REGIONAL EVALUATION,
MEASUREMENT & VERIFICATION FORUM

COST-EFFECTIVENESS SCREENING PRINCIPLES AND GUIDELINES

For Alignment with Policy Goals, Non-Energy Impacts, Discount Rates, and Environmental Compliance Costs

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REGIONAL EVALUATION, MEASUREMENT & VERIFICATION FORUM

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PREFACE

This *Cost Effectiveness Screening Principles and Guidelines* document ('the Guidelines') was prepared by the Regional Evaluation, Measurement and Verification Forum ('the Forum'). The Forum, established in 2008, is a regional project facilitated and managed by Northeast Energy Efficiency Partnerships (NEEP) that represents states in New England[1], New York, Maryland, Delaware, and the District of Columbia.

The Forum supports the development and use of consistent and transparent protocols to evaluate, measure, verify, and report the savings, costs, and emissions impacts of energy efficiency and other demand-side resources. The Guidelines herein emerged out of recognition among Forum member states on the importance of understanding how states screen energy efficiency investments for cost-effectiveness across the region, and of developing guidance on a set of priority cost-effectiveness screening issues.

Cost-effectiveness screening for energy efficiency investments is fundamental to customer energy efficiency programs. It is, in essence, the benefit-cost analysis framework that helps stakeholders – including utility regulators, program administrators, and other policymakers – determine which types of energy efficiency investments represent net beneficial investments for ratepayers according to what is in the public interest based on the state's energy policies. Typically, states determine their cost-effectiveness practices with stakeholder input. State regulatory commissions generally approve programs if their benefit-cost ratio is higher than 1.0.

At present, most states have developed screening tests based upon the California Standard Manual of Practice (CSPM), primarily the utility cost test, the total resource cost test (TRC), and the societal cost test.[2] All of the states in the Forum region use one of these tests, with a majority using the TRC test. A Survey of State Cost-Effectiveness Screening Practices was undertaken as Phase 1 of this project to help inform development of this guidance document, and showed that application of the screening tests practices among the Forum states vary significantly. Despite largely using the same test, differences exist, particularly in accounting for non-energy impacts (NEIs), environmental compliance costs, and accounting for risk, including use of discount rates. These differences can lead to different screening results between states for similar programs. This has been particularly relevant to the TRC test,

[1] Including Connecticut, Massachusetts, New Hampshire, Rhode Island, and Vermont.
[2] The California Standard Manual of Practice includes five tests, which including the participant cost test, utility or program administrator cost test, the total resource cost test, the societal cost test, and the ratepayer impact measure (RIM) test. The participant test and the RIM tests are not used by most states at present.

which calls for challenging decisions about how to account for the costs and benefits for program participants.

Key policy developments are leading some energy efficiency stakeholders to consider or review cost effectiveness screening practices in their state or more broadly. These developments include:

- Support for achieving aggressive levels of energy and peak demand reductions through energy efficiency programs in the Northeast and Mid-Atlantic region;
- Interest among stakeholders across the country in revisiting the application of the cost-effectiveness screening practices, which are defined by the widely referenced, but viewed as limited, California Standard Practice Manual. This guidance is informed by work undertaken by the National Efficiency Screening Project (NESP)[3] in its Resource Value Framework (RFV) report;
- Challenges of using traditional screening approaches in the face of policy goals promoting long-term changes in customer energy use;
- State initiatives that are exploring new models of state energy regulation to modernize their electricity grid and increase customer use of distributed energy resources, which may impact state energy efficiency programs; and
- National and state policies that seek to regulate carbon emissions from power plants, in particular the U.S. Environmental Protection Agency (EPA)'s Clean Power Plan under Section 111(d) of the Clean Air Act.

In light of these key policy drivers, states[4] in the Forum Region may choose to review and make changes to their energy efficiency screening practices in the coming years.

Over the past year, NEEP staff, as manager of this project, with Synapse Energy Economics (the contractor to this project) have sought input and feedback from the Forum's Cost-Effectiveness Screening project subcommittee and the EM&V Forum Steering Committee to inform the development of principles and guidelines herein to assist states in reviewing and revising, where appropriate or applicable, their screening practices. The project subcommittee prioritized areas for cost-effectiveness screening guidance as part of a survey conducted in March 2014, followed by the Steering Committee subsequently supporting the development of this document in April 2014, including overarching principles developed by the NESP. Subcommittee members also provided comment on the initial outline and draft

[3] http://www.nhpci.org/publications/NHPC_NESP-Recommendations_20140816.pdf

[4] Many stakeholders play a role in developing and shaping state screening practices and in screening energy efficiency programs, including state utility regulators, state energy offices, consumer advocates, utility and non-utility program administrators, efficiency industry members, and environmental groups. This document uses the umbrella term "states" when referring to the entity or group of entities that review and inform cost-effectiveness screening protocols.

guidelines during the summer and fall of 2014. This process informed the scope of this guidance document.

PURPOSE, SCOPE AND APPLICATION

The Guidelines are intended to serve two purposes. First, they establish overarching principles that states should consider using in reviewing their energy efficiency screening practices. Second, they provide specific guidance on challenging elements of cost-effectiveness screening as prioritized by Forum members.

The Guidelines begin with introducing the four overarching principles, which are reiterated throughout the document to remind the reader of their relevance. These principles provide states with a common framework for addressing decisions about cost-effectiveness screening with the public interest in mind and ensure that these decisions are made transparently and are better understood by all stakeholders. The principles focus on ensuring that screening practices: 1) align with state energy policy goals, and thus support the public interest, 2) support symmetry of relevant costs and benefits; 3) address hard to quantify relevant benefits; and 4) provide transparency in cost-effectiveness screening by using a sample template for documenting costs and benefits.

The guidance is not meant to prescribe a particular cost-effectiveness test for states to use, nor is the intention to have each state revise their efficiency screening practices. For those states that have already considered their practices in the context of the guidance it is not necessary to re-examine them. If each Forum state applied the four principles in reviewing their current tests, some may make no change to current practice, some may modify their test, and some may decide to make significant changes. In fact, relevance or application of these Guidelines will vary from state to state depending on the state's current screening practices, where some states are already largely aligned with the overarching principles and Guidelines.

The Guidelines emphasize the critical first step of reviewing one's state energy policy goals and ensuring that the associated cost-effectiveness screening takes into account and aligns with those goals (Principle #1). Chapter 2 is dedicated to this principle. Based upon its policy review, a state can then consider what relevant costs and benefits are or should be included in their screening test, taking into account the second and third principles of 'ensuring symmetry' and 'addressing hard to quantify NEIs' which are addressed in Chapter 3. The fourth principle on 'transparency' generally applies to articulating and documenting state policies and relevant costs and benefits.

The second purpose of this document is to provide guidance on specific issues with cost-effectiveness screening among Forum states. The project subcommittee prioritized three areas for specific guidance for their cost-effectiveness screening: accounting for non-energy impacts, accounting for environmental compliance costs, and selecting appropriate discount

rates (Chapters 3-5). Each issue represents an area where practice between states may vary and hence clear guidance can help to promote a better understanding of how each issue can impact screening of efficiency programs. Chapters 3-5 provide guidance on how to apply the four overarching principles in the context of these key issue areas, with a step-by-step process that includes options for stakeholders to consider in selecting appropriate approaches or values in cost-effectiveness screening. Relevant examples regarding each element can be found in each chapter.

Below is a summary of each chapter of these Guidelines:

Chapter 1: Overarching Guiding Principles presents the aforementioned principles that are intended to provide states with a common framework for addressing future decisions about cost-effectiveness screening in support of the public interest and ensure that these decisions are made transparently and are better understood by all stakeholders.

Chapter 2: Alignment of Screening with Energy Policies provides guidance on how states can ensure that relevant state energy policies are clearly identified and documented for all stakeholders to understand purpose of efficiency programs, and relevant costs and benefits to consider.

Chapter 3: Accounting for Non-Energy Impacts (NEIs) discusses options for accounting for non-energy impacts *that may be relevant* to the perspective of a state's cost-effectiveness screening tests (and consistent with the state's energy policies), whether from the utility perspective, the participant perspective, or from a societal perspective. It reviews the symmetry principle in the context of non-energy impacts to help state ensure balance in screening energy efficiency investments. It also discusses the "hard to quantify benefits" principle, providing states with options to account for non-energy impacts using a range of approaches including direct monetization, creating proxy values, alternative screening benchmarks, using regulatory judgment, and multi-attribute decision analysis (MADA), an important new concept in the context of EE screening.

Chapter 4: Accounting for Environmental Compliance Costs is an important element of screening. These are not environmental externalities, but rather reduced costs to states and ratepayers that can be achieved through energy efficiency programs by reducing air emissions from power supply. This chapter focuses on expected *future* environmental compliance costs that are not yet embedded in energy prices but represent potential areas of economic value to ratepayers if avoided, and discusses how to prevent double-counting in this context.

Chapter 5: Choice of Discount Rates represents an important policy choice for each state for their energy efficiency screening. This section discusses the role of discount rates in the context of both the short and long term benefits and costs of energy efficiency programs, as well as the role of energy efficiency programs in mitigating risks to ratepayers. Importantly, different discount rates can lead to significant different screening results for energy efficiency programs. This section also discusses selecting discount rates in the context of the primary screening tests (PAC, TRC, and SC tests).

Chapter 6: Transparency in Screening Practices provides a template table that states can use to document their cost-effectiveness screening assumptions. Use of such a standardized reporting table across the Forum region can help to build transparency and better understanding of practices within states and across the Forum region in sharing information on key assumptions.

CONSIDERATIONS AND RECOMMENDATIONS

These Guidelines are not meant to be prescriptive in recommending any one test over another, inclusion of any particular costs or benefits, or use of a specific discount rate. States' use of these Guidelines can help improve their screening practices by providing greater transparency and understanding of what costs and benefits should be considered, options for how they can be quantified or determined, and guidance on considerations for how to account for risk for the energy efficiency resource.

The Guidelines are considered a living document that may be revised periodically to reflect new policy and program developments, lead to additional chapters to address other key issues of priority to Forum members to support improving cost-effectiveness screening, and to incorporate or build upon other cost-effectiveness screening efforts across the country.

1. GUIDING PRINCIPLES

1.1. Overarching Principles

These Guidelines are supported by the following fundamental principles that states and key stakeholders should consider when examining their screening processes:

1) **Energy Policy Goals**: Energy efficiency screening practices should account for the energy policy goals of each state, as articulated in legislation, commission orders, regulations, guidelines and other policy directives. These policy goals provide guidance with regard to which efficiency programs are cost-effective and in the public interest.
2) **Symmetry**: Energy efficiency screening practices should ensure that tests are applied symmetrically, where both relevant costs and relevant benefits are included in the screening analysis. For example, a state that chooses to include participant costs in its screening test should also include participant benefits, including low-income and other participant non-energy benefits.
3) **Hard-to-Quantify Benefits:** Energy efficiency screening practices should not exclude relevant benefits on the grounds that they are difficult to quantify and monetize. Several methods are available to approximate the magnitude of relevant benefits, as described below.
4) **Transparency**: Energy efficiency program administrators should use a standard template to explicitly identify their state's energy policy goals and to document their assumptions and methodologies.

These principles provide states with a common framework for addressing decisions about cost-effectiveness screening and ensuring that these decisions are made transparently and are clearly understood by all stakeholders. These principles are reiterated through each of chapter of these Guidelines where relevant or applicable.

1.2. Details versus 'Big Picture'

Experience has demonstrated that energy efficiency cost-effectiveness screening is complex and requires significant, detailed information and analysis. One of the overarching themes of these Guidelines is that states should develop the best information available, and prepare the best forecasts available, in order to make informed, thoughtful decisions.

In addition, one of the key principles listed above is the ensure transparency in the cost-effectiveness process; to ensure that all stakeholders have the opportunity to review, assess, comment on, and help guide some of the key assumptions and methodologies used. As the

screening process becomes more complex and more detailed, the need for transparency becomes even greater.

While it is important for states to develop as much information as possible for energy efficiency screening, it is also important that states consider the analysis and the results in light of the "big picture." Thoughtful considerations and informed judgment throughout the screening process can significantly assist in making the analysis more effective and leading to reasonable outcomes.

For example, it may not make sense for a state to spend considerable time and resources to develop monetary values for a certain efficiency impact that stakeholders agree *a priori* as likely to have very little effect on the results of the analysis. As another example, if stakeholders have difficulty determining or otherwise accounting for the value of a particular impact that is expected to have significant effect on the results, then maybe that impact can be evaluated using scenario or sensitivity analyses to indicate how the results might change under different assumptions.

In addition, this document focuses on the primary screening test that should be used to evaluate energy efficiency cost-effectiveness; i.e., the one test that will be used to decide whether an efficiency resource should be funded by customers. Several states use a single primary efficiency screening test, for simplicity sake and to provide a transparent mechanism for making decisions. However, states should consider using multiple tests to evaluate a particular efficiency program, if multiple tests will help to illuminate the full range of impacts of the program in a way that the quantitative analysis does not.

Similarly, determinations of energy efficiency cost-effectiveness should be mindful of the regulatory determinations regarding other, comparable utility activities. Because of the complexities involved in efficiency screening, states run the risk of giving greater scrutiny to efficiency investments than utility investments in transmission and distribution facilities. Many states, for example, have adopted renewable portfolio standards, or other policies supporting renewable resources, with very little quantitative analyses justifying whether such resources are cost-effective. Energy efficiency resources should not necessarily be subject to screening standards that are unduly more stringent or more difficult than comparable utility investments.

In sum, while this document recommends developing as much useful information as possible about the costs and benefits of energy efficiency, states should not let the lack of detailed, quantified information regarding those costs and benefits get in the way of making reasonable decisions about which resources are most likely to support the state's energy policy goals, and be in the public interest.

2. ALIGNMENT OF SCREENING WITH ENERGY POLICIES

2.1. Introduction

One of the overarching principles of this document is that energy efficiency screening practices should account for the specific energy policy goals of each state, as articulated in legislation, commission orders, regulations, guidelines and other policy directives by state agencies or stakeholder processes. These policy goals provide guidance with regard to which efficiency programs are cost-effective and in the public interest. Cost-effectiveness analysis should be done in a manner that supports the public interest (i.e., that helps determine which actions and expenditures are in the public interest), and in a manner consistent with the policy goals.

The standard tests used to evaluate the cost-effectiveness of energy efficiency programs do not easily allow for the accounting of some of these goals. Consequently, certain energy policy goals are sometimes overlooked or otherwise not accounted for in the efficiency screening process. This chapter describes the importance of accounting for energy policy goals, and provides guidance on how states can align their screening processes with their energy policies.

2.2. Background

The standard screening tests used to evaluate the cost-effectiveness of energy efficiency programs are summarized in Appendix A. These tests are based on the California Standard Practice Manual, which has been widely used around the U.S. to inform energy efficiency screening practices. In the Northeast and Mid-Atlantic regions, states most commonly use the Total Resource Cost (TRC) test for screening efficiency programs, while the Societal Cost test is used in a couple states, and one state uses the Utility Cost test as a primary test in combination with the TRC.[5]

While most states in the Northeast and Mid-Atlantic region have energy policy goals regarding utility regulation and planning, these goals are typically not explicitly addressed in the development and application of efficiency screening practices.[6] When a state's policy goals are not directly documented and considered in determining how to screen efficiency programs, there is a risk that the efficiency screening practices will lead to results that are not consistent with those goals.

[5] For more information, see Synapse 2013b.

[6] For more information see National Efficiency Screening Project, 2014.

State energy policy goals can be articulated in several different ways, including legislation; regulations; commission guidelines; commission standards; commission orders; and other pronouncements from a commission or a relevant state agency or stakeholder process. The constellation of energy policy goals in any one state may be different from those of other states. Consequently, the composition of costs and benefits accounted for in efficiency screening tests may likely be different across different states.[7]

Examples of State Energy Policy Goals/Objectives

There are a variety of policy goals that states typically adopt related to utility regulation in general, and energy efficiency in particular. Many, if not all, states have the overarching goals of maintaining just and reasonable rates, and providing safe, reliable, low-cost electricity and services that are in the public interest. Many states also have more specific goals, such as:[8]

- reduce revenue requirements;
- develop least-cost energy resources;
- promote customer equity;
- improve system reliability and resiliency;
- reduce system risk;
- promote resource diversity;
- reduce price volatility;
- reduce the energy burden on low-income customers;
- avoid lost opportunities;
- promote energy efficiency market transformation;
- reduce the environmental impact of energy consumption; and
- promote jobs and economic development.

Some of these energy policy goals may overlap with each other (e.g., reduce system risk and promote resource diversity), while others may be in conflict with each other (e.g., reduce system risk and reduce revenue requirements). State energy policy goals can also evolve over

[7] Very few states, if any, currently use the same efficiency screening test and assumptions, even though they are all based upon the standard tests described in the California Standard Practice Manual.

