No | |
| | Other Avoided Costs | No | |
| **OPIs/NEBs Included in Primary Cost-Effectiveness Test** | Are OPIs included in Primary Test(s)? | Yes | **Source:** MA DPU 2013a, Guidelines § 3.4.4.1(a)(viii), (b)(ii).<br>**Note:** Each OPI is explicitly quantified. |
| | Program Administrator or Utility OPIs | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(a)(viii).<br>**Note:** Each OPI is explicitly quantified. |
| | Participant or Customer OPIs: | | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii).<br>**Note:** Each OPI is explicitly quantified. |
| | Resource | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(i).<br>**Notes:** Includes natural gas, oil, propane, wood, kerosene, water, other. Each OPI is explicitly quantified. |
| | Low-Income | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii)(D).<br>**Notes:** Includes all benefits associated with providing energy efficiency services to Low-Income Customers. Each OPI is explicitly quantified. |
| | Equipment | Yes | **Source:** MA DPU 2013a, Guidelines § 3.4.4.1(b)(ii)(A), (B).<br>**Notes:** Includes reduced costs for operation and maintenance associated with efficient equipment or practices, the value of longer equipment replacement cycles and/or productivity improvements associated with efficient equipment. Each OPI is explicitly quantified. |
| | Comfort | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii).<br>**Note:** Each OPI is explicitly quantified. |
| | Health & Safety | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii)(C).<br>**Notes:** Includes reduced environmental and safety costs, such as those for changes in a waste stream or disposal of lamp ballasts or ozone-depleting chemicals. Each OPI is explicitly quantified. |
| | Property Value | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii).<br>**Note:** Each OPI is explicitly quantified. |
| | Utility Related | Yes | **Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii).<br>**Notes:** Includes reductions in all costs to the electric distribution company associated with reduced customer arrearages and reduced service terminations and reconnections. Each OPI is explicitly quantified. |
| | Societal OPIs | No | **Source:** MA DPU 2013b, pp 105-106.<br>**Note:** The MA DPU explicitly directed the removal of certain societal OPIs from TRC test. |

## Table A.6: New Hampshire

| Cost-Effectiveness Metrics | | Policies & Practices | Notes & Sources |
|---|---|---|---|
| Cost-Effectiveness Test(s) & Application | Primary Test used by state | Total Resource Cost Test | **Source:** NH PUC 2000, p 14. |
| | Other Test(s) considered (if applicable) | n/a | |
| | Level at which Test(s) is applied | Program level | **Source:** NH PUC 2000, pp 4-5, 14. |
| | Discount rate used in Test(s) | Prime Rate | **Source:** NH PUC 2000, p 5; NH Utilities 2012, p 65.<br>**Note:** Adjusted annually, on or around June 1. Current Real Discount rate of 2.46%; nominal discount rate of 3.25%; inflation rate of 0.50%. |
| | Study period over which Test(s) is applied | Measure Lifetime | **Source:** NH Utilities 2012.<br>**Note:** 25 Years. |
| Avoided Costs Included in Cost-Effectiveness Test(s) | Capacity Costs | Yes | **Source:** NH PUC 2000, pp 4, 14-15.<br>**Note:** Values from Synapse 2011. |
| | Energy Costs | Yes | **Source:** NH PUC 2000, pp 4, 14-15.<br>**Note:** Values from Synapse 2011. |
| | T&D Costs | Yes | **Source:** NH Utilities 2012.<br>**Note:** Values based on utilities' weighted costs. |
| | Environmental Compliance | Yes | **Source**: NH PUC 2007; see NH Utilities 2007, p 60.<br>**Note:** Included in Synapse's 2011 AESC Study avoided cost values. |
| | Price Suppression | No | |
| | Line Loss Costs | Yes | **Source**: NH Utilities 2012.<br>**Note:** Values based on utility assumptions. |
| | Reduced Risk | No | |
| | Other Avoided Costs | No | |
| OPIs/NEBs Included in Primary Cost-Effectiveness Test | Are OPIs included in Primary Test(s)? | Yes, but only resource OPIs. | **Source:** NH PUC 2007.<br>**Notes:** OPIs are excluded because they are not adequately quantifiable. |
| | Program Administrator or Utility OPIs | No | |
| | Participant or Customer OPIs: | | |
| | Resource | Yes | **Source:** NH PUC 2000, p 4.<br>**Notes:** "Quantifiable benefits and costs associated with other resources in addition to electricity (e.g., water, gas, oil)." Values from Synapse 2011. |
| | Low-Income | Yes | **Source:** NH PUC 2000.<br>**Notes:** The working group report that this order approves recommends that low-income programs not be required to pass the 1.0 BCR threshold. |
| | Equipment | No | |
| | Comfort | No | |
| | Health & Safety | No | |
| | Property Value | No | |
| | Utility Related | No | |
| | Societal OPIs | No | |

