Appendix D: Energy Efficiency Cost-Effectiveness Tests

Initial Draft Prepared by Synapse Energy Economics

Introduction

The Office of the Governor and his designees are developing a report for Michigan citizens and policymakers that factually describes and summarizes energy optimization programs set forth in Public Act 295 of 2008. Synapse Energy Economics, Inc. (Synapse) has been hired by the Council of Michigan Foundations (CMF) to draft this report focusing on cost-effectiveness tests used for evaluating the economics of energy efficiency and demand response programs.

Cost-Effectiveness Tests Section of Energy Efficiency Policy Report

1. Introduction

This section of the energy efficiency policy summary report addresses current issues with cost-effectiveness screening practices. It summarizes and compares the current energy efficiency cost-effectiveness policies and practices in Michigan and other jurisdictions.

Subsection 2 provides an overview of the general practices and methodologies used for energy efficiency screening in the US. This provides an important foundation for understanding the practices used across states. Appendix B discusses best practices for select, relevant issues in cost-effectiveness screening practices. Subsection 2 also defines the cost-effectiveness screening practices that were surveyed and reviewed in Michigan and other jurisdictions.

Subsection 3 describes Michigan's energy efficiency cost-effectiveness screening policies and practices in detail, including a summary of Act 295's policy goals.

Subsection 4 provides the results of our survey on cost-effectiveness testing policies and practices conducted for the following states: Connecticut, Illinois, Massachusetts, Minnesota, New York, Oregon, Vermont, and Wisconsin. This subsection includes a table summarizing the results of the survey, indicating the current cost-effectiveness tests, primary policies, and key assumptions used across the 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.

Subsection 5 compares Michigan's current cost-effectiveness screening practices with the practices used in other states. It summarizes key findings from the state surveys and research, and discusses the advantages and disadvantages of certain screening practices. This subsection also discusses how Michigan's cost-effectiveness tests are meeting the current and any possible future state public policy goals in comparison to other states' practices.

2. Cost-Effectiveness Tests Fundamentals

2.1 Background on the Evolution of Energy Efficiency Programs and 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, a growing number of 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. Some administrators are also implementing programs for traditionally underserved market segments such as multi-family residents and small businesses. 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 across the country to determine the cost-effectiveness of energy efficiency programs: the Program Administrator Cost (PAC)[1] 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.

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

[1] The Program Administrator Cost test is also called the Utility System Resource Cost Test (USRCT) as referred to in Michigan Public Act 295.

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 Resource Savings (e.g., water, oil, gas)	---	Yes	Yes
Non-Energy Benefits (utility-perspective)	Yes	Yes	Yes
Non-Energy Benefits (participant-perspective)	---	Yes	Yes
Non-Energy Benefits (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

It is important to recognize that the different tests provide different types of information. Each test is designed to estimate the costs and benefits of efficiency investments 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.[2] 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.
- 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 experienced by the utility. 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.

[2] 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, the Societal Cost test should include global costs and benefits.

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 each test is properly applied. This 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 includes 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 include 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:

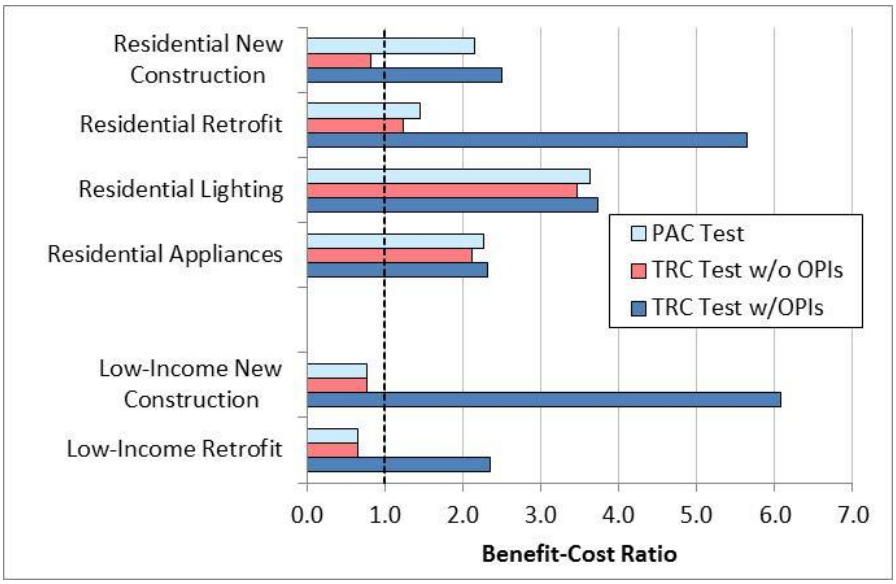
- When using the Societal Cost test, the utility-perspective, participant-perspective, and societal-perspective OPIs should be included.
- When using the TRC test, the utility-perspective and participant-perspective OPIs should be included to the greatest extent possible.
- When using the PAC test, the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

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. (Synapse 2012b; Neme and Kushler 2010).

The importance of adequately accounting for OPIs is apparent in many program administrators' energy efficiency screening results. Figure 1 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.

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



Source: Synapse 2012a.

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 an important objective underlying the energy efficiency programs.

2.4 Attributes Surveyed in Each Jurisdiction

We researched the cost-effectiveness screening practices in eight states, in addition to Michigan. As mentioned above, the eight surveyed states include Connecticut, Illinois, Massachusetts, Minnesota, New York, Oregon, Vermont, and Wisconsin. 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: either the portfolio, program, project, 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. (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.[3]

Avoided Costs Included in the Primary Cost-Effectiveness Test

- *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 generation capacity are 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 Cost 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).[4] 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

[3] Note that measure life as used in Table 2, below, implies that the study period is determined by the measures with the longest measure lives. The actual measure lives for measures with useful lives shorter than the longest measure life are used in benefit-cost analyses.

[4] Michigan does not purchase CO_2 allowances, nor is there any requirement for Michigan to purchase CO_2 allowances at this time.

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 environmental externalities, which include only the environmental costs that occur after all environmental regulations have been met. (Synapse 2012b.)

- *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 rise back towards initial market prices.[5]
- *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. 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.

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

We will also provide each state's 2012 ACEEE Scorecard ranking, which is intended to indicate the comprehensiveness and aggressiveness of each state's historical energy efficiency programs. The ACEEE Scorecard ranks states on their policy and program efforts, documents best practices, and provides recommendations for ways in which states can improve their energy efficiency performance. The scorecard serves as a benchmark for state efforts on energy efficiency policies and programs each year, encouraging them to continue strengthening efficiency commitments. The 2012 ACEEE Scorecard is the sixth edition of this report, with the 2013 ACEEE Scorecard expected to be released in October 2013. (ACEEE 2012b, p v).

3. Michigan's Cost-Effectiveness Tests

Approved on October 6, 2008, Public Act 295 of 2008, also known as the Clean, Renewable, and Efficient Energy Act, is Michigan's premier legislation on Demand-Side Management (DSM) programs. Prior to Act 295, energy efficiency programs had not been in operation in Michigan since 1992, and even then were limited in scope. Therefore, much of Michigan's current energy efficiency cost-effectiveness policies and practices stem from the goal of simply getting the programs quickly, but efficiently designed and implemented to comply with Act 295.

The purpose of Act 295 is clearly stated as "to promote the development of clean energy, renewable energy, and energy optimization through the implementation of a clean, renewable, and energy efficient standard that will cost-effectively do all of the following: (a) diversify the resources used to reliably meet the energy needs of consumers in this state; (b) provide greater energy security through the use of indigenous energy resources available within the state; (c) encourage private investment in renewable energy and energy efficiency; and(d) provide improved air quality and other benefits to energy consumers and citizens of this state." (Act 295, §1). Specifically for energy optimization, the overall goal is to "reduce the future costs of provider service to customer," meaning to reduce the cost of electricity services to customers (Act 295, §71).

Because Act 295's goal for energy optimization focuses on the cost of utility service, the act requires the use of the Program Administrator Cost test, also called the Utility System Resource Cost test. Through subsequent orders and approval of energy optimization plans, the Michigan Public Service Commission (MI PSC) has further detailed the state's cost-effectiveness screening practices. Specifically, the MI PSC requires that the program administrators provide the results of multiple cost-effectiveness tests, including the TRC test, the RIM test, and the Participant Cost test, in order to provide the MI PSC with sufficient information to support the distribution of energy optimization funds among the portfolio of proposed programs, and to ensure that the programs are reasonable and prudent Act 295 requires that the portfolio of programs collectively demonstrate cost-effectiveness under the PAC test, excluding program offerings to low-income residential customers. (Act 295, §71(3)(g); §73(2)). The MI PSC has also required that the utilities provide the results of cost-effectiveness tests at the program and measure levels, again to ensure equitable distribution of energy optimization funds among the proposed programs.

To date, the savings goals for Michigan utilities have been relatively low, and the absence of energy efficiency programs since 1992 provided program administrators with significant energy efficiency savings potential. Therefore, the programs have had little difficultly demonstrating cost-effectiveness at the portfolio, program, or measure levels for any of the cost-effectiveness tests. With three full years of program implementation completed, cost-effectiveness results may begin to be challenged. The MI PSC has allowed program administrators to determine the discount rate used to net present value the future stream of energy efficiency benefits. The program administrators have chosen to rely on the weighted average cost of capital to discount benefits, which has typically been around 8%. The Consumers Energy uniform discount rate in its 2011 energy efficiency annual report was 9.78%. (Consumers Energy 2012, p 18). The deemed savings database used in Michigan previously capped measure lives at 20 years. The cap was lifted with the 2013 version of the deemed savings database to allow for the full lifetime of the measures installed, thereby setting the study period over which the cost-effectiveness tests are applied. Michigan's energy efficiency collaborative has been investigating ways to remove such structural biases against energy efficiency programs by encouraging more permanent energy efficiency measures with longer measure lives.