[8] This list is based on a review of several state statutes and orders, as well as experience working in many states. This list is not intended to be exhaustive, nor is it intended to imply a recommendation of any policies for any states. It is intended to illustrate the types of policies that states typically establish.

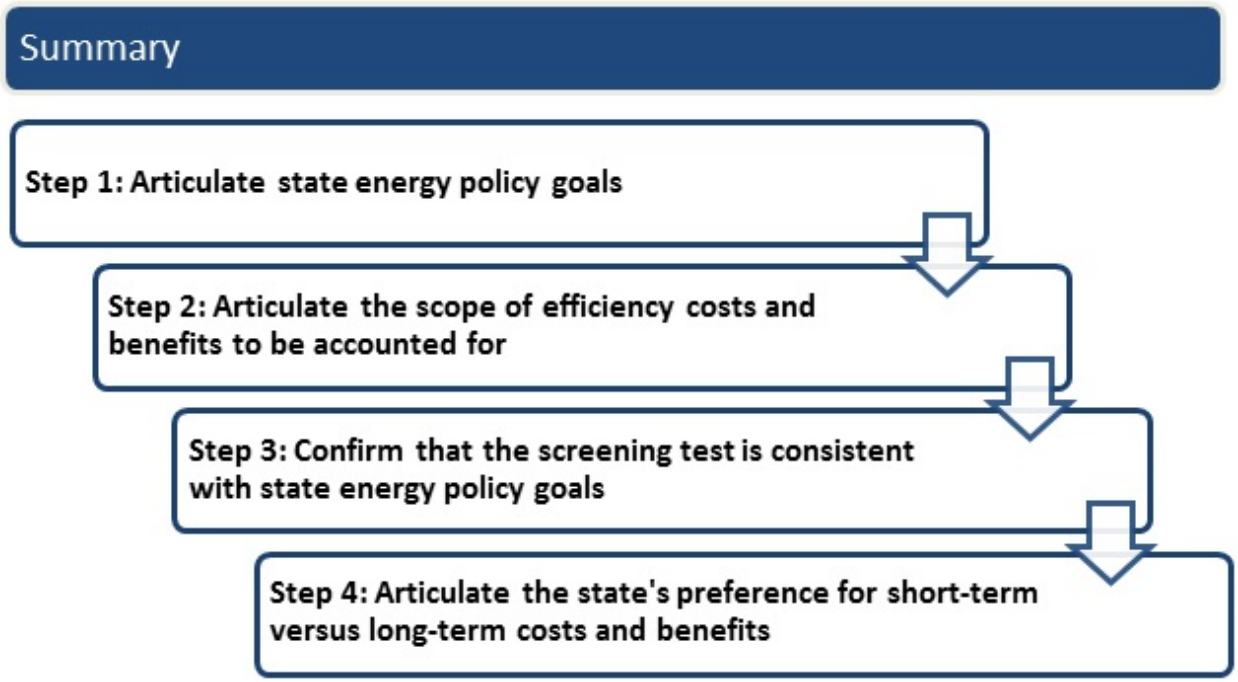
time in response to changes in the energy industries, changing perspectives from the legislature and regulators, and the evolving interests of industry stakeholders.

Transparency

One of the overarching principles of this document is to ensure that the efficiency screening process is transparent. One way to achieve transparency is to encourage the use of standard templates to present the costs, benefits, assumptions and methodologies used. Standard templates can provide immediate, clear and consistent information for reviewing efficiency programs. This information can also be directly compared across programs, across years, across program administrators, and potentially across states.

Chapter 6 presents a sample template that could be used for screening efficiency programs. It presents costs and benefits separately, and clearly presents those impacts that are monetized, as well as those impacts that are not monetized.

2.3. Guidance



When updating or modifying efficiency program screening practices, states can take several steps to ensure that the screening practices are consistent with the state's energy policy goals.

Step 1: Articulate state energy policy goals

States should begin by reviewing and articulating state energy policy goals, based on existing and evolving statutes, regulations, orders and other regulatory or legislative directives. States

should be mindful of which energy policy goals are relevant to their state, how they affect each other, and how they can be accounted for in the efficiency screening process.

If there is ambiguity or uncertainty regarding the state's energy policy goals, then states may want to clarify the goals in order to avoid confusion or contention when developing efficiency screening practices. If certain state energy policy goals overlap or are in conflict with each other, then states could also provide for how to resolve any such issues, recognizing that trade-offs or prioritization of state policies may be needed.

Robust, effective stakeholder processes (e.g., energy efficiency advisory councils or boards, energy efficiency collaboratives) can be used to make the screening process more transparent, and to allow for sufficient stakeholder input. Several states in the Forum region have established such stakeholder processes and these will continue to be useful to achieve greater transparency in light of increasingly complex screening practices.

Step 2: Articulate the scope of efficiency costs and benefits to be accounted for

The scope of the costs and benefits that are accounted for in screening energy efficiency will have important implications for the choice of the screening test to use, and on the choice of non-energy impacts (NEIs) to include in the screening test. In general, the scope of costs and benefits to account for is essentially a policy decision, and should be dictated by the energy policy goals identified in Step 1 above. Once the scope of the costs and benefits is clarified, then some of the other decisions regarding the efficiency screening process become better defined and more straightforward.

There are several ways that the scope of energy efficiency costs and benefits can be defined.

a) The utility system perspective (e.g., avoided energy costs, avoided capacity costs) should be included in any energy efficiency screening test, as regulated efficiency program investments fundamentally impact the utility system.[9]

b) The program participant perspective (e.g., bill savings, non-energy impacts) can also be included within the scope, if that is consistent with state energy policy goals.

c) The societal impacts (e.g., environmental externalities, economic development) can also be included within the scope of the screening tests, if that is consistent with state energy policy.

Specifically, states should consider its screening approach starting with a fully-balanced utility system perspective, incorporating all associated utility costs and benefits in the screening model, and build on this perspective through further consideration of its state energy policy and public interest goals.

[9] The one exception is the Participant Cost test, where the benefits are measured in terms of bill savings.

There may also be impacts relative to a state's energy policy goals that do not fit neatly into the categories of utility system, participant, or society. For example, a state might have goals of promoting customer equity, avoiding lost opportunities or promoting energy efficiency market transformation. If states have these goals, they should be identified and accounted for in screening practices as well, given their potential impact on investments.

Step 3: Confirm that the screening test is consistent with state energy policy goals

The efficiency screening test should be consistent with the state's energy policy goals and scope articulated in Steps 1 and 2 above. This can be done when modifying an existing screening test or when developing a new efficiency screening test.

Existing Test. If a state is required to rely on a specific test, then the test should be consistent with the state's policy goals and the scope, as discussed below. For example, some states may need to revisit their current practice where there is asymmetry, or goals are not reflected in application or accounting of costs and benefits.

- Utility Cost test. If a state has made the decision to apply the Utility Cost test, then states should make sure that the state's test properly accounts for articulated state energy policy goals that are not included in the utility system costs and benefits, e.g., promote customer equity, reduce the burden on low-income customers, reduce system risk, or avoid lost opportunities.
- Total Resource Cost test. If a state has made the decision to apply the TRC test, then states should make sure that (a) the test properly accounts for both participant costs and participant benefits, including non-energy impacts; and (b) the test properly accounts for articulated state energy policy goals that are not included in the utility system or the participant costs and benefits, e.g., promote customer equity, reduce the burden on low-income customers, reduce system risk, avoid lost opportunities.
- Societal Cost test. If a state has already made the decision to apply the Societal Cost test, then states should make sure that (a) the test properly accounts for all of the relevant societal costs and benefits; and (b) the test properly accounts for any articulated state energy policy goals that are not accounted for with the specific choice of societal costs and benefits.

New test. If a state decides to develop a new efficiency screening test, then the test should be constructed based upon the state's policy goals and the scope. In particular:

- The new test should include all of the utility system costs and benefits, because these impacts are the foundation of any test (e.g., avoided energy costs, avoided capacity costs).
- If the state has a policy of accounting for participant impacts, then participant costs and benefits should be included in the test (e.g., bill savings, non-energy impacts).

- If the state has established policy goals regarding specific societal impacts, then the relevant societal costs and benefits should be included in the test (e.g., environmental externalities, economic development).

- If the state has established other policy goals beyond those included already, then those policy goals should be included in the test (e.g., increased jobs, promotion of customer equity).

There are a number of options available to ensure that the screening test properly accounts for articulated state energy policy goals that are not included in the test-specific costs and benefits. For example, states can monetize the values through evaluation study, develop proxy estimates, quantitatively account for policy goals using a non-monetized method, or use regulatory judgment. The same rationale as applied to estimating values of NEIs as detailed in Section 3.4, Step 3 can also be applied here.

Step 4: Articulate the state's preference for short-term versus long-term costs and benefits

As described in Chapter 5, the choice of which discount rate to use for screening energy efficiency programs should reflect an appropriate time preference for costs and benefits. Time preference should be informed by the state's energy policy goals.

It is useful to articulate how the state's energy policy goals might influence the time preference for efficiency screening. In particular, it is important that states consider what is the primary policy rationale for ratepayer-funded energy efficiency programs: to reduce utility system costs, to reduce customer bills, to reduce utility system risk, to reduce environmental impacts, something else, or some combination of the above?

If the primary rationale is to reduce customer bills, then the states should decide how much they value short-term bill reductions versus long-term bill reductions. If the primary rationale is to reduce environmental impacts, then the states should decide how much they value short-term environmental benefits versus long-term environmental benefits. The choices among these options will provide an indication of the value that states should place on future costs and benefits.

3. ACCOUNTING FOR NON-ENERGY IMPACTS

3.1. Introduction

One of the overarching principles of this document is to ensure symmetry in the relevant costs and benefits included in the cost-effectiveness analysis. Another overarching principle is to account for hard-to-quantify costs and benefits. It is important to adhere to both of these principles when considering non-energy impacts. For example, if participant costs are included in the analysis, then participant benefits, including participant non-energy benefits, should also be included, in order to achieve symmetry. However, some participant non-energy benefits are difficult to quantify and thus may require special consideration.

These Guidelines do not recommend inclusion of any specific NEIs. Rather, this chapter provides guidance on options for addressing NEIs (which may or may not be hard to quantify), where, for any particular state, the NEIs should be determined based upon the state's inventory and articulation of its energy policies, as covered under Chapter 2.

In addition, the recent NEEP survey (Synapse 2013b) of energy efficiency screening practices in the region indicated that (a) states use a variety of different practices to account for non-energy impacts, and (b) there would be value to providing guidance to states on how to account for these impacts. This chapter describes non-energy impacts, and provides guidance on whether and how to account for them in the efficiency screening process.

The term "non-energy impacts" is used throughout this report to refer to both non-energy benefits and non-energy costs. It is important that non-energy costs as well as non-energy benefits are accounted for in this context, in order to adhere to the symmetry principle. Non-energy costs might include, for example, transaction costs associated with participating in energy efficiency programs, or opportunity costs associated with changes of behavior or changes to business practices. Much of the discussion in this chapter refers to non-energy benefits, because many non-energy benefits from energy efficiency have been identified, studied and applied to cost-effectiveness screening practices to date. There have been fewer examples of non-energy costs identified to date. To the extent that non-energy costs of energy efficiency resources are identified, then they should be treated comparably to the non-energy benefits.

3.2. Background

Non-energy impacts include those costs or benefits that are not part of the costs, or the avoided costs, of the energy efficiency provided by the utility. There is a wide range of NEIs associated with energy efficiency programs, which can be categorized by the perspective of the party that experiences the impact: the utility, the participant, or society in general.

- Utility-perspective NEIs: reduced customer usage through energy efficiency improvements provides incremental impacts to utilities and their ratepayers (e.g., reduced arrearages, reduced shut-offs and reconnects).

- Participant-perspective NEIs: program participants experience impacts beyond the energy or bill savings that result from the energy efficient measures. There are a variety of NEIs to the program participants, some of which can be particularly significant for low-income program participants (e.g., improved comfort, improved operations).

- Societal-perspective NEIs: energy efficiency programs provide incremental impacts to society, beyond those attributed directly to the utility or participants (e.g., economic development, environmental externalities[10]).

Efficiency evaluators, program administrators, and stakeholders have identified a range of specific NEIs within each perspective, and have used various terminologies to describe the impacts. The range of NEIs identified and the terms used in the NEI literature demonstrates the variety of NEIs experienced from efficiency programs as well as the robust treatment given to studying NEIs.

However, the research has also lead to inconsistent nomenclature of NEIs, which can create confusion when assessing them for inclusion in cost-effectiveness testing. Table 3.1 provides high-level categorization of some of the more frequently cited NEIs and some examples of more specific NEIs that can be included in each category. This table is not comprehensive; it is intended to present typical categories and illustrative examples. Appendix B provides a similar table that also provides more detail for each of the categories. The NEI categories in that table are used throughout this guidance document.

It is important to ensure that NEIs are not double counted, and that they are consistently applied across the different perspectives. For example, if *participant* health and safety benefits (e.g., reduced illnesses) are included in the screening test, then it would be double-counting to include these same benefits as part of the *societal* health and safety benefits. Further, for states that apply a societal perspective, it would be appropriate to include additional societal health and safety benefits that do not accrue to participants (e.g., reduced health care costs).

[10] Note that Chapter 4 addresses environmental compliance costs, which differ from environmental externalities.

Table 3.1 NEI Categories and Specific Examples

Perspective	NEI Category	Specific Examples
Utility	**Financial and Accounting**	reduced arrearages; reduced carrying costs on arrearages; reduced bad debit write offs; reduced low-income subsidy payment/discounts
	Customer service	shutoffs and reconnects; notices; customer calls and collections; emergency and safety
	Other Utility Impacts	insurance savings; T&D savings; fewer substations/infrastructure; power quality / reliability; other primary utility
Participant	**Participant's Utility Savings**	shutoffs / reconnects; bill-related calls to utility; collection costs, intrusions; financial / customer service; greater control over their utility bills; reduced termination and reconnections; reduced transaction costs; buffers against energy price increases.
	Low-Income / Economic Development	economic development (low-income); economic stability; hardship improvement / family stability (low-income); benefits unique to low-income customers; fewer moves (low-income); benefits for owners of low-income rental housing
	Improved Operations	equipment cost, performance, and functionality; lifetime extension of equipment; O&M cost savings; reduced administration costs; reduced labor costs; increased sales revenue; improved employee productivity; reduced spoilage/defects
	Comfort	thermal comfort; noise reduction; light quality
	Health and Safety	health / fewer sick days at work or school; improved safety; reduced incidence of fires and related insurance; reduced chronic illnesses; reduced exposure to hypothermia or hyperthermia – particularly during heat waves and cold spells; improved indoor air quality; reductions in moisture and mold, leading to amelioration of asthma triggers and other respiratory ailments; reduced carbon monoxide exposure
	Education and Contributions	knowledge and control over bills; contributions to the environment; satisfaction; ability to pay other bills
	Home Improvements	Property value increase; ease of selling house; aesthetics in home; home durability
	Other Participant-Perspective NEIs	special / reliable / other; service reliability / avoid interruptions
Societal	**Economic Development**	job creation; economic output
	Tax Impacts	social welfare indicators; tax investment credits; tax revenue
	Environmental / Emissions	fish / wildlife mitigation; reductions of emissions like GHGs, SO2, NOX, particulates, and air toxics; emissions of solid wastes; consumption of water; land use; mining impacts; aesthetic impacts
	Health Care / Health & Safety	health and safety equipment / fires; reduced healthcare costs;
	National Security	reduced energy imports; increased national security
	Other Societal-Perspective NEIs	determined on a case-by-case basis

3.2.1 Estimating Non-Energy Impacts

There are a number of methods available to account for NEIs. Five of the primary means of accounting NEIs are to (1) monetize them directly, (2) develop proxy values, (3) develop alternative screening benchmarks, (4) to rely on regulatory judgment, and (5) Multi-Attribute Decision Analysis. Appendix B provides detail on the different ways that states in the Forum region have estimated NEIs. Below provides an overview of each of these approaches.

1) **Monetary values**: Monetary values are often considered the best way to estimate the value of NEIs. When monetizing NEIs directly, the options available to states include sponsoring a state-specific study (or regional if appropriate/applicable) that quantifies as many individual NEIs as within the scope of the study. Alternatively, a state could utilize studies that other states have conducted on NEIs, and adopt those values for their own, potentially with some state-specific modifications. Finally, a state could develop monetary values for a limited set of NEIs that the regulatory agency has determined to be important for cost-effectiveness. See examples of where monetary values are used in Appendix B.