## Table A.7: New York

| Cost-Effectiveness Metrics | | Policies & Practices | Notes & Sources |
|---|---|---|---|
| **Cost-Effectiveness Test(s) & Application** | Primary Test used by state | Total Resource Cost Test | **Source:** NY PSC 2008, App. 3. |
| | Other Test(s) considered (if applicable) | n/a | **Source:** Personal Communication with NY DPS Staff; ConEdison 2013.<br>**Notes:** A couples of times in recent years rate impact assessments were considered as part of energy efficiency screening. |
| | Level at which Test(s) is applied | Measure Level | **Source**: Personal Communication with NY DPS Staff; NY PSC 2011a, p 10.<br>**Note:** Measures are pre-screened for cost-effectiveness. Project level screenings are also conducted and are not provided to the DPS staff but are subject to audit. New programs are often screened at the program level, but the results do not impact the DPS's determination. |
| | Discount rate used in Test(s) | Utility Weighted Debt/Equity Cost of Capital | **Source:** NYSERDA 2011, p 8-8; Personal Communication with NY DPS Staff.<br>**Notes:** Currently 5.5% real, 7.72% nominal. |
| | Study period over which Test(s) is applied | Measure Lifetime | **Source**: NYSERDA 2011, p 8-8; NYDPS; NY PSC 2011b.<br>**Notes:** Estimated mean measure lifetime. |
| **Avoided Costs Included in Cost-Effectiveness Test(s)** | Capacity Costs | Yes | **Source:** NY PSC 2009a, pp 33-38.<br>**Notes:** Generation is based on FERC price-setting and NYISO market values, with projections based on need date. |
| | Energy Costs | Yes | **Source**: NY PSC 2009a, pp 33-38.<br>**Notes:** Baseline year historic NYISO LBMPs with projections based on MAPS simulations. |
| | T&D Costs | Yes | **Source:** NY PSC 2009a, pp 33-38.<br>**Notes**: Values established by tariff studies. Avoided transmission costs embedded in avoided energy costs. |
| | Environmental Compliance | Yes | **Source:** NY PSC 2008.<br>**Notes:** credit for avoided CO2 emissions at $15/ton. |
| | Price Suppression | No | |
| | Line Loss Costs | Yes | **Source:** NY PSC 2009a, App. 2.<br>**Note:** Divide marginal costs by 0.928 or multiply the savings by (1+7.76%). Avoided transmission line loss costs embedded in avoided energy costs. |
| | Reduced Risk | No | |
| | Other Avoided Costs | No | |
| **OPIs/NEBs Included in Cost-Effectiveness Test(s)** | Are OPIs included in Test(s)? | Yes | **Source:** NY PSC 2008; Personal Communication with NY DPS Staff.<br>**Note:** The DPS provides guidelines for program administrators to report various OPIs qualitatively. In practice, only other resource savings and low income and O&M benefits have been incorporated into screening practices. |
| | Program Administrator or Utility OPIs | No | |
| | Participant or Customer OPIs: | | |
| | Resource | Yes | **Source:** Personal Communication with NY DPS Staff.<br>**Notes:** Includes water and other fuels. Can be modeled as a reduced O&M cost as subtracted from measure costs. |
| | Low-Income Only | Yes | **Source:** NY PSC 2010, pp 64-65.<br>**Note:** Co-benefits considered as part of qualitative analysis, including effect on low-income customers. At least one low-income program was approved despite a TRC ratio less than 1.0. |
| | Equipment | Yes | **Source:** Personal Communication with NY DPS Staff.<br>**Notes:** Flexibility for O&M savings. |
| | Comfort | No | |
| | Health & Safety | No | |
| | Property Value | No | |
| | Utility Related | No | |
| | Societal OPIs | No | |