The MI PSC has specified that the PAC test analysis take "into account the avoided supply costs of energy and demand, the reduction in transmission, distribution, generation, future carbon tax, and capacity valued at marginal costs for the periods when there is a load reduction… At the option of the provider, either the cost-based value provided by the commission or the MISO market-based value can be used as a determinant in estimating the avoided cost." (MI PSC 2008, Att. E, pp 4-5). Michigan also accounts for avoided costs associated with line losses. The avoided supply costs of future carbon tax has been included for renewable energy programs only, and has not been included in cost-effectiveness testing for energy efficiency programs. While the MI PSC allows for the inclusion of avoided costs associated with future environmental compliance regulations, the Michigan utilities currently do not include such benefits in their cost-effectiveness analyses. The avoided transmission and distribution costs included in energy efficiency cost-effectiveness analysis are specific to each utility and could be relatively low. For example, Consumers Energy has noted that the current utility system structure would need to change substantially before the cost of building new transmission and distribution could be avoided. In its 2011 benefit cost analysis, the company used a $5 per kW T&D avoided cost value, with essentially reflects reduce maintenance costs. (Consumers Energy 2012, p 19;).

Benefits associated with price suppression and reduced risk have not been included in cost-effectiveness screening, nor addressed by the MI PSC. Act 295 acknowledges the other program impacts that accrue to low-income customers by excluding low-income programs from cost-effectiveness requirements (Act 295, §71(3)(g)). Additionally, natural gas savings are accounted for only in the natural gas programs. The MI PSC has not required the inclusion of any other non-energy benefits in energy efficiency cost-effectiveness screenings because it relies on the PAC test, which does not consider such impacts on participants. While utility-perspective other program impacts could be included as part of the PAC test results, the MI PSC has not addressed them to date.

4. Other Jurisdiction's Cost-Effectiveness Tests

4.1 Summary of Survey Results

In addition to Michigan, we researched the cost-effectiveness screening practices in eight states across the United States. The results of the state surveys are summarized in Table 2. We provide additional detail for each state in the tables in Appendix A.

To provide context for each state's energy efficiency practices, we conducted interviews with state public utility commission staff. The goal of these 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. The interviews also aim to capture 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. The few specific aspects we focus on are intended to highlight practices that differ across states or explain why certain benefits are omitted by a state.

To summarize, our survey indicates that:

1. All of the states we surveyed provide relatively comprehensive energy efficiency programs according to ACEEE, as they are all ranked within the top 20 most energy efficient states.
2. Cost-effectiveness practices are largely driven by key policy objectives specific to each state. We summarize these objectives in the second row of Table 2.
3. 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.
4. Most states determine cost-effectiveness at either the portfolio or program level, with one state screening at the measure level and one state screening at the sector level. Most states consider results from additional screening levels in addition to the primary screening level.
5. Several different discount rates are used across the states, although the utility weighted average cost of capital is most frequently used by the states. Other states use low-risk or societal discount rates. We note that different discount rates can have significant impacts on the results of the cost-effectiveness screening.
6. All but one state apply a study period that includes the full useful life of the measures.
7. All states account for avoided costs of energy, capacity, and 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.
8. All but one state account for avoided costs and transmission and distribution.
9. Most states do not account for price suppression effects, with only two states including such benefits.
10. Most states do not account for risk mitigation benefits, with only two states include such benefits.

11. All but one state that uses 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).
12. All but one state at least qualitatively account for the participant-perspective low-income benefits, typically by not requiring that low-income programs or measures pass the state's cost-effectiveness test.
13. States treat the participant-perspective non-energy benefits very differently:
    - One state uses 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 or Societal Cost test as the primary test.

4.2 Connecticut

The Program Administrator Cost test[6] 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)[7] 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).

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 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% 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% 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).

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

[7] 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).

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).

4.3 Illinois

The Illinois Public Utilities Act requires the state of Illinois to balance achievement of a number of policy goals, stating that "electric utilities are required to use cost-effective energy efficiency and demand-response measures to reduce delivery load. Requiring investment in cost-effective energy efficiency and demand-response measures will reduce direct and indirect costs to consumers by decreasing environmental impacts and by avoiding or delaying the need for new generation, transmission, and distribution infrastructure." (220 ILCS 5/8-103, § 8-103(a)). The act further states that utilities shall demonstrate that its overall portfolio of energy efficiency and demand-response measures are cost-effective using the total resource cost test and represent a diverse cross-section of opportunities for customers of all rate classes to participate in the programs. (220 ILCS 5/8-103, § 8-103(f)(5)). As such, Illinois relies on the TRC test to screen for cost-effectiveness as it takes into account both the direct and indirect costs to consumers and the utility infrastructure.

Illinois operates two types of energy efficiency programs: those programs that are consistent with 220 ILCS 5/8-103, § 8-103 ("Section 8-103 programs"), and those programs that are consistent with 220 ILCS 5/16-111.5B ("IPA programs").[8] The level at which cost-effectiveness is determined depends on the type of program in consideration. Section 8-103 energy efficiency resources are required to pass the TRC test at the portfolio level, while IPA energy efficiency resources are required to pass the TRC test at the program level.

While the portfolio and program levels are specified in the Illinois Public Utilities Act, the ICC has allowed program administrator discretion on this cost-effectiveness screening practice. Specifically in its approval of Ameren Illinois' energy efficiency plan filings, the ICC stated that "evaluating cost-effectiveness on a portfolio level is necessary to ensure that Ameren not be penalized for planning assumptions that turn out to be inaccurate. The Commission concludes it is appropriate to apply the TRC

[8] The two types of programs have different goals and delivery structures. The programs are still the subject of stakeholder working groups, which are working through ways to integrate the types of programs. (Personal Communication with ICC Staff; ICC 2013). It should be noted that one utility, MidAmerican Energy Company, offers energy efficiency programs in Illinois pursuant to Section 8-408 of the Illinois Public Utilities Act. (220 ILCS 5/8-408). Section 8-408 applies to small (i.e., fewer than 200,000 customers) multi-jurisdictional utilities, and requires each program to be cost-effective, with the exception of reasonable low-income programs. (220 ILCS 5/8-408, § 8-408(a)). The ICC has required only cost-effective measures in Section 8-408 energy efficiency plans, unless extenuating circumstances are shown that would justify inclusion of such cost-ineffective measures. (ICC 2012a, pp 17-18). MidAmerican uses the Societal Cost test.

test at the portfolio level, but Ameren Illinois should be allowed to apply it at the measure or program level if it so chooses." (ICC 2010a, p 30).

Illinois program administrators account for program benefits over the lifetime of the energy efficiency measures installed, and rely on the weighted average cost of capital to discount the stream of future benefits. (Ameren 2013b, Testimony of Andrew Cottrell, p 10; 20 ILCS 3855/1-10). The weighted average cost of capital is the chosen discount rate because it represents the utility's cost of procuring energy, and therefore parallels energy efficiency resources with alternative supply resources. (Personal Communication with ICC Staff).

In its calculation of avoided costs, Illinois program administrators include the avoided costs of energy, capacity, transmission and distribution, environmental compliance, and line losses. (Ameren 2013b, pp 25-29; Testimony of Andrew Cottrell, pp 9-10). With regard to the avoided costs associated with environmental compliance, the Illinois definition of the TRC test specifically states that, "in calculating avoided costs of power and energy that an electric utility would otherwise have had to acquire, reasonable estimates shall be included of financial costs likely to be imposed by future regulations and legislation on emissions of greenhouse gases." (20 ILCS 3855/1-10).

The ICC has specifically rejected price suppression benefits, finding that the party proposing to include the benefits did not provide adequate basis for deviating from the ICC's past practice of not including such benefits. (ICC 2012b, p 270).

Avoided risk benefits are only included to the extent that they are reflected in MISO or PJM market prices used in avoided energy cost estimates. (Personal Communication with ICC Staff). On a preliminary basis, Ameren considered using a 1.2 TRC test benefit-cost ratio to screen measures to compensate for risk and to ensure that the entire portfolio of programs remained cost-effective with a TRC test benefit-cost ratio of 1.0. However, Ameren did not include such a proposal in its final plan filing with the ICC. (Ameren 2013a, p 22).

Regarding other program impacts, Illinois accounts for benefits to low-income customers by not requiring that such measures meet the TRC test. (220 ILCS 5/8-103, §8-103(a)). For example, the Illinois Department of Commerce and Economic Opportunity's (DCEO) energy efficiency plan submitted in August 2013 states that, "though standards are in place in DCEO's low income programs to assure that products being installed are energy efficient, some of the requirements are primarily for health and safety, comfort and building durability." (DCEO 2013, Testimony of David Baker, p 8).

Further, Illinois legislation stipulates that TRC test benefits include other quantifiable societal benefits, including avoided natural gas utility costs. (20 ILCS 3855/1-10). In practice, this has amounted to program administrators quantifying natural gas and water savings. (Ameren 2013b, pp 24-25). For the first time in their three-year energy efficiency plan filings, the Illinois program administrators are flirting with the idea of accounting for participant OPIs. For example, Ameren initially included a 10% adder in its preliminary energy efficiency plan to account for non-energy benefits (Ameren 2013a, p 22). Similarly, DCEO indicated in its plan filed with the ICC that it is not clear whether non-energy benefits will be included in the TRC calculations, so it provided TRC values both with and without NEBs for certain

programs. (DCEO 2013, Testimony of Stefano Galiasso, p 9). The ICC has not yet conducted its review of or issued its decision on the Section 8-103 plans, nor have other program administrators proposed to include such an adder or adjustment in past Section 8-103 plan filings, so it is not yet certain whether or how the ICC will address the inclusion of non-energy benefits. (Personal Communication with ICC Staff).

