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Guidelines for Assessing the Value and Cost-effectiveness of Regional Market Transformation Initiatives

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I. Executive Summary

Restructuring of the electric and gas utility industries is causing fundamental changes in the design and implementation of energy-efficiency programs. Until recently, energy efficiency programs were an essential element of least-cost planning for electric and gas utilities. Now many policymakers are re-examining the continuing need for, purposes served by, and manner of delivering energy-efficiency programs in light of utility restructuring policies across the Northeast and the nation.[1] In parts of the country where support for utility energy-efficiency programs has been strong for years (such as the Northeast, Northwest, California, and Wisconsin), continuing recognition of the important public benefits provided by these programs, in particular the reduction of negative environmental consequences of electricity generation, has inspired both regulatory and legislative efforts to preserve ratepayer funding for them. These efforts also generally recognize that the former utility resource acquisition orientation of these programs has given way to a broader societal perspective that emphasizes the overall economic and environmental benefits provided by energy-efficiency programs.

An emerging focus for energy-efficiency programs in a restructured electricity industry is market transformation.[2] Much attention is now being devoted to implementing energy-efficiency programs that have been explicitly designed to effect lasting beneficial changes in markets. Successful market transformation programs hold the promise of improving the functioning of markets to the point where publicly funded programs are no longer needed. To facilitate regional market transformation efforts, Northeast Energy Efficiency Partnerships, Inc. (NEEP), a nonprofit regional organization, was founded in 1996 to increase and coordinate energy-efficiency efforts in New England, New York, and the Mid-Atlantic region.[3]

Regional market transformation initiatives differ from traditional utility energy-efficiency programs in important ways:

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[1] See Eto, Goldman, and Nadel "Ratepayer-Funded Energy-Efficiency Programs in a Restructured Electricity Industry: Issues and Options for Regulators and Legislators" LBNL-41479. Download from http://eetd.lbl.gov/EA/EMP.

[2] Regulators and legislators have also explicitly supported programs to address "lost opportunity" markets, some low-income residents and public institutions, and maintain at least current levels of savings leveraged by ratepayer-funded programs.

[3] NEEP's primary goal is to reduce the harmful pollution that results from energy use. NEEP accomplishes this by recommending government policies that promote efficient energy consumption. NEEP also develops and informs regional market transformation initiatives to make quality, energy-efficient products commonplace in homes, buildings, and industrial workplaces in the Northeast.

1. They are focused more on *changing markets and the overall patterns of behavior of market participants* and less on influencing individual purchase decisions.

2. They are *multi-year* both in implementation, which may consist of an integrated set of activities that change over time, and in outcomes, which are expected to last after the initiatives have ended.

3. They are *regional*, including multiple service territories and states.

4. Their ultimate success in creating lasting beneficial changes in markets will hinge on how effectively they can introduce and promote energy-efficient products and services that *meet the needs of both customers and other market participants*.

To encourage and assist the development of a consistent policy framework for the implementation of regional market transformation initiatives in Northeast states, these guidelines present recommendations to assess the value and cost-effectiveness of regional market transformation initiatives.

Cost-effectiveness analysis seeks to establish the overall value of an energy-efficiency program or initiative (either the benefits minus the costs or the ratio of benefits to costs). Cost-effectiveness analysis informs many aspects of energy-efficiency program decision making [4] including:

1. The appropriateness of using public or ratepayer funds to support energy-efficiency programs;
2. The design of individual energy-efficiency programs;
3. Setting priorities among individual programs;
4. Balancing a portfolio of programs; and
5. In limited cases, compensation to program administrators.

The basic principles of and applications for cost-effectiveness analysis are no less important for regional market transformation initiatives. However, the unique features of these initiatives - in particular, their focus on stimulating lasting beneficial changes in the workings of markets - pose

[4] Cost-effectiveness analysis is a powerful tool for assessing the value of regional market transformation initiatives. However, cost-effectiveness analysis is not the only or even necessarily the most important consideration for market transformation initiatives. Leverage, opportunity, risk, and equity must also be considered. An improved and common understanding of the uses, perspectives, and methods for cost-effectiveness analysis of regional market transformation initiatives provides a sound basis from which to begin the process of integrating these other important considerations into energy-efficiency program decision making.

significant challenges for traditional approaches for applying cost-effectiveness principles to the analysis of energy-efficiency programs. The recommendations offered in these guidelines represent an effort to re-think and re-apply these basic cost-effectiveness principles in a manner consistent with the design and operation of regional market transformation initiatives.

Table 1 summarizes key features of the analytical framework developed in these guidelines to assess the value and cost-effectiveness of regional market transformation initiatives. The guiding principle in developing these guidelines is common sense, not theoretical elegance. That is, these methods are useful only insofar as they have been proven practical and workable by market transformation practitioners.

Reliance on consistent approaches and methods that make sense for analyzing the cost-effectiveness of regional market transformation initiatives addresses an important challenge for the development of programs and policies across a region. First, it provides a coherent basis for market transformation program planning and implementation across the region. Second, in so doing, it can also build regulatory and management support for a consistent implementation of market transformation initiatives across the region. Both are essential for working toward common goals and objectives through joint and coordinated efforts.

The guidelines are organized in three major sections. Section II provides additional background on the roles that cost-effectiveness analysis plays in market transformation initiatives. Section III introduces key features of and perspectives for cost-effectiveness analysis for market transformation initiatives. Section IV reviews current practices and emerging issues in cost-effectiveness analysis.