## Table A.8: Rhode Island

| Cost-Effectiveness Metrics | | Policies & Practices | Notes & Sources |
|---|---|---|---|
| Cost-Effectiveness Test(s) & Application | Primary Test used by state | Total Resource Cost Test | **Source**: RI PUC 2011, p 24. |
| | Other Test(s) considered (if applicable) | n/a | |
| | Level at which Test(s) is applied | Portfolio level | **Source**: RI PUC 2011, p 26. |
| | Discount rate used in Test(s) | 10 year Treasury Note | **Note:** Latest Real Discount Rate is 1.15%, Nominal is 3.22%, Inflation is 1.6%. |
| | Study period over which Test(s) is applied | Measure Lifetime | 25 years. |
| Avoided Costs Included in Cost-Effectiveness Test(s) | Capacity Costs | Yes | **Source**: RI G.L. c, 39-1, § 39-1-27.7.1(f).<br>**Note:** Values from Synapse 2011. |
| | Energy Costs | Yes | **Source**: RI G.L. c, 39-1, § 39-1-27.7.1(f).<br>**Note:** Values from Synapse 2011. |
| | T&D Costs | Yes | **Source**: RI PUC 2008.<br>**Note:** Values developed from a third-party modeling tool. |
| | Environmental Compliance | Yes | **Source:** RI PUC 2011, pp 24, 27.<br>**Note:** Values from Synapse 2011. Only considers RGGI related benefits. |
| | Price Suppression | Yes | **Source:** RI PUC 2008.<br>**Note:** Values from Synapse 2011. |
| | Line Loss Costs | Yes | **Note:** Values from Synapse 2011. |
| | Reduced Risk | No | |
| | Other Avoided Costs | No | |
| OPIs/NEBs Included in Primary Cost-Effectiveness Test | Are OPIs included in Primary Test(s)? | Yes | **Source:** RI PUC 2011, p 27.<br>**Note:** Each OPI is explicitly quantified. |
| | Program Administrator or Utility OPIs | Yes | **Note:** Values from National Grid 2012, Appendix C. |
| | Participant or Customer OPIs: | | |
| | Resource | Yes | **Note:** Includes gas, oil, water, and waste water. Values from National Grid 2012, Appendix C. |
| | Low-Income | Yes | **Note:** Values from National Grid 2012, Appendix C. |
| | Equipment | Yes | **Note:** Values from National Grid 2012, Appendix C. |
| | Health & Safety | Yes | **Note:** Values from National Grid 2012, Appendix C. |
| | Comfort | Yes | **Note:** Values from National Grid 2012, Appendix C. |
| | Property Value | Yes | **Note:** Values from National Grid 2012, Appendix C. |
| | Utility Related | Yes | **Note:** Values from National Grid 2012, Appendix C. |
| | Societal OPIs | Yes | **Note:** Values from National Grid 2012, Appendix C. |

## Table A.9: Vermont

| Cost-Effectiveness Metrics | | Policies & Practices | Notes & Sources |
|---|---|---|---|
| **Cost-Effectiveness Test(s) & Application** | Primary Test used by state | Societal Cost Test | **Source:** VT PSB 1990a, Section V.14. |
| | Other Test(s) considered (if applicable) | Program Administrator Cost Test; Total Resource Benefits Test | **Source:** Personal Communication with VT PSD Staff. **Note:** Efficiency programs are required to meet the Program Administrator test in order for the utility to receive a performance incentive. Further, 25% of the utility's performance incentive is based on the Total Resource Benefits achieved. |
| | Level at which Test(s) is applied | Portfolio level is primary screening level. Also reviews at measure, project, and program levels. | **Source:** Efficiency Vermont 2011, pp 3-4. **Note:** The decisive "test" under each perspective is the size of the net benefits, rather than the benefit/cost ratio. |
| | Discount rate used in Test(s) | Societal Discount Rate | **Source**: VT PSB 2012a, p 21. **Note:** Discount rate is 3% (real dollars), which is revisited as part of the biennial EEU avoided-cost proceedings. |
| | Study period over which Test(s) is applied | Measure Lifetime | **Source:** Efficiency Vermont 2011, p 4; Personal Communication with VEIC and VT PSD Staff. **Note**: Cost-effectiveness is assessed over the near term (3 years or less) and longer term (3-20 years). However, 30 years is the maximum number of years allowed in the screening analysis, and there have been instances of even longer measures lives. |
| **Avoided Costs Included in Cost-Effectiveness Test(s)** | Capacity Costs | Yes | **Source:** VT PSB 2011. **Note:** Values from Synapse 2011. |
| | Energy Costs | Yes | **Source:** VT PSB 2011. **Note:** Values from Synapse 2011. |
| | T&D Costs | Yes | **Source:** VT PSB 2012b. **Note:** T&D working group established by VT Public Service Board. |
| | Environmental Compliance | Yes | **Source:** VT PSB 2011. **Notes:** Environmental compliance and "externality" values from Synapse's 2011 AESC Study are used for the Societal Cost Test. Externality values not used for TRB or PA tests. |
| | Price Suppression | No | **Source:** Volz, James, et al. **Notes**: Memo denies the use of price suppression effects for Vermont. |
| | Line Loss Costs | Yes | **Source:** Personal Communication with VEIC. |
| | Reduced Risk | Yes | **Source**: VT PSB 2012a, p 23. **Note:** Costs of efficiency measures are decreased by 10%, which will be revisited in the next biennial EEU avoided-cost proceeding. |
| | Other Avoided Costs | No | |
| **OPIs/NEBs Included in Primary Cost-Effectiveness Test** | Are OPIs included in Primary Test(s)? | Yes | **Source**: VT PSB 2012a, p 26. **Note:** A 15% adder is applied to energy benefits. |
| | Program Administrator or Utility OPIs | Yes | **Note:** Included in the 15% adder. |
| | Participant or Customer OPIs: | | |
| | Resource | Yes | **Source:** VT PSB 2012a. **Note:** Water and fuel savings and benefits are directly calculated, separate from the 15% adder. |
| | Low-Income | Yes | **Source**: VT PSB 2012a, p 33. **Note:** An additional 15% adder is applied to the energy benefits of the low-income sector. |
| | Equipment | Yes | **Source:** VT PSB 2012a. **Note:** Changes in O&M expenses by measure are directly calculated, separate from the 15% adder. |
| | Comfort | Yes | **Note:** Included in the 15% adder. |
| | Health & Safety | Yes | **Note:** Included in the 15% adder. |
| | Property Value | Yes | **Note:** Included in the 15% adder. |
| | Utility Related | Yes | **Note:** Included in the 15% adder. |
| | Societal OPIs | Yes | **Source:** VT PSB 2011. **Note**: Included in the 15% adder. |