4.4 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).

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 in the energy efficiency cost-effectiveness analysis. The DPU also requires that these avoided costs account for the relatively stringent requirements to reduce greenhouse gas emissions required in the Global Warming Solutions Act (GWSA). (MA DPU 2009a.) However, the DPU has yet to determine a methodology to estimate the value of these avoided costs of environmental compliance (MA DPU 2012). Therefore, these potentially significant benefits 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).

4.5 Minnesota

The utilities in Minnesota administer energy efficiency programs through implementation of their three-year Conservation Improvement Program (CIP) plans pursuant to Minnesota Statue 216B.241. This statute requires that each utility achieve an annual energy-savings goal of 1.5% of gross annual retail energy sales. It further requires that the Minnesota Department of Commerce (MN DOC) evaluate the CIP plans on how well the goals were met. (MN Statue 216B.241, subd. 1c.(a)).

Minnesota Statue requires that the Minnesota Department of Commerce, Division of Energy Resources (MN DER) consider the costs and benefits to ratepayers, the utility, participants, and society. (MN Statue 216B.241, subd. 1c.(f)). As such, the investor-owned utilities provide the results of the Societal Cost, PAC, Participant Cost, and RIM tests.[9] (Personal Communication with MN DER Staff). Although the statute requires utilities to provide cost-effectiveness results from all of the stated perspectives, the MN DER focuses on the Societal Cost test for approval purposes, as the Societal Cost test measures the ratio of overall benefits and costs to society of energy conservation improvements (MN DER 2010, p 7).

In April 2012, the MN DER announced a policy for the electric and gas utilities' 2013-2015 CIP plans that cost-effective screening would be primarily evaluated at the segment level, rather than the program level, which was the previous screening level. Segments are generally equivalent to customer sectors, and include business; residential; low-income; renewable energy; and assessments. Existing programs were grandfathered in and allowed to be non-cost-effective, so long as the segment in which they resided in still passed the Societal Cost test. (MN DER 2012, pp 9-10). In addition, the MN DER also reviews cost-effectiveness results at the portfolio and program levels, and sometimes at the measure level. (Personal Communication with MN DER Staff).

Both a societal discount rate and a utility discount rate are used in Minnesota. Since environmental costs are not captured and reflected in market prices, the MN DER has found it necessary to impute and impose a societal discount rate to discount the future stream of benefits resulting from avoided environmental damage. The Minnesota societal discount rate is based on the US Treasury's 20-year constant maturity rate, which was 2.67% as of January 3, 2012. The MN DER Staff found that the US Treasury's 20-year constant maturity rate captures the market's expectations regarding inflation, along with a small risk factor. The MN DER Staff concluded that a rate including inflation expectations and a small risk factor is a reasonable method for estimating a social discount rate for externalities. (MN DER Staff 2012).

The utility discount rate in Minnesota is a utility's weighted cost of capital approved in the utility's most recent rate case. While the weighted cost of capital varies by utility, Xcel Energy's weighted cost of capital was 7.04% in its 2010 rate case. Since the utility discount rate is the utility's cost for its capital, MN DER Staff found it a reasonable measure of the value society places on a utility investment. (MN DER Staff 2012).

[9] Sometimes the utilities will also provide the results of the TRC test, but it is not required by statute. (Personal Communication with MN DER Staff).

For the Societal Cost test, residential programs use the societal discount rate, and commercial programs use the utility discount rate. The Participant Cost test uses the societal discount rate, and the PAC test uses the utility discount rate. The rationale for such an application is that a societal discount rate would reflect a residential customer's likely opportunity costs (i.e., the return on investment that a residential customer would likely give up in order to invest in CIP). Similarly, the utility discount rate represents an attempt to reflect in a simple manner a reasonable estimate of a business customer's opportunity costs, although the utility discount rate may be lower than the actual discount rate for a particular commercial or industrial customer. (MN DER Staff 2012).

The period over which the cost-effectiveness tests are applied is generally capped at 15 years in Minnesota. The MN DER Staff have stated that, in most cases, the maximum life used is limited to 15 years for the following reasons: (a) benefits are more uncertain the further out in time the model is extended; (b) benefit streams diminish further out in time and have lesser effects on cost-effectiveness than more current years; (c) the further out in time the model is extended, the more uncertain it becomes that current ratepayers, who are funding CIP, receive the full benefits of CIP; and (d) if a project cannot pay for itself within 15 years, ratepayers should instead be funding other, more cost-effective projects. (MN DER Staff 2012; Personal Communication with MN DER Staff).

Electric utilities in Minnesota account for the avoided costs of energy, capacity, T&D, and environmental compliance. While the MN DER provides the inputs for a number of cost-effectiveness screening assumptions, it does not provide electric utility avoided costs as they can vary significantly between utilities. (MN DER 2012, pp 10-11). Line losses are also included in Minnesota's benefit-cost analyses. Typically the utilities will provide line loss values, and if not (typically with smaller municipal utilities and electric cooperatives), the MN DER assumes 8%. Price suppression and reduced risk have not been addressed by the MN DER or the Minnesota Public Utilities Commission (MN PUC). (Personal Communication with MN DER Staff).

The MN PUC provides the environmental externality values that should be used by the utilities in their CIPs. The MN PUC provides high and low ranges of values at the urban, metropolitan fringe, and rural levels for sulfur dioxide, particulate matter, carbon dioxide, nitrogen oxides, lead, and carbon monoxide, adjusted annually for inflation. The MN PUC previously established an estimate of the likely range of costs of future carbon dioxide regulation on electricity generation of $9 per ton to $34 per ton for carbon dioxide emitted in 2012 and thereafter. This range of values is updated annually. (MN PUC 2013). The utilities will use these values in some instances, but have generally been more focused on including benefits associated with avoided energy, capacity, and T&D, and may not account for the avoided cost of future environmental compliance. (Personal Communication with MN DER Staff).

Minnesota accounts for other program benefits in its cost-effectiveness analyses through its treatment of low-income programs. The MN DER has previously not required low-income programs to pass the Societal Cost test due to their unique purpose and the spending requirement for low-income projects; however, the cost-effectiveness of the programs is still evaluated. (MN DER 2012, p 10). While other non-energy benefits have been discussed and considered by the MN DER, no other non-energy benefits are included in Minnesota energy efficiency cost-effectiveness analyses. Instead, the state has been

more focused on other program challenges, and has limited resource available to devote to the development of non-energy benefits. (Personal Communication with MN DER Staff).

4.6 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 (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).

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.

4.7 Oregon

Oregon's consumer-owned utilities must comply with the Northwest Power and Conservation Council's (NPCC) energy efficiency and conservation targets. For efficiency, the most recent targets were established in NPCC's Sixth Northwest Power Plan, which calls for Northwestern states to meet 85% of future regional load growth with energy efficiency and conservation. On the other hand, for investor owned utilities, the plan is advisory but not mandatory. As such, for IOUs, Oregon is committed to procuring all cost-effective energy efficiency measures (Sixth Northwest Power Plan, p 6; Personal Communication with ETO Staff). The Public Utility Commission of Oregon (OR PUC) is interested in the long-term success of energy efficiency in Oregon but sees a need to pace acquisition in order to maintain a delivery infrastructure and moderate rate impact. Thus, the Energy Trust of Oregon, a non-profit created in 1999 to help establish consistency in funding for efficiency and renewable resources, has a twenty-year acquisition schedule (ETO Website 2013).

Since the early 1990s, energy efficiency programs in Oregon have been screened for cost-effectiveness primarily with the Total Resource Cost test at the program level (OR PUC 1994). The Energy Trust of Oregon also screens energy efficiency resources using the Program Administrator Cost test to inform its cost-effectiveness review process (ETO Methodology 2011).

Oregon accounts for the TRC test benefits that accrue over the full life of the energy efficiency measures installed (Personal Communication with ETO Staff). All programs use a discount rate equal to the risk-adjusted cost of capital for utilities, which is established by utilities during each iteration of the IRP process. As of 2009, the rate was 5.2%.

The TRC test used in Oregon includes all other program impacts that are reasonably quantifiable, such as avoided capacity, energy, T&D, line loss, and risk costs, in addition to any resource benefits, including benefits associated with water and gas savings. Although Oregon does not explicitly utilize a carbon

price in cost-effectiveness screening, the avoided cost of environmental compliance is embedded in the price forecasts utilized by utilities (Personal Communication with ETO Staff). Additionally, Oregon accounts for risk avoidance by adjusting the benefits of energy efficiency programs for their risk hedge values developed by the NPCC. In the NPCC 5th Power Plan from 2005, the Council evaluated over 1,000 plans against a large number of future conditions and determined that conservation measures above the cost-effectiveness threshold lower cost without adding risk. As such, the Council determined a range of risk avoidance values from $5/MWh of risk avoidance for discretionary programs and $10/MWh for lost opportunity programs (Fifth Northwest Power Plan 2005).

Oregon accounts for all other program impacts that are reasonably quantifiable, and includes a 10% adder in the TRC to reflect benefits that cannot be quantified (OR PUC 1994). This adder works as a "catch-all," accounting for unspecified benefits that accrue directly to participants and are not readily quantifiable.