Table 1. Analytical Framework for Cost-Effectiveness Analysis of Regional Market Transformation Initiatives

Key Feature	Rationale
Focus on *societal benefits and costs* as a threshold measure of cost-effectiveness. Rely on other cost-effectiveness perspectives to inform supporting decisions (such as setting program priorities, evaluating alternate design strategies, etc.)	To reflect the broad public purposes (both economic and environmental) served by energy-efficiency programs in a restructured electricity industry, while acknowledging the continuing relevance and importance of other perspectives
Conduct *multi-year analysis* that considers benefits and costs over the entire time horizon of the program strategy, starting with program introduction and ending with lasting effects following implementation of "exit strategies"	To consistently consider all program benefits and costs, recognizing that markets may change slowly and that an integrated set of activities may be required over several years to effect lasting beneficial changes
Adopt a *regional scale* for analysis that may transcend state and service territory boundaries (e.g. rely on regional estimates of avoided costs)	To consider all program benefits and costs consistent with the actual geographic scale of the market(s) targeted by programs
Model *market penetration* with special attention to developing a rigorous program baseline. Do not structure analysis around traditional notions of program "participants"	To address program causality consistently from a "bottom line" point of view that also avoids the difficulties with defining and measuring "participation" on a more dis-aggregated basis
Identify/track *market effects* (e.g., program goals tied to product introduction: increasing market saturation, declining product costs) as measures of program outcomes	To identify market changes that are directly tied to program activities and that can be observed in a timely fashion
Use *scenario analysis* to assess risks and to develop appropriate risk mitigation strategies	To determine the most important assumptions underlying cost-effectiveness analysis and thereby ground the development of monitoring and contingency plans

II The Roles of Cost-Effectiveness Analysis for Market Transformation Initiatives

Cost-effectiveness analysis seeks to establish the overall value of an energy-efficiency program or initiative (either the benefits minus the costs or the ratio of benefits to costs) to inform many aspects of energy-efficiency program decision making including:

1. The appropriateness of using public or ratepayer funds to support energy-efficiency programs;
2. The design of individual energy-efficiency programs;
3. Setting priorities among individual programs;
4. Balancing a portfolio of programs; and
5. In limited cases, compensation to program administrators.

The importance and specific role of cost-effectiveness analysis depends on the audience for the analysis. This section reviews the roles and their audiences.

First and foremost, cost-effectiveness analysis provides a measure of the net worth of an activity. From a policy perspective, cost-effectiveness analysis is a critical input to decisions regarding the appropriateness of energy-efficiency activities. A positive net value is often (but not necessarily) a threshold criteria for proceeding with an energy-efficiency program or initiative; all else being equal, it makes little sense to proceed when there is no expectation for a net beneficial outcome.

Appropriateness, in turn, depends on the perspective from which cost-effectiveness is being evaluated. Policymakers (including state legislators, utility regulators, environmental regulators, energy offices, consumer advocates, and other government agencies), program administrators (e.g., utilities), and other stakeholders (including environmental organizations, consumer groups, towns and municipalities, various market participants, etc.) all have unique or distinct perspectives from which they will evaluate cost-effectiveness.

Policymakers are the primary audience for cost-effectiveness analysis. At bottom, they want to ensure that public funds are spent prudently. A positive analysis of cost-effectiveness, while not a guarantee, creates a significant expectation that society will be better off as a result of the expenditure of public funds for market transformation initiatives. Policymakers may differ in the relative importance they place on the many benefits and costs associated with initiatives. For example, utility regulators will want to know the benefits and costs experienced by ratepayers. Environmental regulators will want to be able to identify environmental impacts. Economic regulators will want to understand the impacts on in-state job creation or enhancement of industrial productivity/competitiveness. Many agree that considering all benefits and costs from a societal perspective is especially appropriate given the broader public purposes now served by energy-efficiency programs in a restructured electricity industry.

Utilities and other stakeholders are another important audience for cost-effectiveness analysis. However, the range of benefits and costs they consider important depends on the institutional, regulatory, or organization boundaries within which they operate. All else being equal, the most important benefits and costs are those that affect the bottom line. Most investor-owned utilities, for example, adopt a societal perspective to the extent that the regulatory framework within which they operate provides incentives (explicitly or implicitly), which align the profit-making goals of the firm (or more broadly the interests of shareholders) with those of society. The bottom line need not necessarily be defined in economic terms. For example, environmental organizations may focus on energy savings and emissions reductions (although, for some, the focus is on the cost to achieve them compared to other environmental policies or programs).

In addition to providing an overall measure of appropriateness, there are other important programmatic applications of cost-effectiveness analysis, including program design, priority setting, portfolio development, and in some cases establishing a basis for compensation for program administrators. The importance of these applications (and the perspectives from which cost-effectiveness is evaluated) depends on the overall importance placed on cost-effectiveness analysis from the policymaking perspectives previously described.

The formalism of cost-effectiveness analysis provides an ideal framework for evaluating program plans and designs. Cost-effectiveness analysis requires analysts to explicitly articulate their assumptions regarding program performance. What is the forecast of market penetration over time? What is the baseline? What is the forecast of measure cost reductions over time? Accordingly, from a program planning and design perspective, cost-effectiveness analysis can provide critical feedback on initial program designs. For example, cost-effectiveness analysis can determine whether projected levels of program spending (developed previously from a "bottom-up" analysis of program administrative costs) can, in fact, be justified. Such an assessment can also provide important insight on the level of financial incentives to market participants, which can be supported. This, in turn, may cause program designers to re-examine their assumptions regarding program-induced market-penetration.