# Appendix B – Summary of Recent Literature

## Is it Time to Ditch the TRC? Examining Concerns with Current Practice in Benefit-Cost Analysis[18]

This paper discusses how energy efficiency programs have changed substantially over time with respect to the kinds of measures being promoted, the ways in which they are promoted, and the breadth and depth of their impact. The authors argue that such change necessitates a re-examination of how cost-effectiveness screening of demand-side investment is conducted. In particular, non-energy benefits (NEBs) are not factored into cost-effectiveness tests, and supply investments are not subject to cost-effectiveness testing. Applying a TRC test screen to utility energy efficiency programs imposes a cost-effectiveness burden that is not applied to any other utility resource.

While many energy efficiency programs intentionally emphasize NEBs, measuring and quantifying NEBs is very difficult and often controversial for regulators to accept as a legitimate factor in utility regulation. In contrast, the full retail cost of an efficiency investment is easy to quantify, and virtually always included in cost-effectiveness testing. The end result is that cost-effectiveness screening becomes inherently skewed, with all of the costs compared to just a portion of the benefits. Such a result fundamentally biases regulatory decisions against efficiency investments, especially since numerous studies suggest that NEBs can be quite large. Omitting such benefits from cost-effectiveness screening can significantly reduce the number of measures that can be promoted within programs.

The authors provide three possible solutions to overcome the NEBs issue. The first option is to assess how much of the total cost is attributable to energy savings and use that portion of the total cost in the TRC test cost-effectiveness calculation. Second, regulators could require that all non-energy benefits are estimated and factored into TRC test screening. Both of these approaches would provide a more balanced assessment of costs and benefits. However, such approaches would also require potentially significant additional expenditure on evaluations. Combined with other disadvantages, these solutions are limited yet workable in certain situations. Finally, the PAC test could be used instead of the TRC test. This approach is simpler, less expensive, less controversial, and would create some symmetry in how supply-side investments are assessed.

## Some Thoughts on Treating Energy Efficiency as a Resource[19]

The purpose of this paper is to more clearly define, through three primary principles, what is implied when energy efficiency is treated as a resource. First, for energy efficiency to be treated as a resource, parity in resource planning must be ensured. This means that assessments of resource cost and availability for energy efficiency are developed with the same rigor as cost and performance estimates for new generating, transmission, and distribution facilities. Such parity should permit that energy efficiency resources not be constrained by geographical location. Parity between supply curves for energy efficiency and those prepared for generating resources also requires that forecasts of achievable energy efficiency potential not be limited by a utility's

[18] Neme and Kushler 2010.
[19] Eckman 2011.

willingness to pay for efficiency measures. Supply curves represent the cost that a utility forecasts it is willing to pay to develop or acquire resources. Finally, parity in resource planning requires that investments in energy efficiency resources not be assumed to be constrained by rate impacts or limits on funding available through public benefit charges.

The second principle to ensure energy efficiency is treated as a resource, the author explains, is equality in cost-effectiveness analysis. The industry-adopted California Standard Practice Manual does not treat energy efficiency and generating resources equally. The California Standard Practice Manual considers all costs incurred in the acquisition of new resources, yet only considers the net savings resulting from those investments (i.e., incorporates the impact of free riders on savings). Estimating the extent of free riders is a measure of the distribution of cost among parties, and not a measure of whether an investment's total benefits exceed its total costs. Utility rebates taken by free riders are still investments in the lowest cost source of supply. This regulatory model often focuses on the question of whether the share of costs to acquire energy efficiency savings being borne by ratepayers is equitable, not whether it is the most economically efficient course of action. The Northwest Power Planning and Conservation Act applies a better approach, whereby resource planners are required to be agnostic about whether a resource is on the supply side or a demand side of the meter when evaluating its relative economic merit.

Finally, for energy efficiency to be considered a resource there must be symmetry in resource acquisition payments. Utilities should base the amount of energy efficiency resources they estimate can be developed by offering consumers full cost reimbursement of all measures in their supply curve that cost less than new generation supplying the same load service function. This does not mean that the utility must offer to pay the full incremental cost of an energy efficiency measure. However, it does mean that utilities should size the amount of energy efficiency it should acquire based on the understanding that it is cost-effective to pay a measure's full incremental cost. Finally, the method for accounting for the cost of energy efficiency resources from ratepayers is asymmetrical because energy efficiency is explicitly shown as a line item on customers' bills while generation resources are buried in other line items on the bill.