4.8 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, and comprehensive energy efficiency programs" (30 VSA § 218c). The requirement to include environmental costs lead 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).

The use of the Societal Cost test 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% adder is applied to program benefits, and an additional 15% adder is applied to low-income program benefits. The decision to use adders of 15% 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% is on the lower end of the range of estimates" (VT PSB 2012b, p 26).

4.9 Wisconsin

The history of cost-effectiveness screening for energy efficiency programs in Wisconsin provides insight into the state's current cost-effectiveness practices. Legislation from 2005 mandated that funding for

energy efficiency programs be capped at 1.2% of operating revenues for gas and electric utilities, but also allowed the Wisconsin Public Service Commission (WI PSC) to request more funding at a future date. As such, following its typical planning process, the WI PSC approached the Joint Committee on Finance and requested additional energy efficiency program funding to meet the level of funding anticipated to be needed to capture all the cost-effective energy efficiency. Soon thereafter, due to state policy decisions beyond the WI PSC's jurisdiction, funding levels for energy efficiency programs were reduced back to the 1.2% operating revenue cap. However, the cost-effectiveness screening policies and practices were not adjusted to reflect the change in funding levels, and continued to operate with the goal of procuring all cost-effective energy efficiency. Now, Wisconsin's primary energy efficiency cost-effectiveness policy is to procure all cost-effectiveness energy efficiency up to the funding cap. (Personal Communication with WI PSC Staff).

Additionally, Wisconsin's screening procedures are informed by certain priorities established by different state and commission policies. According to Wisconsin Act 141, the purpose of energy efficiency programs is to "help achieve environmentally sound and adequate energy supplies at reasonable cost," with a focus on those resources that reduce overall energy use and peak demand. (WI Legislature 196, §69.196.374(2)(a)2)). Further, the WI PSC regulations explain that "the program administrator shall assign priority status to implementing programs that reduce growth in electric and natural gas demand usage, facilitate energy efficiency and renewable resource market development, help market providers achieve higher levels of energy efficiency, promote energy reliability and adequacy, avoid adverse environmental impacts from the use of energy, and promote rural economic development." (WI PSC 2007, §137.05(11)).

As such, Focus on Energy, Wisconsin's energy efficiency program administrator, primarily utilizes what the state refers to as a "modified" TRC test. It is applied at the portfolio level, and accounts for the benefits that accrue over the effective useful life of the measures installed. Both the Wisconsin program administrator and program evaluator apply a low-risk discount rate of 2%, which represents the public sector cost of borrowing and was decided upon by the WI PSC after considering stakeholder feedback on various discount rates.

The WI PSC also requires the program administrator and evaluator to provide the results of two other cost-effectiveness tests: the PAC test, used to inform program design, and an "expanded" version of the TRC test, used to assess additional energy efficiency benefits (WI PSC 2007, §137.05(12)). More specifically, the WI PSC states that "the modified TRC test does not provide useful guidance for appropriate program design, so the Commission finds it reasonable to require that programs must pass the Utility/Administrator test in order to ensure that the benefits ratepayers receive from these programs exceed the programs' costs." Additionally, "the Commission recognizes that other non-economic externalities are also significant, so the expanded test must also be applied at the portfolio level." Wisconsin's "expanded" TRC test falls somewhere in between what are traditionally defined as the TRC test and the Societal Cost test. It includes additional benefits that flow through the economy, including job creation, additional emissions, mercury reductions, increases in comforts, decreases in operation and maintenance costs, etc. The results of the expanded TRC test are only provided every couple of years. (WI PSC 2010; Personal Communication with WI PSC Staff).

In its application of the modified TRC test, Focus on Energy accounts for the avoided costs associated with energy, capacity, line losses, and environmental compliance. Wisconsin does not account for avoided transmission and distribution costs, price suppression or reduced risk. The avoided capacity costs are based on the cost of a new peaking plant and, as of 2012, avoided energy costs are calculated based on a forward-looking average of the locational marginal prices across Wisconsin nodes, and based on MISO data (WI PSC 2012b). Included in these valuations are avoided capacity, line loss and environmental compliance costs. Wisconsin includes a levelized carbon value of $30 per ton in assessing the emissions benefits of a given resource. Additionally, because Focus on Energy offers joint gas and electric programs, gas benefits are calculated and included in the modified TRC test analysis. Other participant-perspective OPIs are excluded from the modified TRC test, and are only included in the expanded TRC test.

5. Comparison of Michigan's Screening Practices to Other Jurisdictions

5.1 Cost-Effectiveness Tests

Michigan is one of the few states that relies on the PAC test as its primary test. In fact, only one of the eight states we surveyed, and only five states throughout the United States use the PAC test as their primary test. Five out of the eight states surveyed rely on the TRC test, and 29 states in the United States use the TRC test as the primary cost-effectiveness test. Two out of the eight states surveyed, and 6 states in the United States rely on the Societal Cost test as the primary cost-effectiveness test (ACEEE 2012a, p 13). Below we discuss the advantages and disadvantages of the three primary cost-effectiveness tests.

The Societal Cost test is the most comprehensive test, and is most appropriate for those states that wish to give consideration to the societal benefits of energy efficiency programs, particularly the environmental and health benefits. The disadvantages of this test are that some stakeholders may view the scope as outside the interests and jurisdiction of regulatory commissions; some of the societal impacts are uncertain and difficult to forecast; and this test could increase the range of cost-effective programs, which might lead to higher cost impacts on utility customers.

The TRC test is the next most comprehensive test, and is the most widely used test. Regulators and legislators are apparently drawn to this test because it intends to evaluate the majority of the costs and benefits for all ratepayers. However, the TRC test creates a dilemma for policymakers. In order to be internally consistent the test must include other program impacts on the program participants, but regulators are often wary of doing so because some of the costs are uncertain and difficult to quantify. In addition, some stakeholders are concerned that including OPIs in the assessment of energy efficiency could lead to utility customers paying higher costs for efficiency programs in order to pay for other program benefits that are not in their interest and should not be paid for through utility rates.

The PAC test is most appropriate for those states that want to limit the energy efficiency cost-effectiveness analysis to the impacts on revenue requirements. There are many advantages to this test: it is consistent with the way that supply-side investments are evaluated; it includes costs that are

relatively easy to identify and quantify; and it includes the energy costs and energy benefits that are most important to utility regulators. Probably the most important benefit of the PAC test is that it provides legislators, regulators, consumer advocates and others with confidence that the energy efficiency programs will result in lower costs to utility customers. This is an extremely important consideration, particularly for those states that seek to implement all cost-effectiveness energy efficiency resources.

However, relying on the PAC test has one significant disadvantage in that the costs and benefits to energy efficiency program participants are not taken into consideration. There are two implications of this. First, by not including the participant's cost the PAC test does not include the full incremental cost of efficiency measures, which may be important to policymakers who may be concerned about the total economic impact of the energy efficiency programs. Second, the PAC test does not include the other program benefits of efficiency measure, some of which are clearly important to policy makers. The other program benefits that are typically most important to regulators are (a) those benefits that pertain to low-income customers, because of the significant public policy implications of this sector; and (b) the other fuel savings, because these savings are important to promote comprehensive, whole-house, one-stop-shopping residential retrofit programs as well as new construction programs where customers tend to use multiple fuels.

5.2 Secondary Test

In addition to relying on the PAC test as its primary cost-effectiveness test, Michigan also considers the results of the TRC, RIM, and Participant Cost tests. Michigan's approach to considering multiple cost-effectiveness tests is comprehensive. Five out of the eight surveyed states consider secondary cost-effectiveness tests, three of which consider multiple cost-effectiveness tests. The TRC and PAC tests are most commonly used by these states as their secondary screening tests. Three states rely on the primary test only, and do not consider the results of other cost-effectiveness tests.

The advantage to using multiple screening tests is that multiple policy objectives can be evaluated through different tests. For example, Wisconsin uses the TRC test as its primary cost-effectiveness test, but uses the PAC test to help inform program design (e.g., whether an incentive level is appropriate) and whether ratepayer funding is spent wisely. Applying multiple tests allows for balancing achievement of various key public policy objectives, such as accounting for the full incremental cost of the efficiency measure, accounting for other program impacts, and accounting for societal benefits, or ensuring a net reduction in costs to customers.

The downside to using multiple screening tests is that it still leaves the ultimate question of which programs to implement, and that, in practice, it is more common and straightforward to use a single, primary test to answer this ultimate question. Further, preparing and analyzing multiple test results is cumbersome, and places additional administrative burdens on the utilities, regulators, and stakeholders.

5.3 Screening Level

Michigan applies its cost-effectiveness tests primarily at the portfolio level, but also considers screening results at the program and measure levels. As the primary screening level, four of the surveyed states

screen for cost-effectiveness at the program level, three consider the portfolio level, one state screens at the sector level, and one state screens at the measure level.[10] Six of the surveyed states consider cost-effectiveness results at other screening levels, while two states do not. Across the country, 30 states apply cost-effectiveness tests at the portfolio level, 30 states apply cost-effectiveness tests at the program level, and 13 states apply cost-effectiveness test at the measure level (ACEEE 2012a, p 31).

Evaluating cost-effectiveness at the measure level means that each individual component (i.e., measure, equipment, or other action) of an efficiency program must be cost-effective. Screening at the measure level is the most restrictive application of the cost-effectiveness tests, and can create a barrier to greater savings levels. (NAPEE 2008, pp.3-9, 3-10).