From a program implementation and evaluation perspective, cost-effectiveness analysis can identify critical program milestones to monitor. How does program-induced market penetration compare to forecasts? How do actual price trends in the market compare to pre-program estimates? Cost-effectiveness analysis provides a framework for assembling feedback and evaluation findings on program performance and using these to improve program design and implementation in real-time (see section III.C).

Cost-effectiveness analysis provides a common metric for use in setting priorities among programs. On the one hand, it provides a basis for program planners to select among competing programs with similar objectives, but perhaps different costs. On the other hand, it also allows program planners to determine, for a given level of expenditure, which program(s) provides the greatest benefits.

Cost-effectiveness analysis can also inform the creation of a balanced portfolio of energy-efficiency programs, which may include programs that pursue both market transformation and other energy-efficiency policy objectives. Few would argue that portfolio development should be based solely on cost-effectiveness analysis (see closing remarks to this section below), but none would argue that portfolio development should never rely on cost-effectiveness analysis as one of many important considerations. For example, demonstrating that an entire portfolio of programs is cost-effective in aggregate may be an important consideration in including individual programs whose cost-effectiveness may be more marginal either by design or by necessity, owing to imprecision in the estimates of the costs and benefits of programs.

A less common application of cost-effectiveness analysis arises when compensation to program administrators is linked to the cost-effectiveness of programs. In this case, the audience consists primarily of the administrator (e.g., a utility) and its regulator. Administrators want to ensure that their earnings opportunities are consistent with internal expectations, recognizing that a portfolio consisting of both highly cost-effective (and possibly more profitable) and less cost-effective (and possibly less profitable) activities may be required to obtain regulatory approval. Regulators want to ensure that the compensation paid to administrators on whatever basis has been established is fair. Given their fiduciary responsibilities to oversee the expenditure of ratepayer funds, regulators are likely to employ higher evidentiary standards for compensation compared to other users of cost-effectiveness analysis.

These applications for cost-effectiveness analysis are no less important for regional market transformation initiatives. In addition, cost-effectiveness analysis for regional market transformation initiatives can also provide a consistent regional view of the initiatives that can build regulatory and management support and approval for consistent implementation of market transformation programs across the region through coordinated and joint program efforts.

Cost-effectiveness analysis is one of the most important tools available to guide decision making for energy-efficiency programs. This section has sketched several of the valuable roles cost-effectiveness analysis can play. However, *while important, cost-effectiveness analysis, alone, does not provide a wholly adequate basis for making energy-efficiency program decisions.*

Relying solely on cost-effectiveness analysis for energy-efficiency program decision making may be misleading for at least two reasons. First, all costs and benefits are rarely known with perfect certainty. Bias and imprecision are inevitable; it is the responsibility of analysts to represent this information in ways that support better decision making (see section III.C). Second, one should never confuse what's countable for what really counts. In practice, factors such as leverage, risk, and equity, among others, may be as or even more important than cost-effectiveness analysis in making decisions. It is important not to lose sight of the other factors when incorporating the findings from cost-effectiveness analysis into energy-efficiency program decisions.

III. Introduction to Cost-Effectiveness Analysis for Regional Market Transformation Initiatives

The unique features of regional market transformation initiatives - in particular, their focus on stimulating lasting beneficial changes in the workings of markets - pose significant challenges for traditional approaches to cost-effectiveness analysis. The recommendations offered in these guidelines represent an attempt to re-think and re-apply cost-effectiveness principles in a manner consistent with the design and operation of these initiatives. In order for cost-effectiveness analysis of regional market transformation initiatives to be meaningful, the analysis must accommodate and reflect the ways in which markets actually work. In order to be useful, cost-effectiveness analysis must present information in ways that facilitate better program decision making. This section outlines recommended approaches of cost-effectiveness analysis for regional market transformation initiatives in three parts: A. Creation of a new market-oriented framework for cost-effectiveness analysis; B. Reliance on three perspectives for cost-effectiveness analysis; and C. Managing uncertainty in cost-effectiveness analysis.

A. Market Transformation Analysis Framework

Important implementation issues arise in analyzing the cost-effectiveness of regional market transformation initiatives because they differ from traditional utility energy-efficiency programs. An analytic framework is needed to address these issues in a manner that is consistent both with the ways markets operate and with the ways market transformation initiatives seek to influence them. This subsection describes this analytic framework organized around several major headings:

1. Market penetration as the basic unit of analysis;
2. Program baselines - current and future "standard" practices;
3. Multi-year analysis horizon;
4. Regional scope; and
5. Capturing benefits and costs consistent with a market orientation.

The cost-effectiveness analysis framework recommended for regional market transformation initiatives may or may not be applicable to other types of energy-efficiency programs; discussion of this issue is beyond the scope of these guidelines.[5] Similarly, different stakeholders have specific requirements for cost-effectiveness analysis that differ from the methods developed for market transformation initiatives. Nonetheless, to build consistent policy support for regional market transformation initiatives, it is useful to provide a regional analysis consistent with the

[5] See, for example, "A Proposed Societal Benefit-Cost Framework" prepared by Regional Economic Research for Massachusetts Electric Company, August 3, 1998.

unique goals, objectives, and features of these initiatives. This allows policymakers and administrators across the region to have at least a consistent view of the initiatives, even if other policy requirements prevail.

1. Market Penetration as the Unit of Analysis

Market transformation initiatives are focused more on changing markets and the overall patterns of behavior of market participants and less on influencing individual purchase decisions. Putting this fundamental insight to work requires a different analytic framework for assessing cost-effectiveness.