2) **Proxies:** Proxies generally represent the next best valuation option, after direct monetization. Proxies are an explicit recognition that a particular impact should not be ignored and should be approximated using the best information available. Proxies can be applied in several forms, including as a multiplier applied to avoided costs, a multiplier applied to electricity saved or generated; or a multiplier applied to the number of participating customers. Proxies can also be applied at different levels of granularity, e.g., portfolio level, resource level, sector level, program level, or impact level.

3) **Alternative screening benchmarks:** In the absence of monetary values or proxies, relevant benefits can be accounted for using alternative screening benchmarks. This approach allows efficiency programs to be considered cost-effective at pre-determined benefit-cost ratios that are less (or greater) than one. Alternative benchmarks eliminate the need for identifying values for impacts by category, or by program. It is, by design, a simplistic way of recognizing that the combination of energy efficiency investments is significant enough to influence the cost-effectiveness analysis. States can choose an alternative benchmark that they are comfortable with by program, by sector, by resource type, or for an efficiency portfolio.

4) **Regulatory judgment:** Accounting for EE impacts through regulatory judgment allows states to make a determination that a resource is cost-effective without monetizing every impact and without applying an alternative screening benchmark. This approach allows states to make the cost-effectiveness determination in consideration of specific monetized impacts and specific non-monetized impacts of energy efficiency. Regulatory judgment should always be made with the greatest amount of information available, including qualitative and quantitative information on impacts that have not been monetized.

5) **Multi-attribute decision analysis (MADA):** Multi-attribute decision analysis is a systematic process for weighting and scoring both monetized and non-monetized

criteria in order to rank several options across all the criteria. To compare alternatives, MADA utilizes a decision matrix that summarizes the data available regarding each alternative's attributes, and weights each attribute according to its importance. This approach requires some amount of regulatory judgment in terms of setting weights across the different criteria, but that judgment is transparent in the MADA framework and can be informed by stakeholder input. Multi-attribute decision analyses must be designed and conducted very carefully to avoid inappropriate manipulation or unintended consequences.

3.2.2 Ease of Estimating and Significance of Non-Energy Impacts

Some NEIs are easier to quantify than others, and some have larger values than others. Others have not been adequately studied to know the significance of the value or how readily they can be quantified.

The utility-perspective NEIs tend to be easier to quantify because there are readily-available utility rates, employee salaries, etc. from which values can be determined. Utility-related NEIs are also generally considered to be small relative to other NEIs. However, some studies have identified significant benefits associated with reduced shutoffs and reconnect, as well as bad debt write offs and carrying costs on arrearages. In addition, utility-perspective NEIs 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 NEIs have been found to be particularly significant, and thus have important implications for cost-effectiveness screening practices. However, participant NEIs can sometimes be difficult to value in monetary terms, such as comfort and productivity, leading to challenges in incorporating them in screening. We note that participant-perspective NEIs can be 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. Consequently, states frequently place a higher priority on the participant-perspective NEIs that apply to low-income efficiency programs.

Societal-perspective NEIs 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, e.g., ENE 2009; other state-specific job impact analyses).

Table 3.2 summarizes some of the NEIs that are likely to have the biggest impact on efficiency screening results.

Table 3.2 NEIs with Most Significant Impact on Screening Results

Perspective	NEI Category	Specific Examples
Utility	**Financial and Accounting**	avoided low-income subsidies; payment-related cost savings
Participant	**Low-Income / Economic Development**	economic development / hardship
	Improved Operations	reduced O&M costs; productivity
	Comfort	comfort, noise and related benefits
	Health and Safety	indoor air quality
	Education and Contributions	Knowledge and control over bills; contribution to the environment
Societal	**Economic Development**	increased jobs and economic development
	Environmental / Emissions	reduced air emissions

Source: adapted from SERA 2014, p. 3, 6.

3.2.3. Summary of Current Practices in the Forum Region

Appendix B provides a summary and analysis of ways that non-energy impacts are currently being treated by some of the states in the NEEP region. Table 3.3 presents a summary of which NEIs are accounted for by which state, and which methodologies are used to account for them. As indicated, the treatment of NEIs varies considerably across these states.

Table 3.3: Whether and How States Account for NEIs

Primary Test	UCT	Total Resource Cost Test					Societal Cost Test	
State	*CT*	*MA*	*RI*	*NY*	*NH*	*DE*	*VT*	*DC*
Utility-Perspective NEIs		Quantified	Quantified				15% Adder	
Low-Income / Economic Development	Alt. Benchmark	Quantified	Quantified	Alt. Benchmark	Alt. Benchmark		30% Adder	10% Adder
Improved Operations		Quantified	Quantified	Alt. Benchmark			O&M Quantified	O&M Quantified
Comfort		Quantified	Quantified				15% Adder	10% Adder
Health & Safety		Quantified	Quantified				15% Adder	10% Adder
Home Improvements		Quantified	Quantified				15% Adder	10% Adder
Participant's Utility Savings		Quantified	Quantified				15% Adder	10% Adder
Education and Contributions							15% Adder	10% Adder
Other Participant-Perspective							15% Adder	10% Adder
Societal-Perspective NEIs			Quantified				15% Adder	10% Adder

A blank cell indicates that the state does not account for this type of NEI. Source Synapse 2013.

Table 3.4 summarizes how NEIs are addressed in four states: Massachusetts and Rhode Island, which use monetary values of non-energy benefits; and Washington DC and Vermont, which use proxies to account for non-energy benefits. The Massachusetts and Rhode Island values are determined from actual data in 2012 energy efficiency reports, by applying actual monetary values to the participation, electricity savings, all fuel savings and avoided costs included in those reports. The Washington DC and Vermont information includes the percent

adders used in those states; the other types of proxy values presented for these states were backed out of the percent adders in order to present "implied" proxies. Additional detail on these calculations is provided in Appendix B.

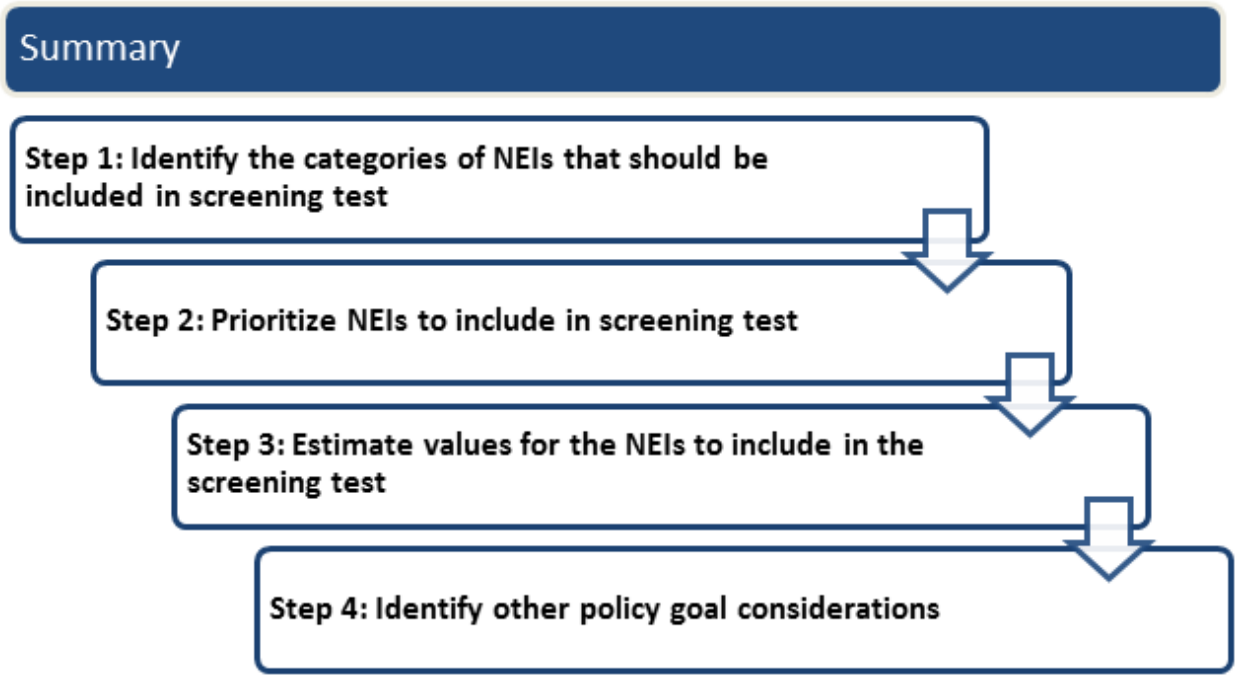
Table 3.4: Summary of NEI Values by Customer Sector – MA, RI, DC, and VT*

Sector	NEI$ / Unit				NEI$ / MWh				NEI$ / MMBtu				% Adder			
	MA	RI	DC	VT	MA	RI	DC	VT	MA	RI	DC	VT	MA	RI	DC	VT
Residential	94	13	14	127	89	19	40	14	9	2	6	2	63%	17%	10%	15%
Low-Income	842	451	124	343	95	58	140	34	9	7	15	4	70%	39%	10%	32%
Commercial & Industrial	5,011	4,201	20,833	3,659	17	13	170	12	2	2	17	1	12%	14%	10%	15%

* Note: It is difficult to assess whether states are quantifying similar types of benefits, but calling them different names such that they appear to value different impacts. Combined, these issues make it challenging to present a true "apples to apples" comparison of benefits across states. See Appendix B.

As indicated in Table 3.4, the implied proxy values that are derived using monetary values (MA and RI) are significantly higher than those based on simple proxies (DC and VT). This is true for the residential and low-income sectors, but much less so for the commercial and industrial sector.

3.3. Guidance



States can take the following steps to decide whether and how to account for NEIs in the efficiency screening process.

Step 1: Identify the categories of NEIs that should be included in screening test

The extent to which each category of NEIs is included in efficiency screening depends upon the energy policy goals and the screening test that is used by the state. In particular:

- Utility-perspective impacts. Avoided utility system costs, including avoided energy, avoided capacity costs, and avoided T&D costs, make up the foundation of cost-effectiveness screening for energy efficiency resources. Utility-perspective NEIs, such as shutoff impacts and customer service impacts, should also be included in any screening tests.[11]

- Participant-perspective impacts. These NEIs should be included in any screening test that includes the participant costs. This is necessary to ensure symmetry and internal consistency in the screening test: if participant costs are included, then participant benefits should be included as well.

- Societal-perspective impacts. These NEIs should be included in any state in which state policy goals include societal perspective and related impacts. In this case, the state should attempt to include reasonable estimates of all the societal NEIs that are important to the state. Societal-perspective NEIs should also be included in any state that has established a policy of accounting for specific societal NEIs (e.g., environmental impacts, job impacts). In this case, the state should attempt to include reasonable estimates of those specific societal-perspective NEIs identified in the relevant energy policies.

Step 2: Prioritize NEIs to include in screening test

Once a state has established which categories of NEIs to include in its screening test, it will be helpful to prioritize across the different subcategories of NEIs. This will allow states to decide which NEIs to include in the near-term, and what methodology to use to estimate values for them. Below are five questions that can help states prioritize across NEIs.[12]

Question 1: Which NEIs are likely to have the most impact on the results? For practical purposes, it may be most appropriate to focus regulatory and stakeholder attention and resources on those NEIs that are expected to have the most impact in the results of the efficiency screening process.

Question 2: Which NEIs are easiest to quantify in monetary terms? Ideally, NEIs should be estimated in monetary terms, so that the dollar values of the costs and benefits can be added to the dollar values of the other costs and benefits used to screen energy efficiency programs.

[11] The one exception is the Participant Cost test, which does not use utility system avoided costs as a benefit.

[12] The lists of NEIs provided are not intended to be exhaustive. Also, different states may have reasons for placing different types of priorities on different NEIs.

Estimating the monetary value of some NEIs may take a considerable amount of time and resources, and still result in a high degree of uncertainty.

Question 3: Which NEIs can be quantified in non-monetary terms? For those NEIs that are not quantified in monetary terms, it may still be useful to quantify them in non-monetary terms. For example, while it may be difficult to put a monetary value on tons of CO_2 emissions, states can quantify the tons of CO_2 emissions avoided by efficiency programs. Non-monetary information for specific NEIs can assist states in developing non-monetary options for accounting for those NEIs in the screening process.

While non-monetary values are useful for understanding the full range of impacts from efficiency programs, the values are not easily incorporated into a typical benefit-cost analysis. Therefore, it does not provide program administrators and other stakeholders with much guidance or certainty for how to screen marginally cost-effective efficiency programs. Consequently, states should establish protocols for whether and how they expect to consider non-monetary terms in screening energy efficiency programs. For example, this approach might be limited to certain program types (e.g., low-income programs) or certain NEIs (e.g., job creation). Or this approach may be applied for a limited period of time, during which better methods to account for NEIs can be developed.

Question 4: Which NEIs can be represented as proxies? For those NEIs that are not presented in terms of a monetary value, the next best option might be to use a proxy to account for the NEI. In prioritizing which NEBs to account for in the efficiency screening process, it is useful to consider which NEIs are well-suited for being represented as a proxy. A related question that states should consider is which NEIs can be represented as proxies in the short-term, with monetized values to be developed later?

Question 5: Which NEIs should be identified as unquantifiable? Some states may decide that certain NEIs are not a high enough priority to monetize or develop proxies for. Some states may decide that they are not willing or able to quantify certain NEIs, for other reasons. For these specific NEIs, it is nonetheless important to clearly identify which ones are relevant to the screening test, so that they can be recognized and accounted for without using monetized or proxy values.

Step 3: Estimate values for the NEIs to include in the screening test

Once a state has prioritized the NEIs to include in its screening test, it will need to estimate values for those NEIs. Estimating values for NEIs allows them to be incorporated into screening tests. Below are three primary options available to states for estimating the prioritized NEIs. Note that states could use a combination of these options depending on the types of NEIs that are estimated.

1) Develop Monetary Values

In general, developing monetary values is the most transparent, comprehensive, and accurate way to determine the values for NEIs to use for efficiency screening. There are three broad

classes of methods that have been used to estimate monetary values for NEIs: (a) engineering or model-based estimates; (b) incremental incidence (marginal valuation) estimates; and (c) specialized comparative surveys.[13]

One option for developing monetary values is to conduct a state-specific study (or regional if applicable/appropriate) of all relevant NEIs. Such a study should be performed by an independent contractor, and could be funded by using energy efficiency program evaluation, measurement and verification budgets. Ideally, a single study, or set of studies, could be conducted on behalf of all the efficiency program administrators in a state. The primary advantages of this approach are: it could provide the most detailed and accurate results; it could reduce uncertainty in the results; and it could increase the confidence of the states and other stakeholders in the NEI estimates. The primary disadvantages of this approach are the costs involved and the time needed to conduct the study.

Another option is to focus a state-specific study on a relatively small number of the highest priority NEIs, and then use other methods to address remaining relevant NEIs. This allows for a relatively quick development of those NEIs that are expected to have the greatest impact. States using this option should be careful to ensure that they do not ignore certain other NEIs because they are relatively difficult to monetize. Such an approach could result in the state not being consistent with the symmetry and energy policy goals principles. Other methods (e.g., proxies) should be used to account for those other NEIs.

Another option is to utilize monetary values from studies conducted for other states. This option would require relatively little time and resources, but runs the risk of resulting in less accurate values of NEIs. States using this option should be careful to do so only for those NEIs where the literature suggests consistency in the NEI values across studies and across states.[14]

2) Develop Proxy Values

In the absence of monetary values for NEIs, proxy values can be used to approximate the likely impact of NEIs on the costs and benefits of energy efficiency. There are three key issues that states should address in developing proxy values: scope, type of proxy and the proxy value itself.

[13] For more information on these methodologies, see SERA 2014, pp. 19-26.
[14] See, for example, SERA 2014, Figure 1.1.

Scope. Ideally, proxy values should be used for all of the NEIs (a) that are relevant to the state's energy policies, and the applicable state's screening test; (b) that are considered a sufficient priority to include in the screening; and (c) that have not had a monetary value estimated. Once the specific NEIs have been decided upon, states should choose among the four options for developing proxies.

- Relevant NEI Proxies: States can develop proxy values for each of the relevant NEIs, and then apply those values to the efficiency programs where the NEIs are relevant. This approach is more detailed, more transparent, and likely to be more accurate than the program-level, sector-level and state-level approaches listed below. This approach allows states the ability to review monetary values of NEIs from recent literature to guide the decision on what value the proxies should have.

- Efficiency Program Proxies: States can develop proxy values for each efficiency program. This approach essentially aggregates the proxy values for all the NEIs into a single value for a program. One disadvantage to this program-level approach is that if a program's design is changed over time, the mix of NEIs related to that program could change, and thus the program-level proxy value would need to be modified accordingly. (States could determine program-level proxy values by adding up the NEI-level proxy values that are relevant to each program; which would theoretically lead to the same result as applying NEI-level proxy values. However, if states were to determine program-level proxy values using other methodologies, then such values may be less accurate and less transparent than NEI-level values.)