## A National Survey of State Policies and Practices for the Evaluation of Ratepayer-funded Energy Efficiency Programs[20]

The ACEEE study provides the results of a comprehensive survey and assessment of the "state of the practice" of utility-sector energy efficiency program evaluations across the 50 states and the District of Columbia. The results of this study confirm the widespread perception that there is a great diversity among the states in how they handle the evaluation of ratepayer-funded energy efficiency programs.

With regard to cost-effectiveness tests, ACEEE found that most states at least consider several or all of the five primary cost-effectiveness tests. However, most states rely on the TRC test as the primary test for decision-making, while six states rely on the Societal Cost test and five states rely on the PAC test. The ACEEE study noted, that in a field where diversity and inconsistency among states is the rule, every single state replies upon one or more of the five tests outlined in the California Standard Practice Manual (CA PUC 2001). Acceptance of a single common source is a

[20] ACEEE 2012.

good first step toward the possibility of establishing certain national standard of best evaluation practices across the states.

Most states screen for cost-effectiveness at the portfolio level or program level. Many states that screen at the program level make exceptions to cost-effectiveness requirements for certain programs (e.g., low-income programs or pilot programs). Some states screen at the measure level, although most of these states make exceptions for low-income programs or measures that can be bundled together into a cost-effective package (e.g., whole house type programs).

Every state in the ACEEE survey uses some measure of utility system avoided costs as a benefit. A total of 26 states calculate avoided costs individually for each utility, while 14 states make avoided cost calculations on a statewide basis. Most utilities develop the avoided cost estimates on their own. However, in some states either the Commission develops them, they are developed by another designated organization, or the utility uses estimates developed in other states. States use various methodologies to estimate avoided costs, including fixed values based on the assumed next power plan, more sophisticated modeling of average or marginal system cost, market price based methods, or other approaches. The majority of states include avoided transmission and distribution costs in their calculation of avoided costs.

Only 12 states treat any type of participant non-energy benefit as a benefit. In contrast, 36 states treat participant costs for the energy efficiency measures as a cost. Many of the non-energy participant benefits considered by states are limited to water and other fuel savings.

Regarding environmental benefits from energy efficiency resources, a total of 13 states quantify some environmental benefits, of which at least eight calculate a specific value while the remaining states use a more general environmental adder. At least ten states include the issue of carbon (i.e., climate change) as part of their rationale for quantifying an environmental benefit.

The ACEEE study found that the median discount rate used by a subset of 12 states was 5.5 percent, with a range of 2 percent to 8.89 percent.

## Best Practices in Energy Efficiency Program Screening: How to Ensure that the Value of Energy Efficiency is Properly Accounted For [21]

The purpose of the NHPC report was to identify the best practices available for screening energy efficiency resources, in order to capture and assess the full value of those resources. As identified in the NHPC report, the best practices to use in applying the cost-effectiveness tests when screening energy efficiency resources include: fully accounting for other program impacts (OPIs) where appropriate; properly estimating avoided costs; using the most appropriate discount rate; capturing spillover effects; fully accounting for the risk benefits of energy efficiency. Each of these best practices as detailed in the NHPC report is summarized below.

There are three categories of other program impacts. First, utility-perspective OPIs include, for example, reduced customer arrearages and reduced bad debt write-offs. Second, participant-perspective OPIs include, for example, improved health, increased safety, other fuel savings, reduced maintenance costs, and increased comfort. Many of these participant-perspective OPIs

[21] Synapse 2012a.

are especially significant for low-income customers. Finally, societal-perspective OPIs include, for example, reduced environmental impacts and reduced costs of providing health care.

These OPIs should be included in cost-effectiveness tests for which the relevant costs and benefits are applicable. The primary rationale for including OPIs is to ensure that the tests are internally consistent. This is especially important in the application of the TRC test. By definition, this test includes the participant cost of the energy efficiency measures, which can be quite large in many cases. In order for the TRC test to be internally consistent, it must also include the participant benefits from the energy efficiency measures, including OPIs.

Among the participant-perspective OPIs that should be included in the TRC test, there are two types that deserve mention at this point: low-income other program benefits, and other fuel savings. First, these two types of OPIs tend to have the biggest impact on the cost-effectiveness of certain programs. Second, these two types of OPIs tend to support important public policy goals of regulators and other stakeholders. Low-income other program benefits are vital because they help justify programs that serve an important, hard-to-reach, disadvantaged set of customers. Other fuel savings are important because they help justify comprehensive residential retrofit and residential new construction programs that are designed to treat multiple fuels in customers' homes. Combined, these OPIs help to support much more comprehensive residential programs and to serve a more diverse set of residential customers, which promotes greater customer equity, both within the residential sector and between the residential and other sectors. Promoting customer equity is clearly an important public policy goal of regulators.

Energy efficiency programs result in several types of avoided costs, and each of them should be included in the screening analysis and calculated correctly. First and foremost, avoided energy and capacity costs should be based on long-term forecasts that properly capture the energy and capacity impacts of energy efficiency resources, account for the structure of the market in which the relevant utility operates, and capture differences between peak and off-peak periods.