Evaluation at the program level means that collectively the measures under a program must be cost-effective, but some measures can be uneconomical if there are other measures that more than make up for them. While non-cost-effective measures may reduce a program's overall cost-effectiveness, the program administrator may be able to achieve greater overall savings through the combination of measures. Additionally, a measure may not be cost-effective on its own, but may become cost-effective when combined with other efforts. (NAPEE 2008, pp 3-9, 3-10).

Evaluating cost-effectiveness at the portfolio level means that all of the programs taken together must be cost-effective, but individual programs can be positive or negative. This is the most flexible application of cost-effectiveness testing, as program administrators have the ability to experiment with different strategies and technologies that may not be immediately cost-effective or require further testing, such as pilot programs, market transformation programs, or emerging technologies. (NAPEE 2008, pp 3-9, 3-10).

Further, the advantages and disadvantages of applying multiple screening levels are similar to applying multiple cost-effectiveness tests. The advantage is that regulators can ensure cost-effectiveness at the most granular level, or the highest level. The disadvantage is that it can result in an overwhelming level of analysis, especially when provided at the measure level.

5.4 Discount Rate

To discount the future stream of benefits, Michigan relies on the utility weighted average cost of capital. Five of the surveyed states also rely on the weighted average cost of capital, two states use a low-risk rate, and two states rely on a societal discount rate.[11] As 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 (e.g., relying on the

[10] Note that Illinois relies on both the portfolio and program level screening results, depending on the statue to which a program corresponds. (220 ILCS 5/8-103,§103(a); 5/16-111.5B).

[11] Note that Minnesota relies on both a societal discount rate utility discount rate in its primary cost-effectiveness test. (MN DER Staff 2012, Inputs 11-13; Xcel 2012a, p 481).

weighted cost of capital) have very different values for the actual rates used (e.g., 3.93% to 10% for the weighted cost of capital).

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 interdependent concepts: the time value of money and the riskiness of the investment (Synapse 2012b). 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.

Energy efficiency programs financed by a system benefits charge, or a similar fully-reconciling charge, represent a funding source with a low financial risk. Energy efficiency resources also represent low project and portfolio risk. A state could account for the low risk of energy efficiency resources by applying a low-risk discount rate. A low-risk discount rate could, for example, be based on a general indicator of low-risk investments, such as US Treasury bonds. To account for the low project risk, a state could reduce the low-risk discount rate further solely on the basis of the cost of capital.

In some cases, a state will chose a discount rate based on the cost-effectiveness test. For example, in Vermont and Minnesota, 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.

5.5 Avoided costs

Energy efficiency resources have the potential to avoid a number of utility system costs, thereby producing substantial benefits to utilities and customers. Michigan does not include two avoided costs in its cost-effectiveness analyses: price suppression benefits and reduced risk benefits.

The advantages to these two avoided costs are the same. These two types of avoided costs provide important benefits, and should be accounted for in cost-effectiveness screening. Otherwise, the cost-effectiveness test results are skewed against energy efficiency as not all benefits are incorporated.

Therefore, the advantage of including the avoided costs in cost-effectiveness testing is that it provides for a complete representation of energy efficiency resources benefits.

The only disadvantage of including these types of avoided costs may be that they are difficult to estimate, or the results may be seen as too uncertain to include in the cost-effectiveness analysis.

Below, we provide a more detailed comparison analysis as well as the rationale for including these two benefits. Appendix B provides additional information on best practices for some of the issues identified below.

Price Suppression

Michigan, along with six out of the eight states in our survey, does not include the benefits of market price suppression in its cost-effectiveness screening. Only Massachusetts and Connecticut incorporate price suppression benefits, which are developed for the states as part of New England's regional avoided energy supply cost study (see Synapse 2013a).

Wholesale market price suppression effects could 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 could 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 could be included in the PAC test, the TRC test, and the Societal Cost test.[12]

Reduced Risk

Most of the states we surveyed, including Michigan, do not recognize that energy efficiency may reduce risks on the utility system associated with supply-side resources. Only Oregon and Vermont account for the benefits associated with reduced risk, which they accomplish by applying an adder of 10% and 15% to program benefits, respectively. Additionally, Oregon accounts for risk avoidance using specific dollar per MWh saved factors, which are based on the risk hedge values of certain efficiency programs.

Energy efficiency can mitigate the various risks associated with large, conventional power plants. A recent study evaluated the costs and risks of various energy resources, and found that energy efficiency is the least cost and least risky electricity resource (Ceres 2012). Given the potential value of reduced risk and the many ways that energy efficiency can reduce utility system risks, states could consider explicitly accounting for the risk benefits of energy efficiency.

5.6 Other Program Impacts

OPIs could 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

[12] A recent study by ACEEE evaluated wholesale price mitigation impacts from energy efficiency programs for Ohio. See ACEEE 2013.

some of the costs (or benefits) from that same perspective, then the test results may be skewed; i.e., they may not provide an accurate indication of cost-effectiveness from that perspective. (Synapse 2012b; Neme and Kushler 2010).

The states in our survey use different approaches for including OPIs in cost-effectiveness analyses, with some states not including such benefits at all. Below we discuss three important categories of OPIs.

Resource benefits

Michigan does not account for savings from other resources such as natural gas and water that participants can experience from energy efficiency resources, primarily because the state relies on the PAC test which does not take into account participant benefits. Except for Connecticut, which also relies on the PAC test as its primary cost-effectiveness test, all of the states in our survey except for Minnesota quantify other resource savings to some extent.

Among the participant-perspective OPIs that could be included in the TRC test, other fuel savings deserve particular consideration. First, this type of OPI tends to have one of the biggest impacts on the cost-effectiveness of certain programs. Second, this type of OPI tends to support important public policy goals of regulators and other stakeholders. 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. (Synapse 2012b, p 24).

Michigan could include resource benefits in its PAC test results as an alternative scenario as it is an important public policy goal. The advantage of including such benefits is that it allows for a more comprehensive analysis. Resource benefits could be included in Michigan's TRC test results as well.

Utility OPIs

Michigan does not include the non-energy benefits that accrue to utilities as a result of energy efficiency resources. Most of the states in our survey do not include such benefits either, although Massachusetts does directly quantify utility-perspective OPIs, and Vermont and Oregon account for such benefits through a 15% and 10% adder applied to program benefits, respectively.

Because Michigan relies on the PAC test, its cost-effectiveness analyses could include utility-perspective OPIs. 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 reconnects, 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.

Similar to avoided costs, the advantage of including utility OPIs is simply that it is more accurate and comprehensive to include them.

Participant OPIs

Michigan effectively considers a portion of participant-perspective OPIs in the PAC test analysis by permitting low-income programs to be less cost-effective. Our survey results indicate that states treat the participant-perspective OPIs very differently. Massachusetts is the only state in our survey that directly quantifies utility- and participant-perspective OPIs, while Vermont and Oregon apply a 15% adder and 10% adder to their benefits, respectively. Several states include few or no non-energy benefits, despite using the TRC test or Societal Cost test as the primary test. However, some of these states consider resource benefits and qualitatively consider low-income benefits.

While Michigan should not include participant-perspective OPIs in its PAC test as that would be inconsistent with the test's perspective, it could in its TRC test and Participant Cost test analyses. As mentioned above, OPIs could be included in cost-effectiveness tests for which the relevant costs and benefits are applicable. If a state has chosen to use the TRC test as the primary screening test, then the cost-effectiveness analysis could include utility- and participant-perspective OPIs. The TRC test should not be used to screen energy efficiency resources if participant-perspective OPIs are not adequately 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 may be inherently skewed against energy efficiency.

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Appendix A – State Cost-Effectiveness Survey Results