- Sector Proxies: States can develop proxy values for each sector. This approach is likely to be much less accurate and less transparent the NEI-level or program-level proxy values. As indicated in Appendix B, the NEI values can be significantly different for different types of efficiency programs, and aggregating them all into a sector-level proxy would be a gross approximation. Also, if the mix of programs within the sector, or the program designs themselves, are changed over time, then the mix of NEIs related to the sector would likely change, and thus the sector-level proxy value would need to be modified accordingly.

- Single Portfolio Proxy: States can develop a single proxy value for all programs. This approach is likely to be much less accurate and transparent than all of the approaches listed above. This state-level approach is not able to capture the significant differences in NEIs that exist between programs and between sectors.

Type of proxy. There are several options available for defining proxies.

- Avoided cost multiplier (i.e., percentage adder). This type of proxy represents NEIs relative to the avoided costs of an efficiency program. It can be applied by increasing the energy efficiency avoided costs (typically avoided energy and capacity costs) by a pre-determined percentage. (Appendix B provides an analysis of several avoided cost multipliers.) It is a simple approach that allows for easy application, and is one of the most common form of proxies used for efficiency screening. However, there is a significant disadvantage to this type of proxy because there may not be a strong correlation between the value of avoided costs and the value of NEIs. Consequently, as avoided costs change over time, the NEI values will change commensurately, even though the NEIs themselves have not changed at all.

- Electricity multiplier ($/MWh). This type of proxy represents NEIs relative to the electricity savings from an efficiency program. It can be applied by multiplying the energy efficiency electricity savings by a pre-determined factor, in terms of $/MWh. The primary advantage of this type of proxy is that it may be more closely correlated with actual NEI values, relative to an avoided cost multiplier; thus it would not fluctuate as avoided costs fluctuate. The primary disadvantage of this type of proxy is that it is not well-suited for efficiency programs that save non-electric fuels (e.g., natural gas, oil). The NEIs from these programs would be better represented by an all-fuels multiplier. Also, the precision of this type of proxy depends upon the mix of end-use measures offered by the program, and if that mix changes over time, then the multiplier would need to be changed accordingly.

- All-fuels multiplier ($/MMBtu). This type of proxy represents NEIs relative to all of the fuel savings from an efficiency program (i.e., electricity, gas, oil, etc.). It can be applied by multiplying the total fuel savings from an efficiency program by a pre-determined factor, in terms of $/MMBtu. The primary advantage of this type of proxy is that it may be closely correlated with actual NEI values, especially for programs that address multiple fuels. A disadvantage of this type of proxy is that its precision depends upon the mix of end-use measures offered by the program, and if that mix changes over time, then the multiplier would need to be changed accordingly.

When choosing among these options there is a clear trade-off between simplicity and precision. States have presumably relied upon avoided cost multipliers because of their simplicity, and because they are intended to be high-level estimates. If a state were to use an electricity multiplier or an all-fuels multiplier, in order to improve the precision, then the process for developing the proxy value may be much less simple.

Estimating proxy values. Non-energy impact proxies are intended to be simple, and to be rough approximations. Consequently, states can develop proxy values simply by making educated guesses. On the other hand, states can dedicate a modest amount of time and resources to review the literature on NEIs, and review what other states have assumed for NEIs, in order to develop the best educated guesses possible. Appendix B provides an example of how recent literature and current state assumptions can help inform the development of proxy values.

- Avoided cost multiplier (a/k/a percentage adder). States (with input from program administrators and other stakeholders) can develop avoided cost multipliers by making educated guesses based upon their knowledge of the state's efficiency programs. States could also review assumptions used by other states, to inform their decision on proxy values.

- Electricity multiplier ($/MWh). An electricity multiplier can be derived in several ways, including: (a) from an avoided cost multiplier; (b) from applying NEI dollar values to electricity savings; or (c) from an analysis of the NEI values applied in other states.

- All-fuels multiplier ($/MMBtu). An all-fuels multiplier can be derived in several ways, including: (a) from an avoided cost multiplier; (b) from applying NEI dollar values to electricity savings; or (c) from an analysis of the NEI values applied in other states.

Once a state has developed monetary values and proxies for as many relevant NEIs as possible, it is important to identify any relevant NEIs that have not yet been given a value. Any remaining NEIs should then be accounted for using other methods, e.g., alternative benchmarks or regulatory judgment. This is necessary in order to be consistent with the principles of alignment with state energy policies, symmetry of costs and benefits, and that NEIs should not be ignored on the grounds that they are difficult to quantify and monetize.

3) Develop Alternative Screening Benchmarks

States could develop alternative screening benchmarks to recognize those relevant NEIs that have not been given a monetary or proxy value. The primary advantage of this approach is that it does not require the development of specific monetary or proxy values. Instead, it is more of a general reflection of the state's willingness to be flexible in accounting for certain costs and benefits.

4) Develop Regulatory Judgment Protocols

Finally, states can determine that a particular efficiency program is cost-effective despite a benefit-cost ratio of less than one, on the basis that the analysis does not account for certain NEIs. Such determinations should always be made with the greatest amount of information available, for example information on NEIs that have been quantified but not put into

monetary or proxy values (e.g., determining carbon dioxide emission reductions in terms of tons avoided, providing the number of jobs in job-years).

The primary advantage of this approach is that it provides states with flexibility to account for NEIs that have not been put into monetary or proxy terms. Conversely, the primary disadvantage of this approach is that it does not provide program administrators and other stakeholders with much guidance or certainty for how to screen marginally cost-effective efficiency programs. Consequently, states should establish protocols for whether and how they might apply regulatory judgment in screening energy efficiency programs and make those protocols clear to all stakeholders. For example, this approach might be limited to certain program types (e.g., low-income programs) or certain NEIs (e.g., job creation). Or this approach may be applied for a limited period of time, during which better methods to account for NEIs can be developed.

5) Multi-attribute Decision Analysis

Multi-attribute decision analysis (MADA) is a systematic process for weighting and scoring both monetized and non-monetized criteria in order to rank several options across all the criteria. To compare alternatives, MADA utilizes a decision matrix that summarizes the data available regarding each alternative's attributes, and weights each attribute according to its importance.

The tables below illustrate how raw qualitative and quantitative data could be used, together with weightings, to calculate an overall score for various alternatives. Table 3.2 presents the "raw data" of net present values and qualitative scores in three other categories. If the monetized values alone were used, Alternative A would be the optimal investment, since its net present value is $1.54 million.

Table 3.5. Raw Data for Hypothetical Multi-attribute Decision Analysis

RAW DATA	Net Present Value of Monetized Costs and Benefits		Non-Monetized Environmental Benefits		Contribution to Market Animation		Non-Monetized Benefits to Participants	
	(Millions)	*Weight*	*(Qualitative Score)*	*Weight*	*(Qualitative Score)*	*Weight*	*(Qualitative Score)*	*Weight*
Alternative A	$1.54	0.60	Low (= 1)	0.20	Low (= 1)	0.15	Low (= 1)	0.05
Alternative B	$1.10	0.60	Medium (= 2)	0.20	Medium (= 2)	0.15	Low (= 1)	0.05
Alternative C	$0.87	0.60	High (= 3)	0.20	High (= 3)	0.15	Medium (= 2)	0.05

Once the data have been normalized and the qualitative information weighted and taken into account, the end result changes. Table 3.3 presents the normalized data (using division by sum), and the final scores. Using MADA, Alternative C is determined to be the optimal choice despite having the lowest NPV.

Table 3.6. Normalized Data and Overall Scores

NORMALIZED DATA	Net Present Value of Monetized Costs and Benefits		Non-Monetized Environmental Benefits		Contribution to Market Animation		Non-Monetized Benefits to Participants		Overall Score
	Normalized	*Weight*	*Normalized*	*Weight*	*Normalized*	*Weight*	*Normalized*	*Weight*	
Alternative A	$0.44	0.60	0.17	0.20	0.17	0.15	0.25	0.05	**0.33**
Alternative B	$0.31	0.60	0.33	0.20	0.33	0.15	0.25	0.05	**0.32**
Alternative C	$0.25	0.60	0.50	0.20	0.50	0.15	0.50	0.05	**0.35**

It is important to note that multi-attribute decision analyses must be designed and conducted carefully. Regulators and other stakeholders must ensure that the analysis includes the proper criteria, uses weights that best reflect the intended value of the different criteria, uses an appropriate normalization technique, includes alternatives that are designed and modeled properly, and includes appropriate input values.

Step 4: Identify other policy goal considerations

As described in Chapter 2, some states may have energy policy goals that are not accounted for using either standard avoided costs or values for non-energy impacts. Examples of such policy goals include: promoting customer equity, reducing risk, fuel diversity, resiliency, reliability, efficiency market transformation, avoid lost opportunities, promote, jobs and economic development.

States should articulate whether such energy policy goals are relevant when screening energy efficiency programs. If so, then states should articulate how these goals should be accounted for in the screening process. For example, a state that has a goal of maintaining or promoting customer equity may wish to recognize the benefit of those programs that serve hard-to-reach customers (e.g., low-income customers, small commercial customers). This could be achieved by applying a proxy value or an alternative regulatory benchmark for such programs.

It is important to avoid double-counting of the impacts of energy policy goals, i.e., to not account for energy policy goals that have already been addressed in other ways. For example, reducing risk and promoting fuel diversity may be accounted for when deciding upon the discount rate to use for energy efficiency screening, as described in Chapter 5.

4. ACCOUNTING FOR ENVIRONMENTAL COMPLIANCE COSTS

4.1. Introduction

The electric and gas industries are subject to a variety of environmental compliance requirements, and some of these requirements can develop and change over time. One of the challenges of accounting for environmental compliance costs arises from future environmental requirements that are expected to be established, but are not established or enforced at the time of the energy efficiency screening. The fact that some environmental requirements may be established in the future can make the cost of compliance uncertain and difficult to quantify. **The overarching principle of accounting for hard-to-quantify impacts requires that reasonably anticipated environmental compliance costs be accounted for when screening energy efficiency programs.**

The U.S. Environmental Protection Agency's proposed Clean Power Plan for reducing greenhouse gases provides an example of some of the challenges of accounting for environmental compliance costs. There is considerable uncertainty about how the EPA's proposal might be applied, yet it is reasonable to expect that some amount of compliance cost will be required. These costs should be accounted for in screening energy efficiency resources; otherwise, electricity and gas customers might incur higher costs associated with more expensive compliance options. This chapter describes how states can account for environmental compliance costs when screening energy efficiency resources.

4.2. Background

Environmental regulations frequently require electric and gas utilities to incur compliance costs, which are typically passed on to customers through their rates. These environmental requirements can take many different forms, including pollution emission limits, power plant retrofits, power plant retirements, alternative dispatch protocols, purchase and sale of pollutant emissions, and more.

The costs of environmental compliance should not be confused with environmental externalities. This report uses the term 'societal NEIs' to refer to environmental externalities, which is addressed in the previous chapter. Environmental compliance costs represent the direct costs that will be incurred by utilities and will eventually be passed on to ratepayers. Environmental compliance costs are part of the utility system costs, comparable to energy, capacity, transmission and distribution costs. Therefore, these costs should be included in any

efficiency screening test.[15] Failure to include environmental compliance costs in energy efficiency screening will skew the evaluations against energy efficiency, and can result in customers paying for alternative environmental compliance options that are more expensive than energy efficiency programs.

In contrast, environmental externalities include the health and environmental impacts to society in general, including ratepayers. These are the impacts that remain, if any, after a utility has complied with relevant environmental regulations. Environmental externalities should be included in the efficiency screening tests for those states that have a policy goal of reducing health and environmental damages from the electric and gas industries.

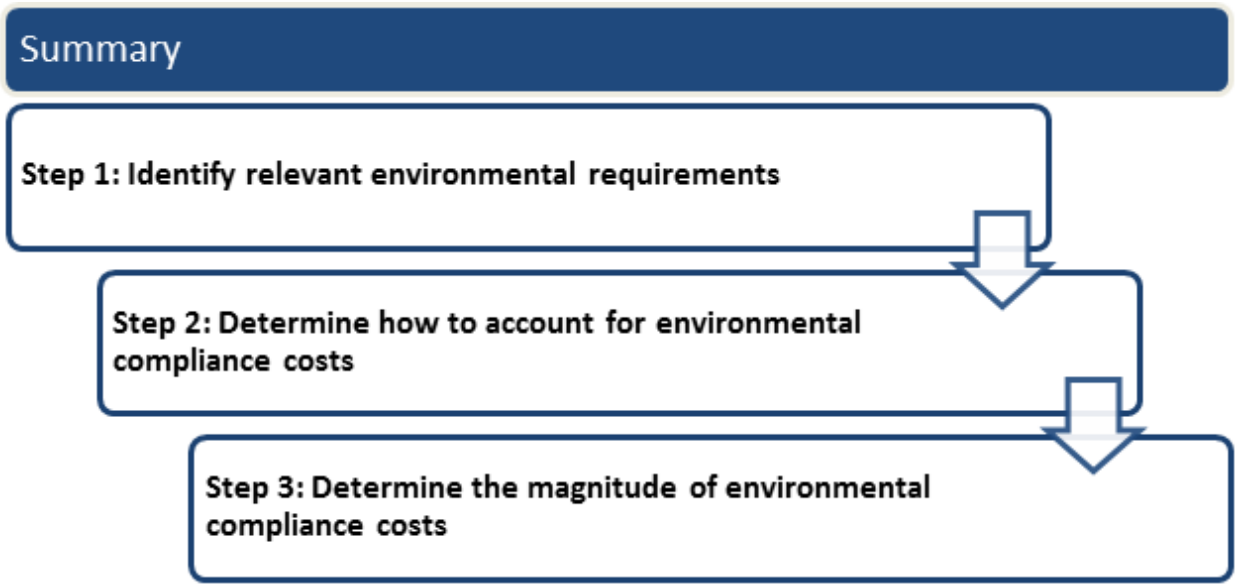
This chapter addresses options for how states can account for environmental compliance costs in energy efficiency screening. Chapter 3 briefly addresses options for how states can account for environmental externalities, in the form of societal non-energy impacts.

Estimates of environmental compliance costs should be based on the environmental requirements pertinent to the relevant energy efficiency program administrator. This might include local, state, regional, or federal regulations.

It is common practice to account for the cost of complying with existing environmental regulations, such as the costs of purchasing SO_2 and NO_X allowances. However, it is less common to fully account for the costs of complying with forthcoming or future environmental regulations. Some states may be reluctant to account for the costs of environmental regulations that are not yet in place or in effect, because of the uncertainty associated with the specific requirements and the cost of complying with those requirements. However, one of the overarching principles of this document is that hard-to-quantify costs and benefits should not be ignored. This principle dictates that future environmental compliance costs should not be ignored, despite the uncertainty associated with them.

[15] The one exception is the Participant test, where the benefits are based on reduced utility bills.

4.3. Guidance



States can take the following steps to determine how to account for environmental compliance costs in the energy efficiency screening process.

Step 1: Identify relevant environmental requirements

States should identify all relevant environmental requirements that might affect the utility system and utility costs, including local, state, regional, and federal policies and requirements. This might include, for example, requirements regarding power plant siting, transmission and distribution siting, air emissions, water impacts, and solid waste disposal.

The relevant environmental requirements should also include requirements that are reasonably likely to be incurred during the study period, regardless of the status of the requirement. In particular, they should include environmental requirements that are

a) currently in place and currently affecting the utility system,

b) currently in place and expected to affect the utility system during the study period,

c) in draft or proposal form and expected to affect the utility system during the study period, and

d) still in development, but expected to affect the utility system during the study period. For those environmental requirements that are in proposal form or are still in development, states can use probability analyses or sensitivity analyses to address the uncertainty associated with those costs.

There are two categories of environmental requirements that are expected to have significant impacts on the electricity industry over the next two decades. The first is a set of EPA regulations that affect the operation of existing and new power plants under the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act. This includes

Mercury/Air Toxic Standards (MATS); Cross-State Air Pollution Rule (CASPR); New Source Performance Standards (NSPS); the Cooling Water Rule; the Wastewater Rule; and Coal Combustion Residuals Rule.[16]

The other category of environmental requirements that are likely to have significant impact on the electricity industry over the next two decades is requirements to address climate change. There currently exist many state and regional requirements to limit greenhouse gases.[17] In addition, the US EPA recently issued proposed regulations for reducing greenhouse gas emissions from existing sources in the electricity industry (EPA Clean Air Act 111(d) regulations).[18] These regulations are still in the proposal stage, and the rules are expected to be challenged on legal grounds. Nonetheless, the proposed CAA 111(d) regulations, or other federal requirements, may impose environmental compliance costs on the electricity industry over the next two decades.