A focus on overall market behavior leads naturally to a *focus on market adoption or penetration rates for energy-efficient products and services* as the unit of analysis for cost-effectiveness analysis of market transformation initiatives. Adoption of a focus on market penetration is a major departure from the traditional focus of cost-effectiveness analysis on program participants.

A focus on "participants" makes sense when discrete energy-efficiency program services have been explicitly targeted and received by readily identifiable recipients of these services. Traditional utility rebate programs have been the archetype for this way of structuring analysis. However, market transformation initiatives by design may or may not promote discrete program services that can be linked readily to individual recipients.[6] Furthermore, to the extent the actions promoted through market transformation initiatives are targeted to identifiable individual recipients, they are done so strategically in view of the catalytic role these recipients are expected to play in leveraging even greater benefits. These benefits may stem from either subsequent actions on the part of these recipients (participant spillover) or, often more importantly, subsequent actions on the part of those they influence (non-participant spillover). The identifiable recipients of program services may represent only the "tip of the iceberg" in terms of the ultimate influence of the programs. Focus on these "participants" alone in cost-effectiveness analysis will significantly understate the benefits and costs of market transformation initiatives.

Finally, a focus on market adoption bypasses the need to conduct separate studies of free ridership and program spillover (see section IV.C). The need for both of these types of studies, which have consumed many resources in the past, is replaced by a more single-minded focus on the bottom line for market transformation initiatives (i.e., by how much has the program increased market penetration relative to what would have taken place in the absence of the initiative?). This is not to say, however, that focus on market adoption is free of analytical complexity and challenges.

[6] Identification of recipients for program services may, however, play a critical role in the design of market transformation initiatives. For example, strategic alliances are a proven strategy for leveraging program efforts.

2. Program Baselines - Current and Future "Standard" Practices

Reliance on market penetration as the unit of analysis for cost-effectiveness shifts the focus of analytical attention from identification of classes of "participants" and "non-participants" to the *development of program baselines.* A program baseline is a forecast of market conditions that would have occurred in the absence of a program. The difference between the program baseline and actual experience is the net effect of a program. The program baseline establishes the reference against which both the benefits and costs of a market transformation initiative are measured.

A rigorous program baseline consists of a comprehensive and consistent forecast of all relevant changes in the market targeted by a market transformation initiative. It is much more than a simple projection of market penetration in the absence of a program. To be comprehensive, it is necessary to project market penetration, total market size, changing product features, future product costs, and the timing of other influences on the market (e.g., updates to relevant codes or standards). To be internally consistent, it is important to articulate the assumptions upon which the projections are based. As a result, changes in these assumptions can be automatically and consistently reflected as changes to various forecast elements (see section III.C).

The rigor of the program baseline is central to the credibility of cost-effectiveness analysis. Changes in assumptions can have dramatic impacts on program baselines and consequently on net program effects. If, on the one hand, baselines are not changing, then the program takes full "credit" for observed changes in the market. If, on the other hand, the baseline is changing, then the program takes only partial "credit" for the observed changes.

Treatment of changes in product cost provides a useful illustration of these concepts. It is a well-accepted principle that incremental customer cost is the relevant cost to include in cost-effectiveness analysis (see section IV.C). Market transformation initiatives introduce an additional nuance to the determination of incremental cost because the initiatives themselves may (and often are intended to) change (i.e., reduce) the cost of the energy-efficient products or services they promote. Hence, a product cost baseline in the absence of the initiative is needed for capturing the full effect of the initiative in a cost-effectiveness analysis.

The uncertainty inherent in forecasting measure cost baselines can be addressed by crediting market transformation initiatives with only a fraction of the value to society of reductions in the cost of energy-efficient products or services. For example, NEEP staff credit initiatives with the value of reductions in measure costs to only the increment in market penetration caused by the initiative. Of course, all units sold are sold at lower cost. Thus, this convention represents a compromise that is used in lieu of a more detailed analysis of the exact causal role of an initiative in lower measure costs (versus the cost trajectory that would have been observed in the absence of the program).

The analytical challenges involved in developing realistic and meaningful program baselines are substantial. The practical reality is that the future can never be known with certainty. At a

minimum, the assumptions underlying the baselines should be documented and ongoing monitoring efforts should be implemented to track the most important assumptions. Section III.C further develops these ideas and methods for implementing them.

3. Multi-year Analysis Horizon

The third major implication of a market-orientation for analyzing the cost-effectiveness of market transformation initiatives is the need to evaluate these initiatives over a *multi-year analysis horizon*. Market transformation initiatives may consist of an integrated set of activities that change over time to achieve specific goals and objectives tied to desired market effects. These outcomes, moreover, are expected to last after the activities have ended.

It is useful to demonstrate the implications of this approach by contrasting it to cost-effectiveness approaches for traditional energy-efficiency programs. In analyzing, say, a traditional rebate program, emphasis is placed on the effects of rebates on customers that receive them. Subsequent adoptions by these same customers without rebates (participant spillover), and by other customers that have been influenced by the program yet have not "participated" in it (non-participant spillover), if they are considered, are included as "adders."[7]

A multi-year analysis horizon focused on market penetration provides a more comprehensive representation of the overall changes in markets that market transformation initiatives are trying to effect. As noted earlier, adoption of such a focus eliminates the need to distinguish between "participants" and "non-participants" (the entire target market is the "participant") and the need to separately attribute (directly or indirectly) the actions of market participants to specific services offered by market transformation initiatives.[8]

For example, NEEP staff use both a 5- and 10-year analysis period in cost-effectiveness analysis to support planning for market transformation initiatives. They provide useful snapshots of both the short-term and long-term effects of market transformation initiatives. That is, the market changes these initiatives promote should be apparent in less than 5 years and, after 10 years, the long-term pattern of expected changes should be stable (in part because most of the formal services provided through the initiatives have been completed by this time).