Table A.1: Michigan

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		Reduce the future costs of service to customers	**Source**: Act 295, § 71(1)(a); Personal Communication with MI PSC Staff. **Note**: "The overall goal of an energy optimization plan shall be to reduce the future costs of provider service to customers. In particular, an EO plan shall be designed to delay the need for constructing new electric generating facilities and thereby protect consumers from incurring the costs of such construction." The state's immediate goal was to quickly and efficiency implement programs as there were previously none.
Cost-Effectiveness Test(s) & Application	Primary Test used by state	Program Administrator Cost Test	**Source:** Act 295, § 73(2). **Note**: "The commission shall not approve a proposed energy optimization plan unless the commission determines that the EO plan meets the utility system resource cost test and is reasonable and prudent."
	Other Test(s) considered (if applicable)	TRC, RIM, Participant Cost	**Source:** MI PSC 2008, Appendix E, 1.e. **Note**: "In order to provide the Commission with sufficient information to support the proposed distribution of energy optimization funds among the portfolio of proposed programs, the filed plan will include multiple cost-effectiveness tests for individual programs including: USRCT, Total Resource Cost Test, Rate Impact Measure Test and Participant Cost Tests."
	Level at which Test(s) is applied	Portfolio	**Source:** MI PSC 2008, Appendix E, 2.a. **Note**: "Cost effective means that the overall plan being evaluated meets the Utility System Resource Cost Test."
	Other level(s) at which Test(s) is applied (if applicable)	Program, Measure	**Source:** MI PSC 2008, Appendix E, 1.e; Personal Communication with MI PSC Staff. **Note**: "In order to provide the Commission with sufficient information to support the proposed distribution of energy optimization funds among the portfolio of proposed programs, the filed plan will include multiple cost-effectiveness tests for individual programs."
	Discount rate used in Test(s)	Utility WACC	**Source:** Consumers Energy 2012, p 18; Detroit Edison 2009, Morgan Testimony, RAM-17; Personal Communication with MI PSC Staff. **Note**: The discount rate is based on a utility's weighted average cost of capital, which varies by utility. The utilities' typical discounts rates range between 7% and 10%, and are about 8% on average. Consumers Energy uses a discount rate of 9.78% for both energy efficiency programs and supply side resources.
	Study period over which Test(s) is applied	Measure Life	**Source**: Personal Communication with MI PSC Staff. **Note**: The deemed savings database previously limited measure lives to 20 years, but that cap has since been lifted to allow for the full lifetime of the measures installed.
Avoided Costs Included in Cost-Effectiveness Test(s)	Capacity Costs	Yes	**Source**: MI PSC 2008, Appendix E, 2.f. **Note**: The Utility Cost Test takes into account the avoided supply costs of demand and capacity valued at marginal costs for the periods when there is a load reduction. At the option of the provider, either the cost-based value provided by the commission or the MISO market-based value can be used as a determinant in estimating the avoided cost.
	Energy Costs	Yes	**Source**: MI PSC 2008, Appendix E, 2.f. **Note**: The Utility Cost Test takes into account the avoided supply costs of energy and generation. At the option of the provider, either the cost-based value provided by the commission or the MISO market-based value can be used as a determinant in estimating the avoided cost.
	T&D Costs	Yes	**Source**: MI PSC 2008, Appendix E, 2.f; Personal Communication with MI PSC Staff. **Note**: The Utility Cost Test takes into account the reduction in transmission and distribution, although the avoided cost varies by utility and can be relatively low.
	Environmental Compliance	No	**Source**: MI PSC 2008, Appendix E, 2.f; Personal Communication with MI PSC Staff. **Note**: The avoided supply costs of future carbon tax has been included for renewable energy programs, but not for energy efficiency programs. Current environmental compliance costs are embedded in avoided energy costs.
	Price Suppression	No	
	Line Loss Costs	Yes	**Source**: Personal Communication with MI PSC Staff; Consumers Energy 2012, pp 18-19. **Note:** The Utility Cost Test takes into account the avoided cost of transmission and distribution line losses. For example, the Consumers Energy line loss study was used to value losses at the secondary, primary, and transmission voltage levels.
	Reduced Risk	No	
	Other Avoided Costs	No	
OPIs/NEBs Included in Primary Cost-Effectiveness Test	Are OPIs included in Primary Test(s)?	Yes	**Source:** Act 295, § 71(3)(g). **Note**: Low-income program offerings are excluded from the cost-effectiveness requirement.
	Program Administrator or Utility OPIs	No	
	Participant or Customer OPIs:		
	Resource	No	**Source:** Personal Communication with MI PSC Staff. **Note:** Natural gas savings are quantified in natural gas programs, but are not included in electric energy efficiency programs.
	Low-Income	Yes - Qualitative	**Source:** Act 295, § 71(3)(g). **Note**: Low-income program offerings are excluded from the cost-effectiveness requirement.
	Equipment	No	
	Comfort	No	
	Health & Safety	No	
	Property Value	No	
	Utility Related	No	
	Societal OPIs	No	

Table A.2: Connecticut

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		Focus on electric system impacts only	**Source:** CT DPUC 1999.
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)	TRC	**Source**: DEEP 2012, pp 19-20.
	Level at which Test(s) is applied	Program	**Source:** CT G.S. §16-245m (d)(1).
	Other level(s) at which Test(s) is applied (if applicable)	n/a	
	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 Life	**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)?	Yes	
	Program Administrator or Utility OPIs	No	
	Participant or Customer OPIs:		
	Resource	No	
	Low-Income	Yes - Qualitative	**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: Illinois

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		Diverse program offerings to customers	**Source:** 220 ILCS 5/8-103, § 8-103(f)(5). **Note**: "The utility shall demonstrate that its overall portfolio of energy efficiency and demand-response measures... represent a diverse cross-section of opportunities for customers of all rate classes to participate in the programs."
Cost-Effectiveness Test(s) & Application	Primary Test used by state	Total Resource Cost Test	**Source:** 220 ILCS 5/8-103,§103(a). **Note**: "cost-effective" means that the measures satisfy the total resource cost test.
	Other Test(s) considered (if applicable)	PAC	**Source:** 220 ILCS 5/16-111.5B(a)(3)(D); ComEd 2013b, p 26. **Note:** Show that "the new or expanded cost-effective energy efficiency programs or measures would lead to a reduction in the overall cost of electric service."
	Level at which Test(s) is applied	Portfolio or Program	**Source**: 220 ILCS 5/8-103,§103(a); 5/16-111.5B. **Note**: Section 8-103 programs are required to screen at the portfolio level. IPA programs are required to screen at the program level.
	Other level(s) at which Test(s) is applied (if applicable)	Portfolio, Program, Measure	**Source**: ICC 2010, p 30; Personal Communication with ICC Staff. **Note**: The Commission finds that evaluating cost-effectiveness on a portfolio level is necessary to ensure that Ameren not be penalized for planning assumptions that turn out to be inaccurate. The Commission concludes it is appropriate to apply the TRC test at the portfolio level, but Ameren Illinois and the DCEO should be allowed to apply it at the measure or program level if they so choose.
	Discount rate used in Test(s)	WACC	**Source:** Ameren 2013b, Testimony of Andrew Cottrell, p 10; Exh. 1.1, App. D, Vol. 3, p 2-23. **Note:** Ameren Illinois used the corporate weighted average cost of capital. Ameren's nominal discount rate is 7% with an inflation rate of 2.92%, for a real discount rate of 3.93%.
	Study period over which Test(s) is applied	Measure Life	**Source**: 20 ILCS 3855/1-10. **Note**: "The benefit-cost ratio is the ratio of the net present value of the total benefits of the program to the net present value of the total costs as calculated over the lifetime of the measures."
Avoided Costs Included in Cost-Effectiveness Test(s)	Capacity Costs	Yes	**Source:** Ameren 2013b, pp 26-27.
	Energy Costs	Yes	**Source:** Ameren 2013b, pp 25-26.
	T&D Costs	Yes	**Source:** Ameren 2013b, pp 27-29.
	Environmental Compliance	Yes	**Source:** 20 ILCS 3855/1-10. **Note**: In calculating avoided costs of power and energy that an electric utility would otherwise have had to acquire, reasonable estimates shall be included of financial costs likely to be imposed by future regulations and legislation on emissions of greenhouse gases.
	Price Suppression	No	**Source:** See ICC 2012, p 270.
	Line Loss Costs	Yes	**Source:** Ameren 2013b, Testimony of Andrew Cottrell, pp 9-10; Exh. 1.1, App. D, Vol. 3, p 2-23. **Note**: Each avoided cost is adjusted upwards in the TRC calculation by the appropriate line loss factor. Ameren uses an electric delivery losses factor of 6.7% and a natural gas delivery losses factor of 0.0085%.
	Reduced Risk	No	
	Other Avoided Costs	No	
OPIs/NEBs Included in Primary Cost-Effectiveness Test	Are OPIs included in Primary Test(s)?	Yes	**Source:** 20 ILCS 3855/1-10. **Note**: A total resource cost test compares the sum of avoided electric utility costs, representing the benefits that accrue to the system and the participant in the delivery of those efficiency measures, as well as other quantifiable societal benefits, including avoided natural gas utility costs.
	Program Administrator or Utility OPIs	No	
	Participant or Customer OPIs:		
	Resource	Yes - Quantified	**Source:** 20 ILCS 3855/1-10; Ameren 2013b, pp 24-25. **Note**: Natural gas and water.
	Low-Income	Yes - Qualitative	**Source:** 220 ILCS 5/8-103,§103(a). **Note**: Low-income measures shall not be required to meet the total resource cost test.
	Equipment	No	
	Comfort	No	
	Health & Safety	No	
	Property Value	No	
	Utility Related	No	
	Societal OPIs	No	

Table A.4: Massachusetts

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		All available cost-effective energy efficiency	**Source:** MA G.L. c. 25.
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. **Notes:** Hard-to-measure EE programs are screened at the customer sector level. MA EE Guidelines, § 3.4.3.2.
	Other level(s) at which Test(s) is applied (if applicable)	n/a	
	Discount rate used in Test(s)	10 year Treasury Note	**Source:** MA DPU 2013a, Guideline § 3.4.6. **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 Life	25 years.
Avoided Costs Included in Cost-Effectiveness Test(s)	Capacity Costs	Yes	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(a)(i). **Note:** Values from Synapse 2011.
	Energy Costs	Yes	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(a)(ii). **Note:** Values from Synapse 2011.
	T&D Costs	Yes	**Source:** MA DPU 2013a, Guidelines § 3.4.4.1(a)(iii), (iv). **Note:** Values developed individually by Program Administrators.
	Environmental Compliance	Yes	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(a)(v). **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). **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). **Note:** Each OPI is explicitly quantified.
	Program Administrator or Utility OPIs	Yes - Quantified	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(a)(viii). **Note:** Each OPI is explicitly quantified.
	Participant or Customer OPIs:		**Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii). **Note:** Each OPI is explicitly quantified.
	Resource	Yes - Quantified	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(i). **Notes:** Includes natural gas, oil, propane, wood, kerosene, water, other. Each OPI is explicitly quantified.
	Low-Income	Yes - Quantified	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii)(D). **Notes:** Includes all benefits associated with providing energy efficiency services to Low-Income Customers. Each OPI is explicitly quantified.
	Equipment	Yes - Quantified	**Source:** MA DPU 2013a, Guidelines § 3.4.4.1(b)(ii)(A), (B). **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 - Quantified	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii). **Note:** Each OPI is explicitly quantified.
	Health & Safety	Yes - Quantified	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii)(C). **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 - Quantified	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii). **Note:** Each OPI is explicitly quantified.
	Utility Related	Yes - Quantified	**Source:** MA DPU 2013a, Guideline § 3.4.4.1(b)(ii). **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. **Note:** The MA DPU explicitly directed the removal of certain societal OPIs from TRC test.