Step 2: Determine where to account for environmental compliance costs

There are many ways that environmental compliance costs can affect utility system costs, and therefore utility costs avoided by energy efficiency. It is important to ensure that relevant environmental compliance costs are properly attributed to the relevant utility system costs. For example:

- Variable costs. Some environmental compliance requirements (e.g., the cost of purchasing SO_2, NO_X, or Regional Greenhouse Gas Initiative allowances) will affect the variable costs of power plant operation. These costs should be accounted for by including estimates of allowance prices in the dispatch models used to calculate avoided costs. This is commonly done for existing pollution allowance systems, but is less commonly done for anticipated future pollution allowance systems. Similarly, some environmental requirements might affect the heat rates or the operation and maintenance costs of power plants, which should also be accounted for in dispatch modeling.

- Capital costs. Some environmental compliance requirements (e.g., the EPA Mercury/Air Toxics Standards, New Source Performance Standards, the Cooling Water Rule) will require capital costs for retrofitting existing power plants, or in building new power plants. These costs should be included in estimates of avoided capacity costs.

- Power plant retirement decisions. Some environmental compliance requirements might require power plant operators to decide to retire a power plant in order to avoid the cost of making major retrofits for environmental

[16] For more information on how these regulations might affect the electricity industry, see RAP 2011.
[17] For more information on current state and region climate change requirements, see Synapse 2012.
[18] For more information on how EPA 111(d) may affect the electricity industry, see ICF 2014.

compliance. Power plant retirement decisions can have significant implications for avoided energy costs and avoided capital costs. Therefore, forecasts of avoided costs should use the best estimates available of potential power plant retirements due to environmental requirements.

Step 3: Determine the magnitude of environmental compliance costs

The best method for estimating GHG compliance costs will depend upon the particular requirement in effect (e.g., cap-and-trade, system-based requirements, source-based requirements). It will also depend upon the scope of the particular requirements (e.g., electricity sector, all sectors, state, region, nation).

A) For cap-and-trade systems, e.g., RGGI, a forecast of the price of allowances can be developed and applied to the variable dispatch costs of affected power plants. These forecasts can be based upon an assessment of recent price trends combined with an analysis of the future demand for and supply of allowances.

B) For source-based systems, where a GHG limit is placed on specific power plants, the environmental compliance cost should be based on the costs required to bring each plant into compliance. If the requirement allows for averaging across power plants, then that effect should be taken into account. These costs of compliance should be included in the avoided energy and capacity estimates.

C) For system-based requirements, where a variety of options are available to reduce GHG's (e.g., energy efficiency, renewable resources, power plant improvements), there are several ways to estimate GHG compliance costs. For states that have vertically integrated utilities and/or use integrated resource planning (IRP) to screen energy efficiency resources, the GHG compliance costs can be accounted for in the IRP process. The GHG emission requirements would be input to the IRP modeling exercise as a constraint, and the planning process should identify the lowest-cost portfolio of resources to reliably meet electricity demands within that constraint.

For states that do not use IRP for screening energy efficiency programs, where a set of avoided cost are developed and compared directly with efficiency program costs, GHG compliance costs can be estimated using marginal abatement cost curves. A marginal abatement cost curve includes a list of all available GHG abatement options, and sorts them from lowest-cost to highest-cost. The point in the curve where the sum of the lowest-cost abatement options are sufficient to comply with the GHG requirements (i.e., the point where supply meets demand) represents the marginal GHG abatement option. The cost of the marginal GHG abatement option should then be accounted for in the avoided costs used for energy efficiency screening.

The US EPA provides a great deal of flexibility for each state to comply with EPA 111(d). The choices made by each state will likely affect the cost of compliance with those regulations. One of the key choices for states to make is whether to coordinate compliance activities across multiple states. Depending upon the configuration of states and compliance options, this approach may significantly reduce the cost of EPA 111(d) compliance given the numerous low-cost abatement options. Many of the states in the Northeast and Mid-Atlantic regions are already coordinating GHG abatement efforts through RGGI. The RGGI framework provides a natural option for Northeast and Mid-Atlantic states to coordinate their EPA 111(d) compliance options. For states that choose this route, the EPA 111(d) compliance cost could be estimated using forecasts of future RGGI allowance prices. These forecasts would need to account for the new balance of supply and demand for allowances under EPA 111(d). It is likely the demand for allowances would be higher under EPA 111(d) than it is under the current RGGI rules.

5. CHOICE OF DISCOUNT RATE

5.1. Introduction

One of the overarching principles of this document is that energy efficiency screening practices should account for the specific energy policy goals of each state. This principle should apply to the choice of discount rate. Discount rates reflect the time value of money, which in the case of energy efficiency screening means the value placed on short-term versus long-term costs and benefits. This value should be consistent with the energy policy goals of each state. This chapter describes why discount rates are relevant to state energy policy goals, and offers guidance on how states can ensure that the two are aligned.

The background section below is more comprehensive than those for the other topics in this document. This is because the issues affecting the choice of discount rate are complex and are often not addressed in depth in the literature regarding energy efficiency screening. In addition, some of the issues raised below are new concepts and thus warrant additional description.

5.2. Background

The Purpose of Discount Rates in General

Discount rates are an essential, yet easily misunderstood, aspect of the evaluation of any multi-year project or investment. When costs and benefits do not all occur in the same year, how should present-day and future amounts be compared? Typically, costs occur sooner, while benefits stretch into the future: a power plant takes a few years to build, and then generates electricity for decades; likewise, a well-insulated house can be built or retrofitted quickly, and then saves energy each year thereafter.

The discount rate essentially reflects a particular "time preference," i.e., the relative importance of short- versus long-term costs and benefits. A high discount rate implies that short-term costs and benefits are valued more than long-term costs and benefits, and *vice versa*.

In general, there are several factors that affect the time preferences of different people and different parties, including:

1. Inflation. Inflation causes future costs to increase, which makes money more valuable today than in the future.

2. The cost of capital. Capital often comes at a cost, and has an opportunity cost as well. If capital is not invested in a particular project, then either (a) the capital does not need to be raised and paid for, or (b) capital that is on hand can be put to other investments that would be expected to provide a return.

3. Risk associated with future outcomes. Future benefits are often subject to risk, and therefore might be less than expected today, or might not occur at all. This makes money more valuable today than in the future.

4. Short-term preference. People tend to place greater value on benefits they can experience in the short-term, relative to those they can enjoy over the medium- to long-term.

5. Personal preference. People tend to place greater value on their own benefits, both short-term and long-term, relative to the benefits that would accrue to other people in the future.

Some of these factors are inter-related. For example, some risk considerations might be factored into a consumer's cost of capital. Short-term preference might be based partly on risk, and partly on other factors.

When deciding upon a discount rate to use for energy efficiency screening, it is important to consider how these various factors are relevant and what they suggest about the appropriate discount rate to use.

Accounting for Inflation

Projections of costs and benefits can be expressed in either of two ways: (a) in "nominal" or "current dollar" terms, unadjusted for inflation; or (b) in "real" or "constant dollar" terms, adjusted to remove the effects of inflation. Similarly, discount rates can be expressed in nominal (unadjusted for inflation) or real terms (with the effects of inflation removed). Either approach can be used to tell the same story, as long as it is used consistently throughout a document or analysis. Economists tend to prefer using real costs and, therefore, real discount rates.

It is generally most convenient to express all costs in real terms throughout a cost effectiveness analysis, and then to use a discount rate expressed in real terms for consistency. This approach (relative to putting everything in nominal terms) simplifies the analysis, ensures consistency, and indicates how costs will change over time independently of inflationary effects.

Further, expressing discount rates in real terms makes it easier to determine the appropriate time preference for costs and benefits. Removing the effects of inflation from the analysis and the discount rate helps to simplify the consideration of how much weight to give to current costs and benefits versus future costs and benefits.

In the remainder of this document it is assumed that states conduct their energy efficiency screening practices in real terms, for the sake of simplicity. Consequently, all of the issues addressed below can be considered separately from the impacts of inflation.

Accounting for the Cost of Capital

Different consumers and different parties have different costs of capital. These differences are discussed in another subsection below. This subsection presents some high-level considerations regarding the cost of capital for energy efficiency resources.

There are two sources of capital that are relevant to efficiency screening: (a) the capital required to fund the efficiency programs; and (b) the capital required to fund the supply-side resources that are avoided by the energy efficiency.

Many efficiency programs are funded through a separate charge that is fully reconciled between rate cases, and treated as an expense. In this case, the efficiency costs are not funded using utility debt or equity, thus the cost of capital is not the utility's cost of capital. The cost of capital for energy efficiency funded this way can be described as very low-risk to the utility, as it comes directly from customers.

The cost of capital for the supply-side resources that are avoided by energy is more complicated. Avoided transmission and distribution facilities are funded using utility debt and equity, thus the cost of capital for these investments can be represented using the utility weighted average cost of capital. Generation costs are typically incurred through wholesale electricity markets, and the cost of capital for those resources is embedded in the wholesale market price.

Accounting for Risk

There are several ways to account for risk in energy planning, including the use of proxy multipliers to represent risks, scenario analyses, sensitivity analyses, and probabilistic analyses. In addition, risk is one of the factors to be considered in choosing a discount rate.

Both supply-side and demand-side resources are subject to a variety of risks. When screening energy efficiency it is important to consider the ways the efficiency programs can increase or decrease risk, relative to supply-side alternatives.

There are several ways that energy efficiency programs can increase utility system risk. All of these increased risks can be seen as "project risk," meaning that they are associated with the implementation and operation of the efficiency programs. For example, efficiency programs may experience risks associated with: low customer adoption rates, poor efficiency measure performance, poor vendor performance, or unanticipated costs. The magnitude these risks depends upon several factors, such as the experience of the efficiency program administrator, experience with the vendors, and historical performance of the efficiency measure. Also, some of these risks can be mitigated through regulatory oversight, stakeholder input and comprehensive planning and implementation practices. Finally, comprehensive

efficiency portfolios typically offer a diverse set of measures and programs, which mitigates the overall risk; if any one measure or program does not perform as well as expected, the impact on customers will be diluted within the performance of the entire portfolio.

There are also many ways that energy efficiency programs can reduce utility system risks. Efficiency programs often have significantly lower "project risk" than alternative supply-side resources that face risks associated with construction cost overruns, fuel price volatility, unanticipated outages, storm damages, siting constraints, evolving environmental regulations, and more. Efficiency programs also can help reduce "portfolio risk" by making the total resource portfolio more diverse. The extent to which efficiency programs can reduce portfolio risk will depend upon the diversity of the current resource mix; efficiency programs would provide greater risk reduction for resource portfolios that are more highly concentrated on specific fuels.

In sum, when assessing the magnitude of risk impacts of energy efficiency, each state should make its own determination based on the conditions of the utility system in the state or region. The key factors in making that determination include: the experience of energy efficiency programs offered in the state to date; anticipated risks associated with transmission and distribution facilities; and anticipated risks associated with generation facilities, either owned, purchased or obtained from a competitive market.

Also, when assessing the risk impacts of energy efficiency, it is important to consider who bears the different risks. For example, one of the most significant risks in the electricity industry is due to the volatility of natural gas prices, thus one of the most significant risk benefits of energy efficiency comes from mitigating this risk. For those states with fuel adjustment charges, or other means of directly passing fuel costs through to customers, the risk of volatile fuel prices is borne entirely by electricity customers, and is not borne by utility investors.

When considering risk in the choice of a discount rate, it is important that the treatment of risk is consistent with the state's energy policy goals. For example, if the state has a policy goal of reducing risks associated with fossil fuels, then the discount rate for screening energy efficiency resources should reflect those risk benefits associated with energy efficiency.

Energy Efficiency Discount Rates in Theory

Several discount rates can be used for energy efficiency screening. The predominant discount rates include the following:

- The utility's weighted average cost of capital reflecting what the utility has to pay investors when it raises new funds to support capital projects, averaged across both equity and debt. In effect, the WACC is an example of a risk-adjusted rate, based on the financial markets' estimate of the utility's average level of risk.
- Customer discount rates, reflecting a utility customer's time value of money in general, not just with regard to energy costs and benefits.

- Risk-free discount rates, reflecting the assumption that there are net risk benefits associated with the energy efficiency resources.
- Societal discount rates, reflecting the tradeoff between short- and long-term costs and benefits to society as a whole.

It is sometimes claimed that the energy efficiency screening discount rates should correspond to the perspective associated with the screening test.[19] In particular:

- The societal discount rate should be applied when using the Societal Cost test.
- The utility weighted average cost of capital should be applied when using the Utility Cost test, the Total Resource Cost test or the Rate Impact Measure test.
- A customer's own cost of capital should be used when applying the Participant Cost test.

However, the notion of choosing a discount rate to be consistent with the choice of screening test should not be accepted at face value, and should instead be evaluated by each state. One of the overarching principles of this document is that energy efficiency screening practices should be consistent with each state's energy policy goals. Consequently, each state's primary screening test should reflect a "perspective" that is consistent with those goals, and the discount rate should also be consistent with those goals.

For example, if a state has a policy goal of mitigating the risks associated with volatile fossil fuel prices, then it would not be appropriate to use the utility cost of capital for a discount rate, because the utility investors do not bear the risks associated with fossil fuel prices (see discussion above). Ratepayers bear those risks. In this instance, a discount rate reflecting the risk and the time preference for all utility customers would be more appropriate than a utility cost of capital discount rate. This point is relevant regardless of which test is used by a state for efficiency screening, including the Utility Cost test.

In addition, some states have chosen to deviate from the simplistic notion that the discount rate must be tied to the perspective associated with the screening test. This point is addressed in more detail below.

Energy Efficiency Discount Rates in Practice

Table 5.1 presents the discount rates recently used by select states in the Northeast and the Mid-Atlantic regions for energy efficiency benefit-cost analysis. It includes both the discount rates used in the states (in real terms), and the states' rationale for choosing the discount rates. The table also indicates the primary test used by the state for its efficiency screening.

[19] See, for example, *NAPEE 2008.

As the table shows, the discount rates used by states vary by rationale, by screening test, and in magnitude. Some states use the same rationale to develop a discount rate (e.g., based on 10-year US Treasury bonds), but come up with different values.[20] The discount rates also vary widely within a specific screening test (e.g., from 0.55 percent to 5.50 percent within the TRC test). Across states, rationales, and tests, the discount rates range considerably from 0.55 percent to 7.43 percent.

Table 5.1: State Discount Rates Used in Energy Efficiency Benefit-Cost Analysis

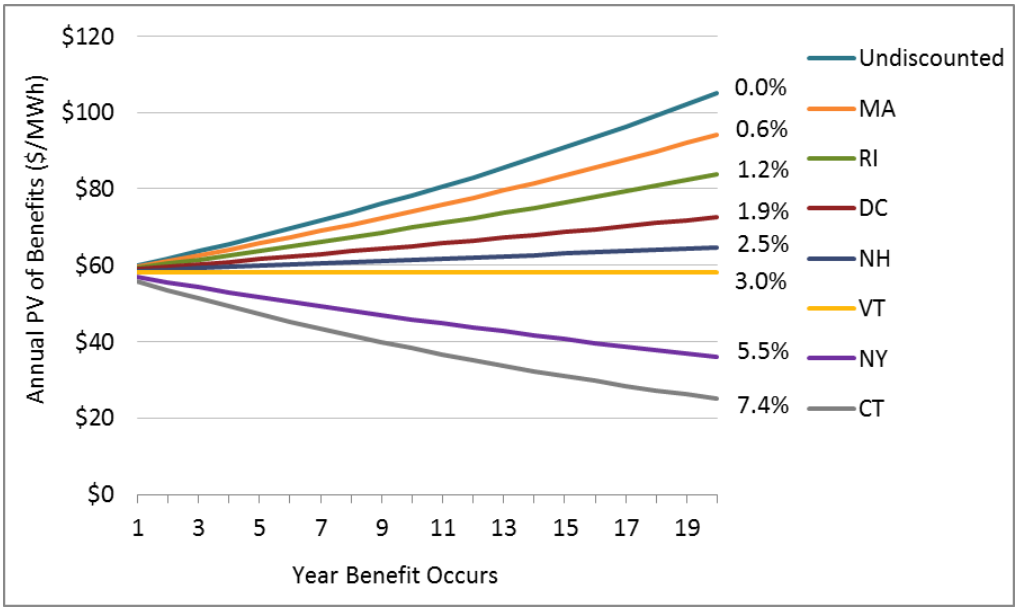
	Primary Test							
	UCT	Total Resource Cost Test					Societal Cost Test	
	CT	NY	NH	RI	MA	DE	VT	DC
Basis for Discount Rate	Utility WACC	Utility WACC	Prime Rate	Low-Risk 10 yr Treasury	Low-Risk 10 yr Treasury	Societal Treasury Rate	Societal	Societal 10 yr Treasury
Current Discount Rate (Real)	7.43%	5.50%	2.46%	1.15%	0.55%	TBD	3.00%	1.87%

The choice of discount rate has significant implications for the value of future costs and benefits, and can significantly affect the screening results. Figure 5.1 illustrates how energy efficiency benefits are affected by the different discount rates used by each state. This example starts with a generic, illustrative stream of avoided costs (i.e., energy efficiency benefits) over the course of a 20-year period. The top, blue line indicates the magnitude of the future avoided costs assuming no real discount rate at all. It is assumed, for illustrative purposes only that the stream of avoided costs begins at $60/MWh in year 1, and then increases by 2 percent annually, reaching nearly $110/MWh annually by the twentieth year. The real growth in avoided costs indicated by this line is due to anticipated increases in costs beyond the effect of inflation. For example, real increases in gas prices of two percent per year would lead to real increases in future avoided costs like those depicted in the "no discount" line.