The choice of these two analysis periods has no bearing on the actual monitoring and evaluation of program implementation. As discussed in section III.C, all major program assumptions should

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[7] For a useful demonstration of how this participant-based perspective can be applied to market transformation initiatives see "A Proposed Societal Benefit-Cost Framework" prepared by Regional Economic Research for Massachusetts Electric Company, August 3, 1998.

[8] Understanding these linkages, of course, remains critically important for program design and, if necessary, for triggering changes in program operation in real-time. However, the need for this type of understanding is less important in cost-effectiveness analysis.

be reviewed at least annually, depending on the design of the initiative. These reviews should be used to re-estimate cost-effectiveness and, if appropriate, provide a basis for changes to programs.

4. Regional Scope

The benefits and costs associated with regional market transformation initiatives are determined by the geography of the markets they seek to influence, not by utility or state boundaries. As a result, a *regional scope* is needed in order to ensure that all relevant benefits and costs are included.

Adoption of a regional scope for cost-effectiveness analysis has special implications for the development of avoided electricity generation, transmission and distribution costs. In particular, utility-specific avoided costs may be less appropriate (in the case of generation) and more difficult (in the case of transmission and distribution) to use when conducting regional analysis of the cost-effectiveness of market transformation initiatives.

Power pool prices represent a logical and consistent source of information for developing estimates for avoided electricity generation costs in a restructured electricity industry. That is, restructuring makes obsolete the notion of administratively-determined avoided electricity costs for generation and replaces it with prices for electricity that are set by market forces.[9] Moreover, the geographic scope of power pools is likely to be closer to that of the markets targeted by market transformation initiatives than are the service territories of individual utilities.

Current practices in Massachusetts, where several forecasts of pool prices are simply averaged for specific DSM program planning applications (see section IV.C), help to clarify that, for purposes of program planning and design, estimates of future pool prices can be decoupled from other uses (e.g., stranded cost recovery). Specifically, averaging several forecasts of pool prices represents a pragmatic approach that recognizes both the uncertainty inherent in all forecasts and the practical needs of program planners for timely information.

Common sense should guide efforts to estimate multi-pool avoided generation costs when markets are not confined to one power pool or another. Of course, theoretically speaking, it is possible to develop a savings-weighted, average pool price across power pools, if energy savings are first allocated to each power pool and estimates of pool prices are developed for each power pool. However, the practicality of such an approach depends on the availability and reliability of the data required to support the analysis. At a minimum, taking this approach should be subject to a preliminary analysis to ensure that the differences in avoided costs among power pools are sufficiently large to warrant this undertaking. As will be discussed in section III.C, scenario analysis offers a powerful tool for bounding the uncertainty that may be introduced by whichever approach is adopted.

[9] See additional discussion of this topic in section IV.

This common sense approach applies equally well to avoided T&D costs. Rate-regulation of T&D services (since they continue to represent natural monopolies) continues to make administratively-determined avoided electricity costs for T&D appropriate for inclusion in cost-effectiveness analysis. In view of the local nature of these costs, evaluating the cost-effectiveness of market transformation initiatives would seem to call for an even more complex weighting and averaging scheme among individual utilities. Here, we would argue even more passionately that analysts should first step back and determine whether the observed variations in marginal T&D costs would justify such detailed treatment. Once again, this topic is particularly well-suited to treatment using scenario analysis (see section III.C).

5. Capturing Benefits and Costs That are Consistent with a Market Orientation

Transforming markets requires developing and making available products and services that customers and other market participants value. Value, in turn, derives from a host of product and service features, only one of which may involve energy use. Thus, while the public interest served by market transformation initiatives may be based primarily on energy-related considerations, ultimate market acceptance of energy-efficient products and services depends on the entire range of values that these products and services bring to customers and other market participants. Indeed, if customers and other market participants do not find value in these products or services (in part through the activities of regional market transformation initiatives), it is unlikely that the initiatives will succeed in transforming markets.

Thus, *non-energy benefits* are likely to play a central role in assessing the value and cost-effectiveness of market transformation initiatives. Common sense judgement is needed in deciding the scope of non-energy benefits that can be meaningfully included in an analysis. For example, those that can be readily quantified, such as changes in O&M costs, savings in other resource costs (e.g., water savings), etc., generally should be included in the analysis.

However, many non-energy benefits are resistant to quantification and/or have controversial values. In this case, methods other than estimates for individual elements should be considered. The use of a stipulated adder can be a useful proxy as it represents a practical compromise between assuming no value and time-consuming (and costly) analysis to develop a more precise (yet possibly still highly controversial) estimate. There are important precedents in the Northeast for reliance on this pragmatic approach for incorporating both non-energy and *environmental benefits* in cost-effectiveness analysis (see section IV.C).

NEEP staff use an adder of 15%[10] applied to avoided electricity costs to account for avoided un-internalized environmental consequences of electricity generation and other non-energy benefits in cost-effectiveness analysis of market transformation initiatives.

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[10] This adder was used by the Massachusetts Electric Company for non-quantified benefits in its societal cost-effectiveness analysis of energy efficiency programs presented in its "1998-2002 Energy Efficiency Plan" July 1997 (p. 13).