Table A.5: Minnesota

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		Achieve annual savings goal of 1.5% of sales	**Source:** MN Statute 216B.241, Subp. 1c; Personal Communication with MN DER Staff.
Cost-Effectiveness Test(s) & Application	Primary Test used by state	Societal Cost Test	**Source:** MN Rules 7690.1200, Subp. 1(c); MN DOC 2011, p 7. **Note**: Although Minnesota Rules require utilities to file cost-effectiveness results from all four perspectives, DER focuses on the Societal test as it measures the ratio of overall benefits and costs to society of energy conservation improvements.
	Other Test(s) considered (if applicable)	PAC, Participant Cost, TRC, RIM	**Source:** MN Rules 7690.1200, Subp. 1(c); MN Rules 7690.0550, Subp. E; Personal Communication with MN DER Staff. **Note**: a utility should provide information on the cost-effectiveness of its programs, as calculated from the utility, participant, ratepayer, and societal perspectives.
	Level at which Test(s) is applied	Segment (essentially Sector)	**Source:** MN DER 2012, pp 9-10. **Note**: In April 2012, the DER announced a policy for 2013-2015 CIP plans that requires portfolios to be cost-effective at the segment level, rather than the program level. Segments include business; residential; low-income; planning; research, evaluations and pilots; renewable energy; and assessments.
	Other level(s) at which Test(s) is applied (if applicable)	Portfolio, Program, Measure	**Source:** Personal Communication with MN DER Staff. **Note:** The MN DER reviews cost-effectiveness results at the portfolio and program levels, and sometimes at the measure level.
	Discount rate used in Test(s)	Social Discount Rate, WACC	**Source:** MN DER Staff 2012, Inputs 11-13; Xcel 2012a, p 481. **Note**: The Societal Discount Rate is based on the US Treasury's 20-year constant maturity rate, which was 2.67% as of January 3, 2012. The Utility Discount Rate is a utility's weighted cost of capital approved in the utility's most recent rate case. Xcel Energy's WACC was 7.04% in the utility's 2010 rate case. For the Societal Cost test, residential programs use the societal discount rate, and commercial programs use the utility discount rate. The Participant Test uses the societal discount rate, and the PAC test uses the utility discount rate.
	Study period over which Test(s) is applied	15 years	**Source:** MN DER Staff 2012, Input 20; Personal Communication with MN DER Staff. **Note**: The Project Life is the expected lifetime of a particular energy conservation measure, expressed in number of years. The measure life is capped at 15 years.
Avoided Costs Included in Cost-Effectiveness Test(s)	Capacity Costs	Yes	**Source:** Xcel 2012a, p 478; Xcel 2012b. **Note:** Avoided Generation included in Avoided Revenue Requirements.
	Energy Costs	Yes	**Source:** Xcel 2012a, p 478; Xcel 2012b. **Note:** Avoided Marginal Energy included in Avoided Revenue Requirements; Bill Reduction included in Participant Benefits.
	T&D Costs	Yes	**Source:** Xcel 2012a, p 478; Xcel 2012b. **Note:** Avoided T&D included in Avoided Revenue Requirements.
	Environmental Compliance	Yes	**Source:** Xcel 2012a, p 478; MN PUC 2013. **Note:** Avoided Environmental Externality included in Avoided Revenue Requirements.
	Price Suppression	No	
	Line Loss Costs	Yes	**Source:** Personal Communication with MN DER Staff. **Note:** Typically the utility will provide line loss values. If not, the MN DER will assume 8%.
	Reduced Risk	No	
	Other Avoided Costs	No	
OPIs/NEBs Included in Primary Cost-Effectiveness Test	Are OPIs included in Primary Test(s)?	Yes	**Source:** Xcel 2012a, p 478.
	Program Administrator or Utility OPIs	No	
	Participant or Customer OPIs:		
	Resource	No	
	Low-Income	Yes - Qualitative	**Source:** MN DER 2012, p 10. **Note:** Due to their unique purpose and the spending requirement for low-income projects, the Commissioner has not required low-income programs to pass the Societal Cost test in previous triennials.
	Equipment	No	
	Comfort	No	
	Health & Safety	No	
	Property Value	No	
	Utility Related	No	
	Societal OPIs	No	

Table A.6: New York

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		Maximize cost-effectiveness given limited funding	**Source:** NY PSC 2008.
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. **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. **Note:** Measures are pre-screened for cost-effectiveness.
	Other level(s) at which Test(s) is applied (if applicable)	Project, Program	**Source**: Personal Communication with NY DPS Staff; NY PSC 2011a, p 10. **Note:** Project level screenings are 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. **Notes:** Currently 5.5% real, 7.72% nominal.
	Study period over which Test(s) is applied	Measure Life	**Source**: NYSERDA 2011, p 8-8; NYDPS; NY PSC 2011b. **Notes:** Estimated mean measure lifetime.
Avoided Costs Included in Cost-Effectiveness Test(s)	Capacity Costs	Yes	**Source:** NY PSC 2009a, pp 33-38. **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. **Notes:** Baseline year historic NYISO LBMPs with projections based on MAPS simulations.
	T&D Costs	Yes	**Source:** NY PSC 2009a, pp 33-38. **Notes**: Values established by tariff studies. Avoided transmission costs embedded in avoided energy costs.
	Environmental Compliance	Yes	**Source:** NY PSC 2008. **Notes:** credit for avoided CO2 emissions at $15/ton
	Price Suppression	No	
	Line Loss Costs	Yes	**Source:** NY PSC 2009a, App. 2. **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. **Note:** The DPS provides guidelines for program administrators to report various OPIs qualitatively. In practice, only CO2 and low income benefits have been incorporated into screening practices.
	Program Administrator or Utility OPIs	No	
	Participant or Customer OPIs:		
	Resource	Yes - Quantified	**Source:** Personal Communication with NY DPS Staff. **Notes:** Includes water and other fuels. Can be modeled as a reduced O&M cost as subtracted from measure costs.
	Low-Income Only	Yes - Qualitative	**Source:** NY PSC 2010, pp 64-65. **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 - Qualitative	**Source:** Personal Communication with NY DPS Staff. **Notes:** Flexibility for O&M savings.
	Comfort	No	
	Health & Safety	No	
	Property Value	No	
	Utility Related	No	
	Societal OPIs	No	

Table A.7: Oregon

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		All-Cost Effective Measures	**Source:** Sixth Northwest Power Plan, p 6; Personal Communication with ETO Staff. **Note:** "Cost-effective energy efficiency should be developed aggressively and consistently for the foreseeable future. The Council's plan demonstrates that cost-effective efficiency improvements could on average meet 85 percent of the region's load growth over the next 20 years."
Cost-Effectiveness Test(s) & Application	Primary Test used by state	Total Resource Cost Test	**Source:** OR PUC 1994. **Note:** The docket calls for an amended application of the TRC as it only examines benefits direct to the utility and ratepayers.
	Other Test(s) considered (if applicable)	PAC	**Source:** ETO Methodology 2011.
	Primary Level at which Test(s) is applied	Program	**Source:** OR PUC 1994.
	Other level(s) at which Test(s) is applied (if applicable)	Measure	**Source:** OR PUC 1994.
	Discount rate used in Test(s)	Risk-adjusted cost of capital	**Source:** Personal Communication with ETO Staff. **Note:** Risk-adjusted cost of capital, as established by Utility IRPs and accepted/allowed by the PUC. As of 2009, it was 5.2%.
	Study period over which Test(s) is applied	Measure Life	**Source:** Personal Communication with ETO Staff.
Avoided Costs Included in Cost-Effectiveness Test(s)	Capacity Costs	Yes	**Source:** ETO Methodology 2011.
	Energy Costs	Yes	**Source:** ETO Methodology 2011, p 2.
	T&D Costs	Yes	**Source:** ETO Methodology 2011.
	Environmental Compliance	Yes	**Source:** Personal Communication with ETO Staff. **Note:** Avoided environmental compliance costs are embedded in market predictions. For instance, carbon regulation risk is assumed to be included in price forecasts utilized by utilities.
	Price Suppression	No	**Source:** Personal Communication with ETO Staff.
	Line Loss Costs	Yes	**Source:** ETO Methodology 2011.
	Reduced Risk	Yes	**Source:** Fifth Northwest Power Plan 2005; ETO Methodology 2011. **Note:** 10% credit for energy efficiency that acts as a "catch-all" for other avoided costs that aren't quantifiable. Specifically, this credit recognizes the benefits of conservation in addressing risk and uncertainty.
	Other Avoided Costs	Yes	**Source:** ETO Methodology 2011. **Note:** A range of risk avoidance values are applied from $5/MWh for discretionary programs to $10/MWh for lost opportunity programs. A 10% credit for energy efficiency that acts as a "catch-all" for other avoided costs that aren't quantifiable.
OPIs/NEBs Included in Primary Cost-Effectiveness Test	Are OPIs included in Primary Test(s)?	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** 10% credit for energy efficiency that acts as a "catch-all" for other avoided costs that aren't quantifiable.
	Program Administrator or Utility OPIs	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** Included in 10% adder.
	Participant or Customer OPIs:		
	Resource	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** Included in 10% adder.
	Low-Income	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** Included in 10% adder.
	Equipment	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** Included in 10% adder.
	Comfort	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** Included in 10% adder.
	Health & Safety	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** Included in 10% adder.
	Property Value	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** Included in 10% adder.
	Utility Related	Yes - 10% Adder	**Source:** ETO Methodology 2011. **Note:** Included in 10% adder.
	Societal OPIs	No	**Source:** Personal Communication with ETO Staff. **Note:** PUC only accounts for benefits to participants and the utility system.