The discount rates for each state from Table 5.1 are individually applied to this generic stream of avoided costs to observe the impact of using the different discount rates. As the figure shows, lower discount rates result in significantly higher values of avoided costs.

[20] Presumably these different discount rates based on 10-year US Treasury Bonds were calculated using different time periods to come up with such different values.

Figure 5.1: Implications of State Discount Rates Used in Benefit-Cost Analysis



Different Stakeholders Have Different Time Preferences

As noted above, the choice of discount rate is essentially a decision about time preference, i.e., the relative importance of short- versus long-term costs and benefits. The choice of discount rate is thus closely linked to who will be experiencing the costs and benefits of the efficiency resource. To explain this point, the time preferences of the different stakeholders affected by energy efficiency resource decisions are summarized below:

Utility investors: Investors that hold shares of utility stocks or bonds are interested in maximizing the return on their investments, in combination with the other investments in their financial portfolio. Their time preference for utility-related investments is reflected in the utility's cost of equity or cost of debt. The value that utility investors place on short- versus long-term costs and benefits is based on their goals when making financial decisions (e.g., balancing risks and rewards, maximizing profits, maximizing short-term versus long-term returns).

Utility management: Utility management has a range of responsibilities, including: developing electricity resources (both supply-side and demand-side) that will best serve their customers at just and reasonable rates, achieving state energy policy goals, and meeting its fiduciary responsibility to investors. The utility weighted average cost of capital is a good indication of management's time preference with regard to its investors, but it is not necessarily a good indication of the time preference associated with some of its other responsibilities as a regulated company. In particular, the time preference of utility investors may be significantly different from the time preference of utility customers.

Program participants: When deciding whether to participate in an efficiency program or install an efficiency measure, each customer must apply his or her time preference for short- versus long-term costs and benefits, based upon his or her own financial goals. Consequently, a participant's discount rate is relevant when applying the Participant Cost Test, which measures the net impacts over time on program participants. The results of the Participant Cost Test is also important in determining whether a program or technology is marketable and viable. A program participant's time preference, however, may be significantly different from a time preference appropriate for energy efficiency screening for the benefit of all customers as a whole.

Individual utility customers: Individual electricity customers tend to have a wide range of time preferences, based upon their own financial goals. An individual customer's time preference, however, may be significantly different from a time preference appropriate for energy efficiency screening for the benefit of all customers as a whole

All utility customers: The time preference of all utility customers as a whole (i.e., the utility system) should be based on goals defined by states, including: reduce electricity costs, increase electricity system efficiency, maintain reliability, reduce risk, and achieve the other energy policy goals, both in the short-term and the long-term future. The time preference for all utility customers is not a simple average of all customers' personal time preferences or discount rates.

Society: One of the interests of society is to help meet the needs of the present without compromising the ability of future generations to meet their needs.[21] Therefore, society has a broader tolerance for incurring costs in the short-term in order to experience benefits over the long-term. In addition, society, as represented by government agencies, is generally better able to access funds at a relatively low borrowing cost. Consequently, the societal discount rate tends to be lower than the discount rates of all of the stakeholders listed above.

The Time Preference for Efficiency Screening

In sum, the appropriate time preference, and discount rate, for energy efficiency screening should account for several different inter-related factors and considerations.

The purpose of efficiency screening. The overall purpose of efficiency screening is to identify those resources whose benefits are expected to exceed their costs. The screening is performed on behalf of utility customers, for the purpose of serving utility customers. The results should reflect the interests of utility customers as a whole. Therefore, states should consider the interests of utility customers as a whole when selecting an efficiency screening time preference.

Regulatory goals. Energy efficiency screening is conducted to identify those efficiency resources that will meet a set of regulatory goals. The paramount goal is to reduce electricity

[21] Social security is one example. Environmental regulations are another example.

and gas costs; but other goals frequently articulated by states include: increase electricity system efficiency, maintain reliability, reduce risk, reduce environmental impacts, and more. Therefore, the efficiency screening time preference should be consistent with a state's energy policy goals. In particular, what do the state's energy policy goals suggest about the value of short- versus long-term costs and benefits?

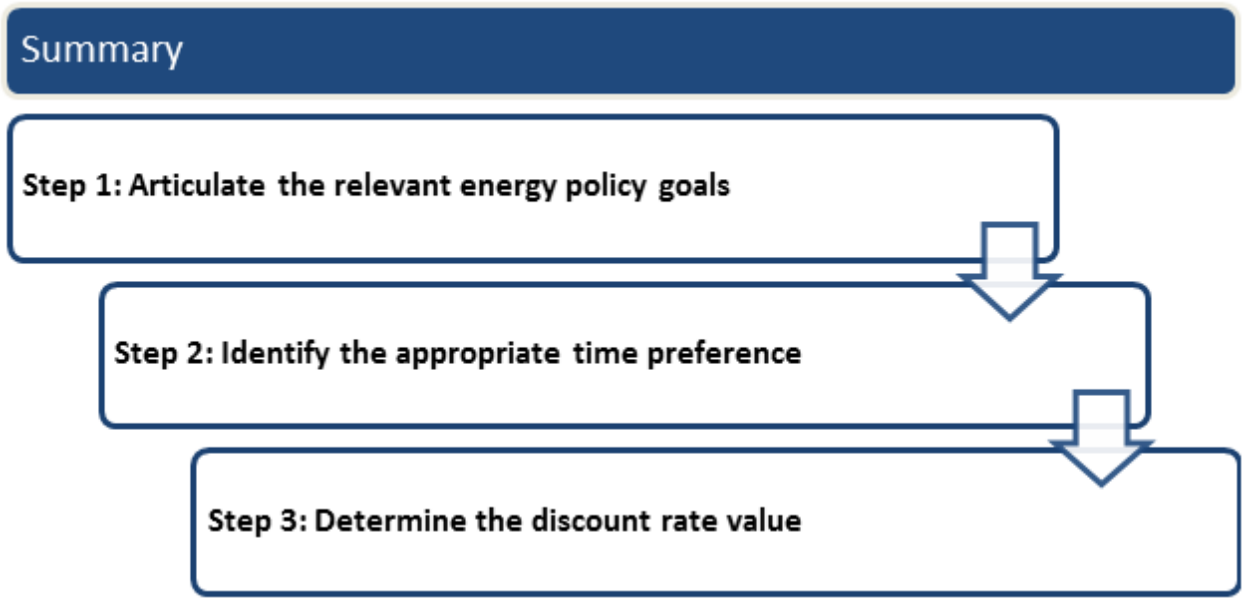
Cost of capital. In the context of efficiency screening, the cost of capital has several dimensions. For states that use a reconciling charge to fund energy efficiency resources, the cost of capital is very low, because it come directly from customers on a timely basis. Avoided supply-side resources will have a different cost of capital, some of which is reflected by a utility's cost of capital, and some of which is embedded in wholesale market prices. In the end, the efficiency investments are made on behalf of ratepayers, and the ratepayers experience both the costs and the avoided costs of the efficiency resources. Therefore, states should consider the time value of money for all utility customers as a whole when selecting an efficiency screening time preference.

Future risks. As noted above, there are many different risks relevant to efficiency planning, and they affect different stakeholders differently. When developing a time preference for efficiency screening, states should consider which risks are most important to address, and which stakeholders are most exposed to those risks.

Future benefits. Aside from the cost of capital and the risk associated with future benefits, consumers sometimes prefer to experience a particular benefit sooner rather than later. States should consider this tendency, and the extent to which it is relevant to efficiency screening.

Future customers. Some of the future benefits of energy efficiency might not be experienced by some of the current customers, as customers leave the utility system during the period of efficiency savings. Similarly, some of the future benefits of energy efficiency might be experienced by future customers that are not part of the current system and do not pay for current efficiency investments. States should consider this inter-generational equity issue when determining a time preference for efficiency screening.

5.3. Guidance



As indicated by the discussion above, the choice of discount rate is not necessarily a formulaic, simple decision. States can take the following steps order to choose a discount rate for energy efficiency screening.

Step 1: Articulate the Relevant Energy Policy Goals

As described in Section 3.3, one of the steps in aligning efficiency screening practices and state energy policy goals is to articulate the energy policy goals. These goals provide a critical foundation for identifying the appropriate time preference for efficiency screening.

Step 2: Identify the Appropriate Time Preference

As described above, the time preference for efficiency screening does not need to be tied directly to the perspectives associated with the specific choice of screening tests. Identifying the appropriate time preference should take into account several important factors. In balancing these different factors, states should consider the following key questions:

- What are the key energy policy goals relevant to efficiency screening? What do those goals indicate about the value of short- versus long-term costs and benefits?
- Which stakeholder's time preference is most relevant to the choice of which efficiency resources to invest in? Utility investors? Program participants? Any one customer? All customers as a whole?
- What are the utility system risks of most concern to the state? To what extent does EE reduce (or increase) utility system risk? Which stakeholders are most susceptible to those risks?

- How does the cost of capital affect the time preference in the context of energy efficiency screening? What is the appropriate cost of capital considerations in this context?
- How much value should be placed on future benefits? To what extent should current customers pay for benefits that they will not experience in the short-term? The answer to this question should be consistent with the answer to the same question applied to supply-side resources.
- How much value should be placed on future customers? To what extent should current customers pay for efficiency benefits that will be enjoyed by customers that are not currently on the system? The answer to this question should be consistent with the answer to the same question applied to supply-side resources.

There is no formulaic way to combine all of these considerations into a single number or preference. States may want to combine all of these considerations into simple indicators of time preference. For example, a state may conclude that, based upon all of the considerations above, it has high, medium or low preference for short-term costs over long-term costs. This general indication of time preference can be used to determine a specific value for the discount rate.

Step 3: Determine the Discount Rate Value

In the end, states need to choose a specific value for the discount rate, or a rationale and process for determining such a value. There are several benchmarks that can be used for this purpose. In particular:

- A utility investor time preference is often represented by the weighted average cost of capital. These averages tend to be in the range of five to seven percent in real terms.
- A low-risk time preference is often represented by United States Treasury Bills. These are offered for a number of different terms, and change over time with changes in the economy and changes in federal monetary policies. In recent years, 10-year US Treasury Bills have been valued roughly in the range one to three percent in real terms.
- A societal time preference is often represented by a societal discount rate. There is no general consensus on what the societal discount rate should be, but they tend to be roughly in the range of zero to three percent in real terms.

These benchmarks are not the only choices available to states for setting discount rate values. They should be considered as benchmarks only. States can decide to use a different discount rate in order to best reflect its own time preference. States that choose a high preference for short-term versus long-term benefits could choose a discount rate value at the high end of these benchmarks; while states that choose low preference for short- term versus long-term could choose a discount rate value at the low end of these benchmarks.

6. TRANSPARENCY IN SCREENING PRACTICES

6.1. Introduction

One of the overarching principles of this document is to ensure that the efficiency screening process is transparent. Transparency will ensure that all stakeholders understand the inputs and assumptions used within cost-effectiveness screening and can help inform each state's cost-effectiveness screening protocols. One way to achieve transparency is to encourage the use of standard templates to present the costs, benefits, assumptions and methodologies used. Standard templates can provide immediate, clear and consistent information for reviewing efficiency programs. This information can also be directly compared across programs, across years, across program administrators, and potentially across states.

6.2. Sample Template

Table 6.1 presents a sample template for documenting screening practices for efficiency programs. The template presents the key screening assumptions (e.g., discount rate, measure life, savings levels), as well as the quantitative and qualitative cost and benefit findings. It presents costs and benefits separately, from different perspectives (utility, participant, and public interest) and identifies those impacts that are monetized versus not.

Table 6.1: A Sample Efficiency Screening Template

Efficiency Screening Template			
1. Key Assumptions, Parameters, and Summary of Results			
Program Administrator:		**Reporting Period**:	
Program Name:		**Date of Filing:**	
Analysis Level (e.g., program, porfolio):		**Relevant State Policies:** [ADD LINK TO SUPPORTING DOCUMENT]	
Average Program Measure Life		Discount Rate	
Projected Annual Savings		Projected Lifetime Savings	
2. Monetized Utility Costs		**Monetized Utility Benefits**	
Program Administration		Avoided Energy Costs	
Incentives Paid to Participants		Avoided Capacity Costs	
Shareholder Incentive		Avoided T&D Costs	
Other Utility Costs		Wholesale Market Price Suppression	
		Avoided Environmental Compliance Costs	
		Other Utility System Benefits	
NPV Total Utility Cost		NPV Total Utility Benefits	
3. Monetized Participant Costs		**Monetized Participant Benefits**	
Participant Contribution		Participants' Savings of Other Fuels	
Particiapnt's Increased O&M Costs		Participant Non-Energy Benefits	
Other Participant Costs		Participants' Water and Sewer Savings	
		Participants' Reduced O&M Costs	
		Participants' Health Impacts	
		Participant Employee Productivity	
		Participant Comfort	
		Additional Low-Income Participant Benefits	
		Other Participant Non-Energy Benefits	
NPV Total Participant Cost		NPV Total Participant Benefits	
4. Monetized Energy Policy Costs		**Monetized Energy Policy Benefits**	
Public Costs		Public Benefits of Low Income Programs	
		Reduced Environmental Impacts (if monetized)	
		Public Fuel and Water Savings	
		Reduced Public Health Care Costs	
		Other Public Benefits	
NPV Total Participant Cost		NPV Total Public Benefits	
Total Monetized Costs and Benefits			
Net Benefts (PV$): Utility		**BCR: Utility Impacts**	
Net Benefts (PV$): Utility + Participant		**BCR: Utility + Participant Impacts**	
Net Benefts (PV$): Utility + Participant + Public		**BCR: Utility + Participant + Public Impacts**	
5. Non-Monetized Energy Policy Benefits and Costs			
Benefits or Cost	**Comments (how considered in screening)**		
Promotion of Customer Equity			
Promotion of Market Transformation			
Reduced Environmental Impacts (if not monetized)			
Increased Jobs and Economic Development			
6. Determination			
Program Benefits Exceed Costs		**Program Benefits Do Not Exceed Costs**	

6.3. Guidance

Templates such as the one presented in Figure 6.1 can be used by states to articulate and document all of the key assumptions and results of the efficiency screening process.

Section 1 of this template should include the key pertinent assumptions used in screening the efficiency resource. If the resource is screened at the program level, then there should be one template filled out for each program. If the resource is screened at the sector or portfolio level, then the template should be completed for the sector or portfolio.

Section 2 should include the monetized utility system costs and benefits. These costs and benefits should be included in any efficiency screening test.

Section 3 should include monetized participant costs and participant benefits—for those states that have explicitly decided to include participant costs and benefits. If a state chooses not to include participant benefits (including reasonable estimates of participant non-energy benefits), then it cannot include participant costs either. In such a case, Section 3 should be left blank.

Section 4 should account for monetized costs and benefits related to the state's articulated energy policies. These impacts can be added in to all of the other monetized costs and benefits.

Finally, Section 5 should include all of the non-monetized costs and benefits, so that these can be considered separately from the total monetized costs and benefits.

It is important to reiterate that Section 2 presents a list of the utility system costs and benefits that should be included in any efficiency screening test. Sections 3, 4 and 5, however, present an illustrative list of costs and benefits that a state should take into account, depending upon its energy policy goals. States may choose to account for impacts beyond the illustrative impacts presented above. Also note that this template should be accompanied by references that provide full documentation for all the assumptions and results presented.[22]

[22] These assumptions are often documented in a Technical Reference Manual.

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APPENDIX A. BACKGROUND: COST-EFFECTIVENESS SCREENING

The California Standard Practice Manual ("SPM") has been widely used for many years as a guide for how to apply energy efficiency screening tests. The five tests in the SPM are the Utility Cost test, the Total Resource Cost ("TRC") test, the Societal Cost test, the Ratepayer Impact Measure ("RIM") test, and the Participant 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.