A. Three Cost-Effectiveness Analysis Indicators

To date, NEEP staff has used three cost-effectiveness indicators to analyze the appropriateness and to design of market transformation initiatives:[11] Societal, Distribution Utility, and Leveraged Benefits. These indicators capture a broad spectrum of the benefits and costs associated with regional market transformation initiatives. Each provides information on a different aspect of a regional market transformation initiative. All play important roles in decision making for these initiatives.

This subsection describes the basic elements and rationale for each of the three cost-effectiveness indicators used by NEEP staff. The links between the three approaches and those traditionally used for other energy-efficiency programs are documented in order to clarify that they build upon long-accepted principles used in cost-effectiveness analysis. Table 2 summarizes the major benefit and cost elements of the three cost-effectiveness analysis approaches used by NEEP staff for regional market transformation initiatives.

1. The Societal Perspective

The Societal perspective is the most important measure of cost-effectiveness for regional market transformation initiatives. The Societal perspective provides a global or overall measure of the net benefits of an initiative. It is not concerned with the distribution of costs and benefits among individual members of society. Instead, it assesses the extent to which society, as a whole, will be improved by pursuit of an initiative. The Societal perspective, therefore, best captures the broad public purposes served by market transformation initiatives in a restructured electricity industry. It is an important threshold in choosing or setting priorities for ratepayer funding.

[11] To date, NEEP staff has not used cost-effectiveness analysis for some of the other applications described earlier, such as develop portfolios of programs or provide a basis for establishing compensation to program administrators, but recognizes that these applications may be important for other stakeholders.

Table 2. Summary of Benefit and Cost Elements for Cost-Effectiveness Analysis of Market Transformation Initiatives

	Societal	Distribution Utility	Leveraged Benefits
Benefits			
Avoided Energy Generation, Transmission, and Distribution Costs (related to energy services offered by the distribution company)	X	X	X
Other avoided energy costs (*not* related to energy services offered by the distribution utility)	X		X
Avoided Environmental Externalities	X		X
Non-energy benefits	X		X
Costs			
Incremental Customer Costs	X		
Program Administrative Costs	X	utility only	utility only

In a restructured industry, the goal of energy-efficiency programs has changed from a narrow focus on avoiding power plant construction to a broader focus on maximizing a much wider range of environmental and economic benefits. These benefits can include those directly related to saving energy, such as avoiding the un-priced environmental consequences of electricity generation. But, they can also include other resource-conserving benefits, such as reduced water use. More importantly, they can also encompass a host of economic (and not-so-strictly economic) factors that are intimately related to the ways in which energy is used. These include convenience, comfort, and productivity, among others. The inclusion of these factors, which has not been a focus of traditional cost-effectiveness analysis, is essential for capturing the most important aspects of initiatives that seek to transform markets.

Table 2 indicates that the same benefits and costs considered in assessing the cost-effectiveness of traditional ratepayer-funded energy-efficiency programs are also considered in assessing the cost-effectiveness of market transformation initiatives (see section IV.A). This is not an accident. The principles involved in assessing cost-effectiveness from a societal perspective remain the same regardless of the type of energy-efficiency program analyzed.

While the principles underlying assessment of cost-effectiveness from a Societal perspective remain the same, implementation of these principles for regional market transformation initiatives differs dramatically, as described in the previous subsection.

2. The Distribution Utility Perspective

The Distribution Utility perspective traces its origins to the Utility Cost perspective used to assess the cost-effectiveness of traditional ratepayer-funded energy-efficiency programs. The Utility Cost perspective measures the impacts of energy efficiency on an individual utility's revenue requirements. Utility revenue requirements for electricity and/or gas generation, transmission, and distribution are reduced by market transformation initiatives. Utility revenue requirements are increased by the program administrative costs (including planning, implementation, evaluation, and if applicable performance incentives). Given restructuring, revenue requirements for electricity and/or gas generation are no longer avoided by the distribution company; they are instead directly avoided by the customers served by the distribution company. Hence, the Distribution Utility perspective can be thought of as a measure of the aggregate impact of market transformation initiatives on the customers served by a given distribution utility.

The Distribution Utility perspective assesses the value of the program relative to the provision of electric or gas services to customers. Depending on the policy objectives for the implementation of the energy efficiency program being assessed, the Distribution Utility perspective may be used to set priorities among programs based on their relative aggregate value to the customers of a distribution company sponsoring the programs. The applicability of this perspective is less clear where ratepayer-funded programs are sponsored by an entity other than a distribution company (e.g., a statewide administrator).

3. The Leveraged Benefits Indicator

The Leveraged Benefits indicator is not a distinct perspective, but is instead a hybrid of the Societal and Distribution Utility perspectives. It includes the same costs considered by the Distribution Utility perspective but also the many additional benefits not captured in the Distribution Utility perspective. It provides a measure of the extent to which the broad societal benefits that result from market transformation initiatives have been "leveraged" by the expenditure of ratepayer dollars. Since funding from ratepayers is the primary source of funds for market transformation initiatives, the Leveraged Benefits indicator provides a useful counterpart to the Distribution Utility perspective. For example, if the B/C ratio is less than one for an initiative from the Distribution Utility perspective (i.e., the initiative is not cost-effective from this perspective), while the B/C ratio is greater than one from the Societal perspective (i.e., the initiative is cost-effective from this perspective), then it may be appropriate to consider ratepayer funding for this initiative, given both the broader societal benefits that these funds can leverage, and the broader public purposes now served by energy-efficiency programs in a restructured electricity industry.