Table A.8: Vermont

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		Least cost planning including environmental costs	**Source:** 30 VSA § 218c
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)	PAC, TRC	**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	**Source:** Efficiency Vermont 2011, pp 3-5. **Note:** The decisive "test" under each perspective is the size of the net benefits, rather than the benefit/cost ratio.
	Other level(s) at which Test(s) is applied (if applicable)	Program, Project, Measure	**Source:** Efficiency Vermont 2011, pp 3-5. **Note:** Because cost-effectiveness of the portfolio is the primary objective, cost-effectiveness of any one component of the portfolio is secondary. The relative importance of cost-effectiveness of each component is hierarchical: (i) measure-level cost-effectiveness is subordinate to project-level cost-effectiveness; (ii) Individual measure- and project-level cost-effectiveness are subordinate to program cost-effectiveness; and (iii) Individual program cost-effectiveness is subordinate to overall portfolio cost-effectiveness.
	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 Life	**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 - 15% Adder	**Note:** Included in the 15% adder.
	Participant or Customer OPIs:		
	Resource	Yes - 15% Adder	**Source:** VT PSB 2012a. **Note:** Water and fuel savings and benefits are directly calculated, separate from the 15% adder.
	Low-Income	Yes - Additional 15% Adder	**Source**: VT PSB 2012a, p 33. **Note:** An additional 15% adder is applied to the energy benefits of the low-income sector.
	Equipment	Yes - 15% Adder	**Source:** VT PSB 2012a. **Note:** Changes in O&M expenses by measure are directly calculated, separate from the 15% adder.
	Comfort	Yes - 15% Adder	**Note:** Included in the 15% adder.
	Health & Safety	Yes - 15% Adder	**Note:** Included in the 15% adder.
	Property Value	Yes - 15% Adder	**Note:** Included in the 15% adder.
	Utility Related	Yes - 15% Adder	**Note:** Included in the 15% adder.
	Societal OPIs	Yes - 15% Adder	**Source:** VT PSB 2011. **Note**: Included in the 15% adder.

Table A.9: Wisconsin

Cost-Effectiveness Metrics		Policies & Practices	Notes & Sources
Primary Policy Driver		All cost-effectiveness energy efficiency up to funding cap	**Source:** Personal Communication with WI PSC Staff.
Cost-Effectiveness Test(s) & Application	Primary Test used by state	Modified Total Resource Cost Test	**Source:** Cadmus 2012, p 48; WI PSC 2010. **Note**: The TRC is used because it is "consistent with the Commission's focus on energy use and peak demand reduction." Michigan refers to its primary cost-effectiveness test as the modified TRC to distinguish it from the expanded TRC test, which is also used in cost-effectiveness screening.
	Other Test(s) considered (if applicable)	PAC, Expanded TRC	**Source:** WI PSC 2010. **Note**: "the modified TRC test does not provide useful guidance for appropriate program design, so the Commission finds it reasonable to require that programs must pass the Utility/Administrator test in order to ensure that the benefits ratepayers receive from these programs exceed the programs' costs." "The Commission recognizes that other non-economic externalities are also significant, so the Expanded test must also be applied at the portfolio level."
	Level at which Test(s) is applied	Portfolio	**Source:** WI PSC 2010, pp 7-8.
	Other level(s) at which Test(s) is applied (if applicable)	Measure, Program	**Source:** WI PSC 2010, p 7; Personal Communication with WI PSC Staff.
	Discount rate used in Test(s)	Low-Risk	**Source**: Cadmus 2012, p 49; WI PSC 2010. **Note**: The low-risk discount rate represents the public sector cost of borrowing. It also provides an appropriate balance between the benefits of current ratepayers and benefits of future ratepayers. It is current set at 2% by the MI PSC.
	Study period over which Test(s) is applied	Measure Life	**Source:** Personal Communication with WI PSC staff.
Avoided Costs Included in Cost-Effectiveness Test(s)	Capacity Costs	Yes	**Source:** Cadmus 2012, p 48; WI PSC 2010. **Note:** Avoided capacity costs based on the cost of a new peaking plant.
	Energy Costs	Yes	**Source:** Cadmus 2012, p 48; WI PSC 2010. **Note**: Avoided energy costs are based on the most recent three-year historical average of locational marginal prices.
	T&D Costs	No	**Source:** Cadmus 2012; Personal Communication with WI PSC Staff. **Note**: It is included in the line losses calculation, but significantly undervalued.
	Environmental Compliance	Yes	**Source:** Cadmus 2012, p 49. **Note**: Emissions Benefits for CO2, NOx, and SOx. A levelized carbon value of $30/ton is reasonable.
	Price Suppression	No	**Source:** Personal Communication with WI PSC Staff.
	Line Loss Costs	Yes	**Source:** Cadmus 2012, p 49; WI PSC 2010. **Note:** Line loss factor of 8%.
	Reduced Risk	No	**Source:** Personal Communication with WI PSC Staff.
	Other Avoided Costs	No	**Source:** Personal Communication with WI PSC Staff.
OPIs/NEBs Included in Primary Cost-Effectiveness Test	Are OPIs included in Primary Test(s)?	Yes	**Source:** WI PSC 2010. **Note**: Only gas benefits are included in the modified TRC. No other OPIs are included in the modified TRC test, although the expanded TRC test does included additional OPIs.
	Program Administrator or Utility OPIs	No	
	Participant or Customer OPIs:		
	Resource	Yes	**Source:** Cadmus 2012, App. I. **Note**: Includes gas benefits only.
	Low-Income	No	
	Equipment	No	
	Comfort	No	
	Health & Safety	No	
	Property Value	No	
	Utility Related	No	
	Societal OPIs	No	

Appendix B – Best Practices on Select Issues

Introduction

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 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.

The public policy goals in each 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. These different policy objectives apparently explain some of the key differences between the cost-effectiveness practices across states.

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. The following best practices 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

It is best practice to include OPIs 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 may be skewed; i.e., they may not provide an accurate indication of cost-effectiveness from that perspective. (Synapse 2012b; Neme and Kushler 2010).

Therefore, if a state has chosen to use the TRC test as the primary screening test, then it would be more internally consistent for the state's cost-effectiveness analysis to include utility- and participant-perspective OPIs. The TRC test includes all the costs to program participants, and therefore it should also include all the benefits to program participants in order to maintain internal consistency. Otherwise the test results may be inherently skewed against energy efficiency. (RAP 2013, pp 13-14).

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 the state would benefit from using the PAC test, as the test results would be more internally consistent. Otherwise, if a state uses the TRC or Societal Cost test

without including OPIs, then the state may undervalue energy efficiency, which may result in customers paying higher costs than necessary for energy services.

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 reconnects, 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.

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 could 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 could be addressed through some proxy approach.[13]
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 would benefit from using the PAC test to screen efficiency resources instead of the TRC test.

Price Suppression Effects

Energy efficiency resources provide benefits through wholesale market price suppression effects 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. The price suppression effects act as a benefit because it represents a reduction in costs to wholesale electric customers, which are passed on to retail electric customers. Therefore, cost-effectiveness results from the PAC test, the TRC test, and the Societal Cost test would be more accurate if they included benefits associated with price suppression.

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 a real reduction in wholesale electricity market prices as a result of the energy efficiency savings, and those reductions will represent real

[13] 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.

savings to electricity customers. Cost-effectiveness test results would better account for all energy efficiency resource benefits if states ensured that estimates of the price suppression effect account for the dissipation of this effect, rather than simply excluding the price suppression 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, cost-effectiveness results from the PAC test, the TRC test, and the Societal Cost test may better account for all energy efficiency resource benefits by including benefits from the price suppression effect.

Reduced Risk

Most states do not recognize that energy efficiency may reduce risks on the utility system associated with supply-side resources. States could 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.[14] 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.

[14] 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 (RAP 2013, pp 41-42). 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.

The choice of discount rate (addressed in the next section) is likely the best way to reflect the risk benefits of energy efficiency for a state. The discount rate is likely the best approach to addressing *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.

While a proxy adder for risk benefits is a reasonable way to approximate the risk benefits of energy efficiency, 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, when states apply risk benefit adders and/or risk-adjusted discount rates they should consider explicitly identifying the extent to which each mechanism is meant to address financial risk, project risk, portfolio risk, or some combination of these risks.

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. (RAP 2013, p 19).

Discount rates are used to account for two concepts: the time value of money and the riskiness of the investment (Synapse 2012b).[15] 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.

It is best practice that the discount rate used for efficiency screening 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, would provide cost-effectiveness test results that are more internally consistent if states used 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.

Also, when screening energy efficiency resources states could 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, could 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.

In some cases, a state will choose a discount rate based on the cost-effectiveness test. For example, in 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.

Finally, it is important to note that the choice of discount rate is essentially a policy decision. In addition to the considerations described above, states could consider choosing a discount rate that is informed by the weight the regulators wish to give to the future benefits of energy efficiency programs. At a minimum, each state's cost-effectiveness test results would be more internally consistent if the state explicitly identified what objectives it is trying to achieve with its choice of discount rate, and ensured that the choice of discount rate is consistent with these objectives.

[15] 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.