It is important to account for the cost of transmission and distribution that is avoided by energy efficiency. All energy efficiency program administrators develop reasonable estimates of avoided T&D costs, using methodologies that are best able to capture the expected future costs of transmission and distribution in their system and their region. These avoided costs can be significant and will have important implications for energy efficiency cost-effectiveness screening.

The avoided costs of compliance with environmental regulations should be explicitly accounted for in the Societal Cost test, the TRC test and the PAC test. The costs of environmental compliance will eventually be passed on to ratepayers, and those that can be avoided should be included as part of the avoided costs of energy efficiency.

In regions of the country with organized wholesale energy and capacity markets, energy efficiency resources will reduce energy and capacity demands, which can lead to reduced wholesale energy and capacity prices. Because wholesale energy and capacity markets provide a single clearing price to all wholesale customers, the reductions in wholesale energy and capacity clearing prices are experienced by all customers of those markets. This price suppression effect should be included as one of the benefits of energy efficiency in those regions with competitive wholesale electric markets.

Generating facilities are often located at great distances from customers and require step-up transformers to get the power onto the transmission system, long transmission lines, transmission substations, step-down transformers to distribution voltages, distribution lines, and distribution line transformers. Losses occur at each of these steps of the transmission and distribution system. Marginal line losses are the losses actually avoided when energy efficiency measures are installed, and are usually significantly larger than average line losses. Marginal line losses require more information and more detailed calculations to measure than average losses, and few utilities or regulators have studied the marginal losses that can be avoided with incremental investments in efficiency measures that provide savings at the time of extreme peak demands. However, energy efficiency measures typically provide significant savings at the time of the system peak demand, and that time occurs when the line losses are highest. Therefore, program administrators should use marginal line losses in efficiency cost-effectiveness screenings instead of average line losses.

The choice of discount rate to use for calculating the present values of costs and benefits has significant implications for the cost-effectiveness of energy efficiency programs. This is because program costs are typically incurred in the early years, while program benefits are enjoyed over the life of the energy efficiency measure. The different cost-effectiveness tests require the use of different discount rates because they represent the perspectives of different decision-makers. The Societal Cost test requires the use of a societal discount rate, which is typically very low due to society's (i.e., government's) tolerance for waiting for future benefits, and its ability to access funds at relatively low borrowing costs. The discount rate applied to the TRC test and the PAC test should reflect the lower financial risk of energy efficiency investments to utilities, as compared to higher-risk supply-side resources. States should use a generic market indicator of a low-risk investment, such as the interest rate on long-term US Treasury Bills, when applying the TRC test or the PAC test.

It is also important to recognize that energy efficiency can mitigate various risks associated with energy planning and the construction and operation of large, conventional power plants. These risks include fuel price risk, construction cost risk, planning risk, reliability risk, and risks associated with new regulations. These risk benefits should be accounted for when screening energy efficiency programs, either through system modeling or through risk adjustments to the energy efficiency benefits.

Energy efficiency measures produce savings over the course of their useful lives. Depending on the measure, the effective useful life can be as long as 20 years or more. Energy efficiency screening practices should use a study period that includes the full useful life of the measures.

Cost-effectiveness tests should be applied at the appropriate level in the planning process. States should not require energy efficiency to be screened at the measure level, because this is unnecessarily restrictive given that it ignores important interactions between measures and/or programs. In particular, it ignores the fact that some measures have benefits in terms of encouraging customers to adopt other efficiency measures.

### Energy Efficiency Cost-Effectiveness Screening: How to Properly Account for Other Program Impacts and Environmental Compliance Costs [22]

[22] Synapse 2012b.

The purpose of the RAP report was to address two elements of energy efficiency program screening that are frequently treated improperly, and therefore provide biased results: other program impacts and the costs of complying with environmental regulations. These recommendations regarding these two elements and other cost-effectiveness screen practices as presented in the RAP report are summarized, below.

Similar to the NHPC report, the RAP report recommends that OPIs should be included in cost-effectiveness test for which the relevant costs and benefits are applicable: When using the Societal Cost test, it is important to account for the utility-perspective, participant-perspective, and societal-perspective OPIs to the greatest extent possible. When using the TRC test, it is important to account for the utility-perspective and participant-perspective OPIs to the greatest extent possible.

Unfortunately OPIs are rarely accounted for in a comprehensive manner, are often understated, and are frequently ignored altogether. When OPIs are improperly understated in this way, then the TRC and the Societal Cost tests will include all of the relevant costs but not all of the relevant benefits. As a result, the cost-effectiveness analysis will provide misleading results that are skewed against energy efficiency, and will result in under-investment in energy efficiency programs and higher costs for customers.

Those states that do account for OPIs have found that they can be quite large and are difficult to fully quantify and monetize. This is especially true for all of the participant-perspective non-energy benefits associated with all energy efficiency programs. Nonetheless, when applying the Societal Cost test or the TRC test, using the best estimates available is a significant improvement over using no estimates at all.