C. Managing Uncertainty in Cost-Effectiveness Analysis of Market Transformation Initiatives

The cost-effectiveness approaches for market transformation initiatives described in these guidelines have been developed recognizing the tension between the ideal and the practical realities of the needs of energy-efficiency program planners. This tension between the ideal and practical realities, and the associated uncertainty, is inherent in cost-effectiveness analysis. Thus, it is important to develop methods for representing and managing uncertainty in ways that lead to better decisions. This final subsection offers several guiding principles and approaches for managing uncertainty in the cost-effectiveness analysis of market transformation initiatives.

1. Clearly State and Document Assumptions Necessary for Analysis

As a representation of current conditions and a projection of future conditions, cost-effectiveness analysis is based on a set of assumptions with underlying judgements about many *independent* and *interdependent* factors such as baseline market conditions (e.g., the price and market share of high efficiency goods and services relative to standard less efficient products), the value of avoided resources (e.g., energy generation and delivery, water services), the cost of operating a program over time, and the resulting effects of the program (e.g., product cost, market saturation, institution of new government standards, projected energy savings). These judgements are approximations or best guesses that allow analysis to proceed. Absolute certainty can never be attained in making such assumptions. As a result, the credibility and usefulness of the analysis is enhanced where assumptions are clearly stated and, where possible, documented to reference sources of information.

2. Scenario Analysis Is a Powerful Tool for Identifying, Understanding, and Managing the Effects of Uncertainty

All assumptions are uncertain. Each has some influence on the outcomes of cost-effectiveness analysis. *Scenario analysis* is a powerful tool for identifying, understanding, and laying the groundwork for managing the effects of the most important uncertainties. Scenario analysis answers the question of whether a particular initiative is cost-effective under different possible future states of the world. Whereas sensitivity analysis typically involves selectively (yet independently) varying one or more assumptions, scenario analysis involves simultaneously varying more than one assumption in a logically consistent fashion. For example, a change in natural gas prices might be associated with a change in electricity prices (assuming electricity is generated by burning natural gas).

Scenario analysis aids in identifying the significance of sources of uncertainty. The significance of different sources of uncertainty depends on the sensitivity of outcomes to the influence of various sources of uncertainty. The analysis approach is similar to the evaluation of stock portfolios. One is concerned by both the largest and most volatile elements in the portfolio because they have the greatest potential to influence to overall performance of the portfolio. These elements are

therefore deserving of comparatively greater scrutiny than ones which are smaller in magnitude or less volatile. Thus, scenario analysis can be used to identify the relative importance of variables in the analysis: What is the potential magnitude of benefits? How important are energy savings compared to other program benefits? What is the sensitivity of the analysis to changes in avoided costs or in load shape impacts (e.g., due to climate variations)?

Scenario analysis aids in understanding the sources of uncertainty. Scenario analysis requires articulation of the logical interrelationships among inputs to cost-effectiveness analysis. As in the example above, scenario analysis is based on making internally consistent changes to related inputs: How are product costs related to sales/production volumes? How is total market size related to regional macro-economic conditions?

Perhaps the most important application of scenario analysis lies in using it proactively to lay the groundwork for subsequent efforts to manage uncertainty. In the planning stages of an initiative, identification and understanding key sources of uncertainty can be used to establish critical program goals and objectives. For example, what are the threshold levels of market penetration or product cost reductions necessary to ensure cost-effectiveness? It can also be used to establish critical implementation strategies. For example, what is most important to emphasize in the near, mid, and long term - increasing market penetration?, or lowering product costs? Finally, it can be used in the design and implementation of ongoing initiative monitoring and evaluation activities.

3. Use Cost-Effectiveness Analysis to Guide Ongoing Monitoring and Evaluation of Market Changes and Market Effects

Managing uncertainty proactively requires ongoing program monitoring and evaluation activities. Information collected in real time should be used to monitor progress towards program milestones and to trigger contingency plans when milestones are not met (or have been exceeded). To be meaningful, milestones must be based on readily observable indicators of progress toward program goals and objectives.

Cost-effectiveness analysis is an important precursor to these activities (albeit not the only or necessarily the most important precursor). First, it identifies which issues to track. As discussed above, one of the most important uses of scenario analysis is identification of the most significant influences and sources of uncertainty on the outcomes of cost-effectiveness analysis. Ongoing monitoring and evaluation activities should be organized, in part, to provide information on these issues.

Second, cost-effectiveness analysis provides a basis for determining what exactly should be tracked in order to inform decisions. In some cases, the most important issues to track are difficult to observe directly, such as regional macro-economic trends. Cost-effectiveness analysis requires that these issues be expressed in terms of readily observable market changes (and market

effects)[12], such as volumes of product shipments. In other words, the specificity of and the interrelationships among the inputs to cost-effectiveness analysis (as identified through scenario analysis) provides the blueprint for these ongoing monitoring and tracking activities.

4. Update Cost-Effectiveness Analysis Periodically

The results of ongoing tracking and monitoring activities must be represented in ways that are meaningful to decision making. Here, again, cost-effectiveness analysis provides a useful "bottom line" orientation for organizing and representing this information.

Periodically updating cost-effectiveness analysis to incorporate the latest findings from the field is an important method for tracking progress toward market transformation objectives. Is the initiative on track to achieve projected benefits? Is the initiative still worth funding? Are changes to the initiative necessary?

All critical program assumptions, as identified through scenario analysis, should be reviewed on a frequency consistent with their importance relative to the cost of monitoring. Updating cost-effectiveness annually is generally appropriate, though more frequent updates may be necessary depending on the design of an initiative.

5. Recognize The Limits of Cost-Effectiveness Analysis for Decision Making

This final subsection has focused on methods for managing uncertainty in the conduct of cost-effectiveness analysis. These methods are framed in terms of the analyst's responsibility to represent this information (with its inherent uncertainties) in ways that support better decision making.