The first three tests are the primary tests used most often in the Forum region and across the country to determine the cost-effectiveness of energy efficiency programs, so the following analysis focuses only on those tests.

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

The Societal Cost test includes the costs and benefits experienced by all members of society. The costs include all of the costs incurred by any member of society: the program administrator, the customer, and anyone else. Similarly, the benefits include all of the benefits experienced by any member of society. The costs and benefits are the same as for the TRC Test, except that they also include externalities, such as environmental costs and reduced costs for government services.

The Total Resource Cost test includes the costs and benefits experienced by all utility customers, including both program participants and non-participants. The costs include all the costs incurred by the program administrator and participating customer, including the full incremental cost of the efficiency measure, regardless of whether it was incurred by the program administrator or the participating customers. The benefits include all the avoided utility costs, plus any other program benefits experienced by the customers, such as avoided water costs, reduced operations and maintenance costs, improved comfort levels, health and safety benefits, and more.

The Utility Cost test includes the energy costs and benefits that are experienced by the energy efficiency program administrator. This test is most consistent with the way that supply-side resources are evaluated by vertically integrated utilities. The costs include all

expenditures by the program administrator to design, plan, administer, deliver, monitor and evaluate efficiency programs offset by any revenue from the sale of freed up energy supply. The benefits include all the avoided utility costs, including avoided energy costs, avoided capacity costs, avoided transmission and distribution costs, and any other costs incurred by the utility to provide electric services (or gas services in the case of gas energy efficiency programs).

While the SPM has been instrumental to many states in the development of energy efficiency screening practices, the SPM is out of date and does not address several of the key challenges facing states today. Its treatment of many issues is also very general, leaving significant details to interpretation. As a result, what are commonly thought to be "standard" tests are in fact applied inconsistently across states.

Table A.1: Components of the Standard Cost-Effectiveness Tests

	Participant Test	RIM Test	Utility Test	TRC Test	Societal Test
Energy Efficiency Program Benefits:					
Customer Bill Savings	Yes	---	---	---	---
Avoided Energy Costs	---	Yes	Yes	Yes	Yes
Avoided Capacity Costs	---	Yes	Yes	Yes	Yes
Avoided Transmission and Distribution Costs	---	Yes	Yes	Yes	Yes
Wholesale Market Price Suppression Effects	---	Yes	Yes	Yes	Yes
Avoided Cost of Environmental Compliance	---	Yes	Yes	Yes	Yes
Non-Energy Benefits (utility perspective)	---	Yes	Yes	Yes	Yes
Non-Energy Benefits (participant perspective)	Yes	---	---	Yes	Yes
Non-Energy Benefits (societal perspective)	---	---	---	---	Yes
Energy Efficiency Program Costs:					
Program Administrator Costs	---	Yes	Yes	Yes	Yes
EE Measure Cost: Program Financial Incentive	---	Yes	Yes	Yes	Yes
EE Measure Cost: Participant Contribution	Yes	---	---	Yes	Yes
Non-Energy Costs (utility, participant, societal)	---	Yes	Yes	Yes	Yes
Lost Revenues to the Utility	---	Yes	---	---	---

For an overview of current energy efficiency screening practices used in the Forum region, refer to the October Synapse report (Synapse 2013b).

APPENDIX B. CURRENT PRACTICES: NON-ENERGY IMPACTS

Definition of NEIs used in the NEEP Region

Evaluators, program administrators, and efficiency stakeholders have identified a range of specific NEIs within each perspective, and have used various terminologies to describe the impacts. The range of NEIs identified and the terms used in the NEI literature demonstrates the variety of NEIs experienced from efficiency programs as well as the robust treatment given to studying NEIs. However, the research has also lead to inconsistent nomenclature of NEIs, which can create confusion when assessing them for inclusion in cost-effectiveness testing. The table below provides high-level categorization of some of the more frequently cited NEIs, a definition for the category, and some examples of more specific NEIs that can be included in each category. The NEI categories in this table are used throughout this guidance document.

Table B.1: NEI Categories and Definitions

NEI Category	Definition	Specific Examples
Utility-Perspective		
Financial and Accounting	A number of NEIs are realized from efficiency program implementation in the form of financial savings. Energy-efficient technologies often result in reduced energy bills for participants, which can decrease the likelihood that customers experience difficulties with paying their utility bills. In turn, utilities realize financial savings through reduced costs associated with events such as arrearages and late payments. (NMR 2011; Hall and Riggert 2002).	reduced arrearages; reduced carrying costs on arrearages; reduced bad debit write offs; reduced low-income subsidy payment/discounts
Customer service	Timely customer bill payments can result in fewer collection activities, such as customer calls, late payment notices, shut-off notices, terminations, reconnections. The utility realizes savings in staff time and materials.	shutoffs and reconnects; notices; customer calls and collections; emergency and safety
Other Utility Impacts	Utilities may realize savings from their efficiency programs due to a reduction in safety-related emergency calls and insurance costs due to reduced fires and other emergencies (NMR 2011). Efficiency also increases the utility's system reliability and power quality.	insurance savings; T&D savings; fewer substations/infrastructure; power quality / reliability; other primary utility
Participant-Perspective		
Participant's Utility Savings	Just as utilities incur costs associated with making bill-related calls to payment-troubled participants or service terminations and reconnections, participants also incur opportunity costs of time spent addressing utility billing issues. (NMR 2011; SERA 2010; Hall and Riggert 2002).	shutoffs / reconnects; bill-related calls to utility; collection costs, intrusions; financial / customer service; greater control over their utility bills; reduced termination and reconnections; reduced transaction costs; buffers against energy price increases.

NEI Category	Definition	Specific Examples
Low-Income / Economic Development	Low-income households spend a disproportionate amount of their income on energy costs when compared to the population at large. Reducing energy costs decreases rates of mobility among low-income households, and allows income to be made available for other uses, such as healthcare (NMR 2011; SERA 2010). Owners of low-income rental properties can experience NEIs such as marketability/ease of finding renters, reduced tenant turnover, property value increases, reduced equipment maintenance for heating and cooling systems, reduced maintenance for lighting, greater durability of property, and reduced tenant complaints (NMR 2011).	economic development (low-income); economic stability; hardship improvement / family stability (low-income); benefits unique to low-income customers; fewer moves (low-income); benefits for owners of low-income rental housing
Improved Operations	Participants often experience efficient equipment performing better than previous equipment or inefficient equipment, resulting in reduced (or increased) maintenance costs, improved lighting quality, and so on (NMR 2011; SERA 2010). There are a variety of these NEIs that pertain specifically to C&I customers (Tetra Tech 2012). Improvements in comfort and lighting can result in increased worker and student productivity.	equipment cost, performance, and functionality; lifetime extension of equipment; O&M cost savings; reduced administration costs; reduced labor costs; increased sales revenue; improved employee productivity; reduced spoilage/defects
Comfort	Participants in energy efficiency programs commonly experience greater perceived comfort, either due to fewer drafts and more steady temperatures with HVAC equipment or reduced noise from better equipment. Improved (or worsened) aesthetics can also be considered a comfort NEI (NMR 2011; SERA 2010).	thermal comfort; noise reduction; light quality
Health and Safety	Energy efficiency programs may have direct impacts on health through improved home environments. Reduced incidence of fire and carbon monoxide exposure are also commonly identified as safety-related benefits resulting from weatherization. Safety is also improved from better, more durable lighting equipment. Health and safety benefits can result in reduced student and worker sick days. (NMR 2011; SERA 2010; NZ EEAC 2012).	health / fewer sick days work and school; improved safety; reduced incidence of fires and related insurance; reduced chronic illnesses; reduced exposure to hypothermia or hyperthermia – particularly during heat waves and cold spells; improved indoor air quality; reductions in moisture and mold, leading to amelioration of asthma triggers and other respiratory ailments; reduced carbon monoxide exposure

NEI Category	Definition	Specific Examples
Education and Contributions	Customers that participate in energy efficiency programs improve their knowledge of their utility bills and usage. Customers also feel better about reducing their environmental footprint from energy efficiency programs.	knowledge and control over bills; contribution to the environment; satisfaction; ability to pay other bills
Home Improvements	Increased property value is frequently recognized as a non-energy benefit associated with program participation. The benefit of increased property value has been estimated through the value of anticipated ease of selling or renting, or in some cases, increased resale or rental value. The improved durability and reduced maintenance for the home is also taken into consideration. (NMR 2011; SERA 2010).	property value increase; ease of selling house; aesthetics in home; home durability
Other Participant-Perspective NEIs	Participants experience additional impacts from energy efficiency improvements, such as increased reliability.	special / reliable / other; service reliability / avoid interruptions
Societal-Perspective		
Economic Development	Efficiency programs can impact economic conditions such as employment, earnings, and economic output (NMR 2011; SERA 2010). Energy efficiency can offer significant benefits in terms of creating jobs, even relative to alternative supply-side resources.	job creation; economic output
Tax Impacts	Energy efficiency programs provided to government facilities, including public schools, town halls, libraries, police and fire stations, military facilities, and others, will help lower the costs of supporting those facilities. These lower costs will often translate into lower taxes to the local, state, or federal taxpayers. Efficiency programs can also impact taxes as it relates to economic development, so there can be some overlap between these NEI categories.	social welfare indicators; tax investment credits; tax revenue

NEI Category	Definition	Specific Examples
Environmental / Emissions	Electricity generation can have a variety of environmental impacts. By reducing the need to generate, transmit, and distribute electricity, energy efficiency can result in a variety of significant environmental benefits that will accrue to society as a whole (NMR 2011; SERA 2010).	fish / wildlife mitigation; reductions of emissions like GHGs, SO2, NOX, particulates, and air toxics; emissions of solid wastes; consumption of water; land use; mining impacts; aesthetic impacts
Health Care / Health & Safety	To the extent that energy efficiency programs can improve health and reduce healthcare costs, they provide a benefit to society (NMR 2011; SERA 2010; NZ EEAC 2012). Healthcare costs can fall on individuals, insurance providers (which are generally passed to individuals through higher premiums), or taxpayers.	health and safety equipment / fires; improve health; reduce healthcare costs; reduced hospitalization and visits to doctors due to reduced incidences of illness or reduced incidence rates of chronic conditions
National Security	A benefit of efficiency comes from reducing the need for energy imports, thereby enhancing national security (NMR 2011; SERA 2010).	reduced energy imports; increased national security
Other Societal-Perspective NEIs	Energy efficiency can have additional impacts to society.	determined on a case-by-base basis

Overview of Current NEI Practices in the NEEP Region

In October 2013, Synapse surveyed states in the NEEP region on their cost-effectiveness practices. This report found that most states screen for cost-effectiveness using the TRC test as the primary test, while a few states rely on the Societal Cost test or the Utility Cost test as the primary test. This survey included a review of how states treat NEIs in their cost-effectiveness tests, which is summarized in Table B.2, below.

Table B.2 summarizes the NEIs that each state accounts for and how the state is accounting for the NEI. The NEIs are presented at a high level for utility-perspective NEIs, at a more detailed level for participant-perspective NEIs to be consistent with the NEI categories in Table B.1, and at a high level for societal-perspective NEIs.[23] The NEI categories are intended to give a general sense of the participant-perspective NEIs included in cost-effectiveness tests. Each participant NEI category can include one or more specific NEIs; for example, Improved Operations can include reduced O&M costs and/or improved equipment performance. "Quantified" means that the state has determined a monetized value for each

[23] The October 2013 survey focused primarily on participant-perspective NEIs, so details on the utility- and societal-perspectives are not available.

type of NEI, an "Adder" means that the state applies an adder to program benefits to estimate those NEIs, and "Alt. Benchmark" means that the state accounts for NEIs by allowing for benefit-cost ratios less than one.

This table demonstrates three points. First, each state accounts for a different set of NEIs, even states that rely on the same test. For example, Massachusetts and Rhode Island quantify most types of utility- and participant-NEIs but Rhode Island includes some societal benefits while Massachusetts does not. Meanwhile, Delaware does not include any NEIs, yet all three of these states rely on the TRC test to screening programs.

Second, states take different approaches to estimating the NEIs they do consider:

- Two states use quantified values for non-energy impacts.
- Two states use adders to represent non-energy impacts.
- Three states use alternative benchmarks or qualitative methods to consider NEIs.

Third, in general, states are not estimating the majority of NEIs. While Massachusetts and Rhode Island quantify most NEIs, not all of the participant NEI categories are monetized. Vermont and the District of Columbia apply adders to generally account for NEIs, but it is difficult to know with certainty whether the adders fully capture the value of each type of NEI. It is important to note that Low-Income / Economic Development NEIs are more likely to be accounted for then other types of NEIs, even by Connecticut, New York, and New Hampshire which do not account for many other NEIs.

Table B.2: Whether and How States Account for NEIs

Primary Test	UCT	Total Resource Cost Test					Societal Cost Test	
State	*CT*	*MA*	*RI*	*NY*	*NH*	*DE*	*VT*	*DC*
Utility-Perspective NEIs		Quantified	Quantified				15% Adder	
Low-Income / Economic Development	Alt. Benchmark	Quantified	Quantified	Alt. Benchmark	Alt. Benchmark		30% Adder	10% Adder
Improved Operations		Quantified	Quantified	Alt. Benchmark			O&M Quantified	O&M Quantified
Comfort		Quantified	Quantified				15% Adder	10% Adder
Health & Safety		Quantified	Quantified				15% Adder	10% Adder
Home Improvements		Quantified	Quantified				15% Adder	10% Adder
Participant's Utility Savings		Quantified	Quantified				15% Adder	10% Adder
Education and Contributions							15% Adder	10% Adder
Other Participant-Perspective							15% Adder	10% Adder
Societal-Perspective NEIs			Quantified				15% Adder	10% Adder

A blank cell indicates that the state does not account for this type of NEI.

Implications of Current NEI Practices in the NEEP Region

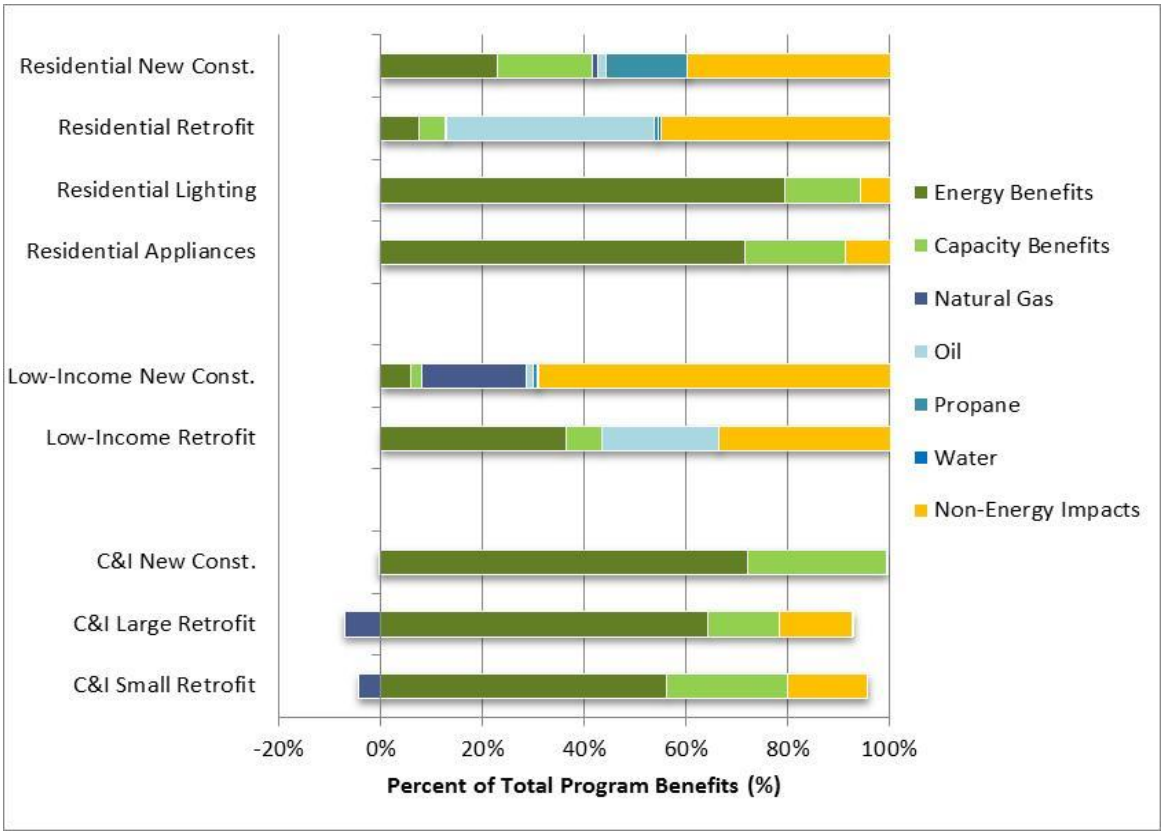
As noted above, each state accounts for a different set of NEIs, and uses different approaches for estimating those NEIs. Such a range of approaches to NEIs can have a significant impact on program benefits and cost-effectiveness.