However, when including participant-perspective and societal-perspective OPIs it is important to consider customer equity concerns. Properly accounting for OPIs and the associated public policy benefits may increase the universe of efficiency measures that are deemed cost-effective. This may lead to increased energy efficiency budgets, or in the case of limited efficiency budgets it may result in the adoption of a different, more expensive mix of efficiency measures. In addition, properly accounting for OPIs and the associated public policy benefits may be seen as burdening utility customers with costs for achieving benefits that are not related to utility services. This is a critical consideration, particularly for states that are pursuing aggressive levels of energy efficiency savings or pursuing all cost-effective energy efficiency.

To address this concern, the RAP report recommends that (a) the TRC test or the Societal Cost test be applied (with all relevant OPIs) when screening energy efficiency programs; and (b) the PAC test be applied to the entire portfolio of efficiency programs. The PAC test includes only those costs and benefits that affect utility revenue requirements, and thus provides a clear indication of potential impacts on customer bills. If a portfolio of efficiency programs passes the PAC test, then regulators and other stakeholders will be assured that the portfolio will result in a net reduction in utility costs to utility customers. This net reduction in utility costs from the portfolio of energy efficiency programs can also be directly quantified to provide a clear indication of direct customer benefits.

The RAP report also makes recommendations regarding the costs of complying with environmental regulations. The US Environmental Protection Agency (EPA) has proposed and promulgated a number of environmental rulemakings that have significant implications for the operation of existing and new power plants. Costs associated with complying with these regulations should be included in the PAC, the TRC, and the Societal Cost tests when evaluating energy efficiency resources. These costs are not environmental externalities; they will be incurred by utilities and passed on to ratepayers, and therefore should be included in all of these tests.

All states should recognize the importance of accounting for climate change compliance costs now. Uncertainty regarding the timing and size of those costs does not justify inaction. Resource decisions made today should be based on the best assumptions available about the conditions that will exist over long periods of time to account for the life of supply- and demand-side resources. Energy efficiency program administrators should account for all anticipated environmental compliance costs (EPA regulations, climate change requirements, and others), because this is the most accurate reflection of the future, and these environmental requirements can have significant cumulative effects.

## Whose Perspective? The Impact of the Utility Cost Test[23]

This paper examines the theory behind each test's perspective; the rationale for adopting each test; and key outcomes, including achieved savings, overall cost-effectiveness, cost-per-kWh, and the diversity of program offerings. The authors find that the TRC and PAC tests generally use the same benefits with the exception of measures where the rebate exceeds the incremental cost or where tax credits are available resulting in significant differences in cost-effectiveness. With regard to costs, the TRC test uses a measure's incremental cost, while the PAC test only uses the cost paid by the utility (generally as rebates to participating customers).

While the California Standard Practice Manual cites the TRC's scope as a strength, given it captures all demand-side option costs, this can also be considered its weakness. A price impact perspective considers only costs incurred by the utility as relevant. While utilities typically incur total costs of supply-side options, demand-side options incur only program administration and incentive costs. Using the PAC test accounts for this difference in accounting for supply- and demand-side costs.

The use of the TRC test appears to be driven by a concern for appropriate use of ratepayer funds. However, some states have recently adopted the PAC test to put demand-side resources on the same footing as supply-side resources, and to increase demand side management resources selected as cost-effective in future integrated resource planning cases.

However, customers commonly participate in programs that do not pass the Participant Cost test or TRC test, indicating that costs have been overstated or not all benefits perceived by participants have been accurately captured. In such instances, the authors reason, it is worthwhile to review the Participant Cost test results as an indicator of non-energy benefits, but to rely on the PAC test as it more accurately reflects economics and behavior. Indeed, relying on the PAC test can expand program offerings and potential savings, but use of the TRC and Participant Cost tests can assist in carefully assessing measures for program inclusion, setting rebate levels, and forecasting participation.

[23] Daykin et al. 2012.

The authors ultimately recommend testing energy efficiency programs using the TRC test to provide a cost comparison with supply-side resources, and relying on the PAC test as the threshold test for program approval and cost recovery.

## Valuing Energy Efficiency: The Search for a Better Yardstick[24]

This article addresses modifications to the TRC test and use of the PAC test. The authors explain that the market for ratepayer-funded energy efficiency is shrinking due to new energy building codes and equipment standards, market saturation from successful energy efficiency programs, and declining avoided energy costs. Such factors have spawned a wave of ideas to reform the TRC test, and while the arguments for a modified TRC test come in many guises, they share the objective of lowering the threshold for determining cost-effectiveness.

One proposed TRC test modification is to expand program benefits to include OPIs, but that can only be achieved through use of the Societal Cost test. Such benefits are difficult to quantify directly, leading several states to adopt simple adders to represent the benefits. Other attempts have been made to account for OPIs indirectly, either by lowering the discount rate or ignoring the participant's contributions in measure costs. However, there is no economically justifiable rationale for lowering the discount rate, nor would such an approach be consistent with the idea of treating supply- and demand-side resources equally.

The authors also take issue with the incremental costs included in the TRC test, which represents the cost of the efficient measure relative to a baseline technology. The TRC test's reliance on incremental costs has lead program administrators to view incentives as a means of defraying part of the participant's cost, rather than reflecting the value of the energy saved. Such a cost-based method is inconsistent with the basic principle of integrated resource planning, as the choice of energy supply options is made on the value of their output not their incremental costs. The article states that avoided costs should establish the incentive ceiling, and program administrators should pay as little as possible to acquire the resources they need. Furthermore, including incentive payments in the TRC test double-counts that portion of the measure's cost because incentives are considered transfer payments.

To the authors, the PAC test is superior to the TRC test since there is no question as to the appropriateness of using the utility's cost of capital to discount savings, or how the incentive payments should be treated. The PAC test is also more consistent with the basic idea of least-cost planning, and is more straightforward from a resource procurement point of view.

The grim outlook for avoided costs due to natural gas price forecasts could be exaggerated. Natural gas prices are historically volatile, and could rise as quickly as they have fallen. Eventually, natural gas prices will increase. Further, incorporating externalities, specifically the cost of carbon, into the price of power would lead to higher avoided costs. Including externalities would also coordinate supply-side with demand-side policies more closely. Additionally, if avoided costs were based on the price of renewables, as is the case in British Columbia, then that would raise the benchmark for energy efficiency cost-effectiveness.

[24] Haeri and Khawaja 2013.

The California Standard Practice Manual cost-effectiveness tests ignore the equity question of whether energy efficiency programs benefit all ratepayers or just the average ratepayer. A study of rate impacts provides such an analysis, not cost-effectiveness testing. Energy efficiency affects a utility's average revenue requirement as well as its sales, therefore any program that passes the TRC test or PAC test would lower the utility's revenue requirement and customer bills would go down. Rate impacts also vary over time, with the greatest impacts shown in the short run, with small impacts in the long run. While little attention has historically been paid to rate impacts, policy makers and regulators have recently begun to consider them with greater scrutiny.

# Appendix C – Range of Values for Non-Energy Benefits

The following tables present a partial list of the utility- and participant-perspective NEB values provided in two recent studies conducted for the Massachusetts program administrators (NMR 2011; Tetra Tech 2012). These tables are provided as examples of the types of NEBs estimated in recent studies, and to provide a sense of the range of values associated with each type of NEB.

Both Massachusetts and Rhode Island use these two studies as the source for their NEB values. However, not all of these benefits are used in their 2013 program planning: some of them have been modified to align them with specific programs and directives from the public utility commissions, and some have been modified based on recent evaluation, measurement and verification results.

**Table C.1: Utility-Perspective NEBs**

| Utility-Perspective OPIs | Value |
|---|---|
| Financial and accounting | |
| Arrearages | $2.61 per participant |
| Bad Debt Write-offs | $3.74 per participant |
| Customer Service | |
| Terminations and Reconnections | $0.43 per participant |
| Customer Calls and Collections | $0.58 per participant |
| Notices | $0.34 per participant |
| Safety-Related Emergency Calls | $8.43 per participant |

*Note: The values presented in this table apply to low-income participants on an annual basis.*

**Table C.2: Participant-Perspective OPIs – Residential& Low-Income**

| Participant-Perspective OPIs | Value or Range of Values |
|---|---|
| Low-Income | |
| Economic Development | $0.04 per kWh saved |
| Equipment | |
| Lighting Quality and | $3.50 per LED or CFL fixture; $3.00 per LED or CFL bulb |
| Equipment Maintenance | $9.42 to $124 per participant depending on the customer sector, heating or cooling system, program |
| Window AC Replacement | $45 per measure |
| Comfort | |
| Thermal Comfort | $3.92 to $125 per participant depending on the customer sector, heating or cooling system, and program |
| Noise Reduction | $1.42 to $40 per participant depending on the customer sector, heating or cooling system, and program |
| Health & Safety | |
| Health Benefits | $0.13 to $19 per participant depending on the customer sector, heating or cooling system, and program |
| Improved Safety | $45.05 per measure |
| Property Value | |
| Home Durability | $1.54 to $149 per participant depending on the customer sector, heating or cooling system, and program |
| Property Value Increase | $62.65 to $1,998 per participant depending on the customer sector, heating or cooling system, and program |

*Note: The values in this table apply to participants on an annual basis, except for economic development, lighting quality and lifetime, and property value increase, which are one-time only benefits.*

**Table C.3: Participant-Perspective OPIs – Commercial & Industrial**

| Participant-Perspective OPIs | Value or Range of Values |
|---|---|
| Equipment | |
| Lighting O&M Savings | $0.009 to $33.65 per measure depending on the type of lighting measure |
| Administrative Costs, Material Handling, Material Movement, Other Costs, Other Labor Costs, O&M, Product Spoilage, Rent Revenue, Sales Revenue, Waste Disposal | -$0.015 to $0.097 per kWh saved depending on the measure's end use |

*Note: The values in this table apply to participants on an annual basis.*