For example, NEIs vary significantly by program, as demonstrated in Figure B.1 below. This figure provides the break out of actual 2012 benefits for a number of electric energy efficiency programs implemented by a Massachusetts program administrator. For each program, the figure provides each benefit's percent of the program's total benefits.

There are two important trends to note from this figure. First, for each program, non-energy impacts comprise a different percentage of total benefits. For example, NEIs comprise about 45 percent of benefits for the residential retrofit program, whereas NEIs comprise approximately 6 percent of the residential lighting program's benefits. Such variances in NEI values across programs suggest that it is more appropriate to account for NEIs on a program specific basis, rather than across a portfolio or programs or across customer sectors.

Second, NEIs can comprise a relatively high value of total program benefits. Specifically, NEIs comprise more than 10 percent of total benefits for most programs, and more than 25 percent of total benefits for low-income programs. The commercial programs are closer to 10 percent as well as the residential appliances and residential lighting programs, but other programs have NEIs that comprise significantly more than 10 percent or 25 percent of total program benefits. As examples, NEIs make up about 40 percent of the residential new construction program's total benefits, and about 75 percent of the low-income new construction program's total benefits. The significance of the NEIs suggests that adders below 25 percent may not adequately capture the full range of NEIs, and again advocates for considering NEIs on a program-specific basis.

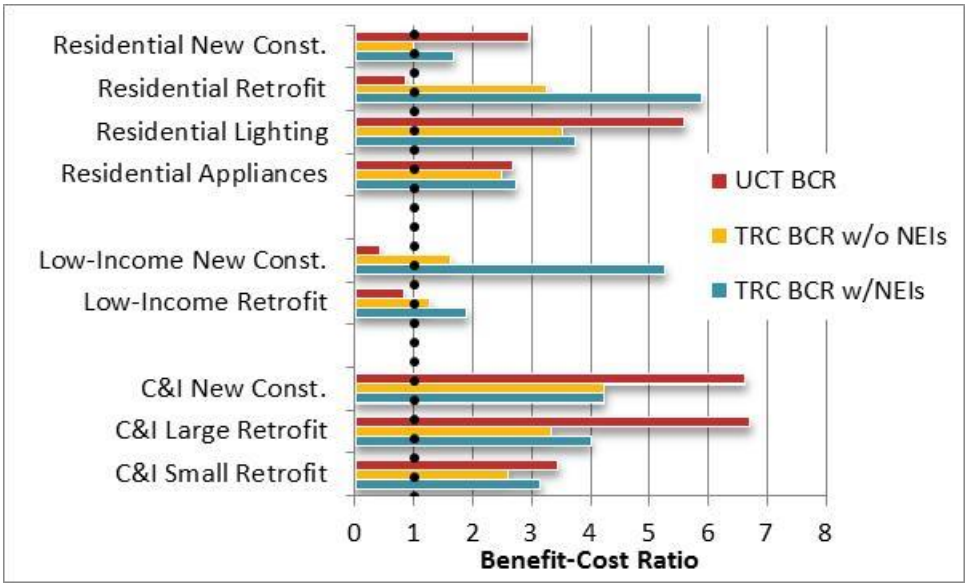
Figure B.1: Massachusetts - Percent of Benefits Made Up by NEBs, by Program



The importance of fully accounting for NEIs is apparent in many program administrators' energy efficiency screening results. Figure B.2, below, presents the 2012 actual cost-effectiveness results for an electric utility in Massachusetts for energy efficiency programs implemented in 2012. The figure presents the benefit-cost ratios under the Utility Cost test, the TRC test with NEIs included, and the TRC test without NEIs included.

The figure shows that NEIs have a significant impact on overall program cost-effectiveness when comparing the results under the TRC test with and without NEIs. If the NEIs are not included in the TRC test, then the residential new construction program would be inaccurately deemed cost-effective, and the low-income programs would also be deemed inaccurately marginally cost-effective, which could threaten the longevity of the low-income programs. 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.

Figure B.2: Massachusetts - Effect of Non-Energy Impacts



Current Monetization and Proxy Values in the NEEP Region

This subsection analyzes the NEI assumptions used in Massachusetts, Rhode Island, Maryland, Vermont, and the District of Columbia. There are two purposes for doing this. First, these states account for NEIs using different methodologies, and a comparison across the different methods allows states to better understand the implications of the different methodologies in use. Second, given that states may not be accounting for the full range or value of NEIs, and given the principles and guidance for accounting for NEIs in Chapter 3, states may wish to revisit the NEI assumptions currently in use. The comparisons below might suggest some assumptions or proxies that could be used by states that are looking for proxies.

Importantly, the types of benefits included in each NEI category can vary - in some cases significantly – by state. States may individually quantify NEIs or aggregate them across broader categories, making it difficult to assess the specific benefits that are accounted for in the state. For example improved comfort can include comfort related to noise, thermal, lighting, or other related areas of comfort. Some states may account for each type of comfort benefit, while others may include a general comfort value to address all types of related benefits. This issue is especially present for states that apply proxy values without identifying the types of NEIs that the proxies are intended to value. Further, research has led to inconsistent nomenclature of NEIs, which clouds the degree of certainty with which benefits can be compared across states. It is difficult to assess whether states are quantifying similar types of benefits, but calling them different names such that they appear to value different impacts. Combined, these issues make it challenging to present a true “apples to apples” comparison of benefits across states. Nevertheless, the analyses presented below indicate the range of values for broad NEI categories, and are intended to be informational rather than exact estimates.

Finally, the analyses below relied on readily available data, which may be incomplete or otherwise unavailable in some instances. For example, the Vermont's values below focus only on the proxy value used in the state, and do not include other benefits that the state directly quantifies, such as O&M and water benefits. As a result, Vermont's values are understated.

Massachusetts and Rhode Island are the only states that quantify most of the individual participant NEIs, which allows for a more detailed review and analysis of their NEIs. Table B.3, below, summarize the range of values used for each NEI category in both Massachusetts and Rhode Island, as well as the values recommended for Maryland in a recent study, in addition to an average of values across all three states (see SERA 2014). The NEI values in this table are presented in terms of dollars per household per year.

As Table B.3 shows, each utility-perspective NEI is around $10 per participant or less. All three states are relatively consistent on this matter, with the most significant variance among Financial and Accounting NEIs. Participant-perspective NEIs have a larger range of values: from $0 to a one-time benefit of $1,988. The range of values for the three states is relatively consistent for Improved Operations, Comfort, and Health & Safety. However, the Home Improvement values have a more significant range of values, likely due to differences in property value increase across states. The societal-perspective NEIs are more difficult to compare across states as there is limited consistency in the data available across the three states.

Table B.3: NEI Values in Massachusetts & Rhode Island, and Maryland (proposed) ($ per household)

Perspective / NEI Category	Maryland (SERA 2014) Dollar Range	Maryland (SERA 2014) Typical Value	Massachusetts Dollar Range	Rhode Island Dollar Range	Average Across All NEIs
Utility-Perspective					
Financial and Accounting	$2.55 - $25.00	$9.70	$2.61 - $39.90	$2.61 - $3.74	$13
Customer Service	$0.10 - $8.50	$3.25	$0.34 - $8.43	$0.34 - $8.43	$4
Other Utility Impacts	$0.13 - $2.60	$1.40	na - na	na - na	$1
Participant-Perspective					
Participant's Utility Savings	$0.27 - $36.70	$3.60	na - na	na - na	$18
Low-Income / Economic Development	$0 - $115	$75	na - na	na - na	$58
Improved Operations	$26 - $127	$82	$0.96 - $124	$0.96 - $102.40	$64
Comfort	$26 - $105	$69	$31 - $125	$1.42 - $125	$69
Health & Safety	$3.02 - $100.50	$16.50	$4 - $45	$0.13 - $45	$33
Education and Contributions	$26.25 - $177.00	$89.75	na - na	na - na	$102
Home Improvements	$10.50 - $77	$36	$17* - $1,998*	$0.32* - $678.52*	$464
Other Participant-Perspective	$0 - $4	$0	na - na	-$0.015 per kWh saved	$2
Societal-Perspective					
Economic Development	$8 - $340	$115	na - na	$0.39 per kWh saved*	$116
Environmental / Emissions	$3 - $180	$60	na - na	na - na	$92
Health Care / Health & Safety	$0 - $0.30	$0	na - na	$0 - $172.53*	$58
Tax Impacts	na - na	na	na - na	na - na	n/a
National Security	na - na	na	na - na	$1.83 per MMBtu oil saved	n/a
Other Societal-Perspective NEIs	na - na	na	na - na	na - na	n/a

**Indicates a one-time benefit, not an annual benefit that accrues for the duration of a measure's lifetime.*

Dollar values are per house hold per year.

The Massachusetts values are based on the 2013 Technical Reference Manuals. The Rhode Island values are based on the 2014 Technical Reference Manual.

Tables B.4 and B.5 summarize the NEIs used in Massachusetts and Rhode Island, this time by program instead of by NEI, using different types of proxies. The NEIs are estimated in terms of dollars per participant or unit, dollars per MWh saved, dollar per MMBtu saved, and as a percent adder applied to electricity benefits (excluding benefits from other fuel savings). The NEIs in dollar benefits, the number of participants, lifetime electric savings in MWh, lifetime energy savings in MMBtu, and electric benefit dollars are also shown in the tables to increase transparency for how the proxy values were estimated. All of the values represent the statewide total from each state's 2013 annual energy efficiency reports.[24]

The dollars per MWh estimate focuses on electricity savings, which may not be as relevant or useful to program administrators that provide multiple fuel savings. Therefore, the electric, natural gas, propane, and oil savings have been converted to MMBtus (using a 8,254 btu/kWh conversion for electric savings, consistent with the 2013 Synapse Avoided Energy Supply Cost study) to more readily compare and apply NEI assumptions.

[24] Some NEIs are experienced over the life of the measures installed, while other NEI are only experienced once, at the time of installation. The analysis herein reviewed total program non-energy benefits and total program lifetime savings for the year. Therefore, the annual and one-time NEI values are combined, which leads to NEI proxies that may be understated.

Tables B.4 and B.5 indicate that presenting NEI proxy values using different approaches (i.e., $/unit, $/MWh, etc.) results in a wide range of values. Some of the NEIs by program can be quite large. For example, a program with a percentage adder that exceeds 100 percent implies that the NEIs are larger than the avoided energy and capacity benefits for that program. States are encouraged to review the different types of proxies and potentially adopt an approach that is appropriate for its state.

Table B.4: Summary of NEI Values by Program Type – Massachusetts

Sector / Program	NEIs ($)	Participants or Unit	*NEI$ / Unit*	Lifetime Electric Savings (MWh)	*NEI$ / MWh*	Lifetime Energy Savings (MMBtu)	*NEI$ / MMBtu*	Electric Benefits ($)	*% Adder*
Residential									
New Construction	2,973,977	4,082	729	94,405	32	1,025,047	3	20,707,708	14%
Home Retrofit	230,401,701	45,507	5,063	439,534	524	7,272,785	32	63,081,897	365%
Products & Services	11,880,390	1,704,759	7	1,818,060	7	15,006,266	1	252,808,182	5%
Average Residential	249,267,785	2,655,894	94	2,803,962	89	26,579,446	9	394,000,079	63%
Low-Income									
New Construction	2,091,096	663	3,154	6,253	334	104,751	20	1,499,141	139%
Single-Family	14,787,093	11,813	1,252	139,188	106	2,009,321	7	21,441,617	69%
Average Low-Income	30,143,459	35,793	842	315,878	95	3,497,519	9	43,220,724	70%
Commercial & Industrial									
New Construction	27,917,270	22,982	1,215	2,787,145	10	21,604,730	1	425,275,873	7%
Small C&I Retrofit	34,184,135	5,551	6,158	1,187,307	29	8,848,203	4	177,389,086	19%
Large C&I Retrofit	91,820,037	2,184	42,042	4,907,610	19	33,887,618	3	686,087,421	13%
Average C&I	153,921,441	30,717	5,011	8,882,062	17	64,505,193	2	1,288,752,380	12%

The Massachusetts values are based on the statewide electric 2013 Plan-Year Report.

Table B.5: Summary of NEI Values by Program Type – Rhode Island

Sector / Program	NEIs ($)	Participants or Unit	*NEI$ / Unit*	Lifetime Electric Savings (MWh)	*NEI$ / MWh*	Lifetime Energy Savings (MMBtu)	*NEI$ / MMBtu*	Electric Benefits ($)	*% Adder*
Residential									
New Construction	1,790,548	474	3,778	10,103	177	83,392	21	2,808,894	64%
Home Energy Retrofit	1,287,537	8,645	149	65,969	20	544,506	2	9,795,069	13%
Products and Services	1,199,433	31,201	38	46,686	26	385,346	3	4,943,804	24%
Average Residential	5,998,506	458,439	13	321,843	19	2,656,491	2	35,101,836	17%
Low-Income									
New Construction	na	na	na	na	na	na	na	na	na
Single-Family	2,851,019	2,646	1,077	45,200	63	373,084	8	7,508,841	38%
Average Low-Income	3,614,972	8,016	451	62,349	58	514,626	7	9,213,223	39%
Commercial & Industrial									
New Construction	-	2,271	-	421,072	-	3,475,531	-	43,834,590	0%
Small C&I Retrofit	-	1,175	-	213,224	-	1,759,953	-	21,549,776	0%
Large C&I Retrofit	15,921,532	344	46,284	564,007	28	4,655,316	3	49,904,758	32%
Average C&I	15,921,532	3,790	4,201	1,198,304	13	9,890,800	2	115,289,124	14%

The Rhode Island values are based on National Grid's 2013 Annual Report.

Vermont and the District of Columbia also account for NEIs, and do so by applying adders to their program benefits. Both the District of Columbia and Vermont apply their NEI adders to the sum of avoided energy and capacity benefits, and, if applicable, increases or decreases in other fuels in terms of dollar benefits. Similar to the analysis above for Massachusetts and Rhode Island, the NEI adders in Vermont and in the District of Columbia have been converted to NEIs in terms of dollars per participant or unit, dollars per MWh, and dollars per MMBtus. These values have been backed out of the NEI benefits from the adder, and using information from each state's 2013 annual energy efficiency reports.

Table B.6: Summary of NEI Values by Customer Sector – District of Columbia

Sector	NEIs ($)	Participants or Unit	*NEI$ / Unit*	Lifetime Electric Savings (MWh)	*NEI$ / MWh*	Lifetime Energy Savings (MMBtu)	*NEI$ / MMBtu*	*% Adder*
Residential	557,183	38,472	14	14,008	40	99,024	5.63	10%
Low-Income	949,464	7,645	124	6,776	140	62,751	15.13	10%
Commercial & Industrial	5,020,822	241	20,833	29,587	170	303,444	16.55	10%

The District of Columbia values are based on the DCSEU's preliminary results for 2013. The percent adder is the current practice.

Table B.7: Summary of NEI Values by Customer Sector – Vermont

Sector	NEIs ($)	Participants or Unit	*NEI$ / Unit*	Lifetime Electric Savings (MWh)	*NEI$ / MWh*	Lifetime Energy Savings (MMBtu)	*NEI$ / MMBtu*	*% Adder*
Residential	4,473,900	35,171	127	316,289	14	2,868,229	1.56	15%
Low-Income	714,380	2,080	343	20,948	34	194,075	3.68	32%
Commercial & Industrial	8,404,306	2,297	3,659	694,792	12	6,313,387	1.33	15%

The Vermont values are based on Efficiency Vermont's 2013 Savings Claim Report. The percent adder is the current practice.

To summarize the above analysis, Table B.8 below compares the different NEI proxies by sector across all four states.

Table B.8: Summary of NEI Values by Customer Sector – MA, RI, DC, and VT

Sector	NEI$ / Unit				NEI$ / MWh				NEI$ / MMBtu				% Adder			
	MA	RI	DC	VT	MA	RI	DC	VT	MA	RI	DC	VT	MA	RI	DC	VT
Residential	94	13	14	127	89	19	40	14	9	2	6	2	63%	17%	10%	15%
Low-Income	842	451	124	343	95	58	140	34	9	7	15	4	70%	39%	10%	32%
Commercial & Industrial	5,011	4,201	20,833	3,659	17	13	170	12	2	2	17	1	12%	14%	10%	15%