In closing, it is of the upmost important to remember that, while cost-effectiveness analysis is an extremely valuable source of and means for organizing information for energy-efficiency decision making, it is not the only source of or means for organizing information. In practice, other factors such as leverage, risk, and equity, among others, may be as *or even more important* than cost-effectiveness analysis in making decisions. It is important not to lose sight of the other factors when incorporating cost-effectiveness analysis into energy-efficiency program decisions.

[12] Market changes refer to all observable changes in the market that occur over time. Market effects refer to those market changes that are the result of market interventions, such as regional market transformation initiatives.

IV. Current and Emerging Practices in Cost-Effectiveness Analysis

This section reviews current and emerging practices in cost-effectiveness analysis in order to establish the foundation or traditions upon which cost-effectiveness analysis for market transformation initiatives rests. The primary focus of this section is to identify the points of connection and departure between current practices and those appropriate for regional market transformation initiatives (as described in section III).

The reviews in this section are organized in three subsections. The first subsection provides a broad overview of current cost-effectiveness analysis practices in the Northeast. The second subsection reviews emerging cost-effectiveness analysis practices in regions where market transformation is also a focus of ratepayer-funded energy-efficiency policies: the Northwest Energy Efficiency Alliance (NEEA) and the California Public Utilities Commission's (CPUC) California Board for Energy Efficiency (CBEE). The third subsection provides additional information on selected technical aspects of current cost-effectiveness analysis practices, such as treatment of free riders and spillover, estimation of avoided electricity costs, inclusion of environmental and non-energy benefits, treatment of customer costs and treatment of performance incentives paid to the administrators.

A. Current Cost-Effectiveness Analysis Practices in the Northeast

The policy framework for assessing the cost-effectiveness of ratepayer-funded energy efficiency programs was initially developed in the context of utility least cost planning with the intent to defer more costly energy supply additions. In this context, Northeast regulators generally adopted three tests or perspectives for assessing the cost-effectiveness of energy efficiency programs. The Total Resource Cost, the Societal, and the Utility Cost tests have been three primary benefit/cost perspectives examined for ratepayer-funded energy-efficiency programs. Not surprisingly, the importance placed upon any one test in making decisions varies considerably among the jurisdictions. The major benefit and cost elements included in each of these perspectives are summarized in Table 1.

With the focus of current regulatory policy on utility restructuring - which is proceeding at different paces with different results across the region - the development of a policy framework for the cost-effectiveness analysis of regional market transformation strategies to address broader public benefits has not been specifically considered by any of the Northeast states. It is early still in the process, and the regulatory agenda has been full. Nonetheless, policymakers in at least two states - Massachusetts and New Jersey - have indicated that they will turn their attention in the next year to the issue of cost-effectiveness analysis for energy efficiency in a restructured utility environment.

Table 3. Comparison of Total Resource Cost, Societal, and Utility Cost Benefit/Cost Perspectives

	Total Resource Cost	Societal	Utility Cost
Benefits			
Avoided Energy Generation, Transmission, and Distribution Costs (related to the services offered by the distribution company)	X	X	X
Environmental Benefits		X	
Other Avoided Resource Benefits	other fuels, only	X	
Other Non-Energy Benefits		X	
Costs			
Incremental Customer Costs	X	X	
Program and Administrative Costs (including evaluation costs)	X	X	X
Performance Incentives	X	X	X

The Total Resource Cost (TRC) perspective embodies the least-cost utility resource planning framework, which has been at the center of utility energy-efficiency program developments since at least the mid-1980's. This perspective assesses the net impact of a program on the direct economic cost of the end-use service that is provided through energy-efficiency measures or practices in lieu of providing this service through increased energy use. Under this perspective, benefits consist of the energy generation, transmission, and distribution (and, if applicable, other fuel) costs that are avoided by the energy-efficiency program. Costs consist of the incremental cost of the energy-efficiency measures or practices promoted by a program (regardless of whether these costs are paid by the utility or program participant), along with all other utility costs associated with designing, implementing, evaluating, and, if applicable, performance incentives paid to the utility for operating a program.[13]

The Societal perspective can be viewed as an enhancement of the TRC perspective because it includes a wider range of benefits and costs than is captured by the TRC perspective. This perspective assesses the net impact of a program on overall societal welfare. For this reason, the

[13] The final subsection (IV.C) discusses differences in the scope of and methods used for estimating these benefits, as well as some of the issues that arise in defining these costs.

Societal perspective is sometimes used in place of the TRC in making public-policy decisions for energy-efficiency programs. The inclusion of environmental benefits in some fashion is the most notable departure from the TRC. The Societal perspective also more explicitly considers other non-energy benefits (and costs). As discussed in section III, the Societal perspective is especially well-suited for assessing the cost-effectiveness of market transformation initiatives.

The Utility Cost (UC) perspective considers benefits and costs from the standpoint of the utility company acting on behalf of its ratepayers. The UC perspective assesses the net impact of a program on utility revenue requirements. Benefits include the electric (and/or gas) system costs (generation, transmission, and distribution) that are avoided by a program. Costs include just those costs incurred by the program administrator (e.g., the utility) in designing, implementing and evaluating a program. If applicable, costs also include performance incentives paid to the program administrator for operating the program. This perspective also forms the basis for one of the cost-effectiveness perspectives used to analyze market transformation initiatives (i.e., the Distribution Utility perspective).

The results of cost-effectiveness analysis from the three perspectives can be represented in two ways: First, they can be expressed as a ratio of benefits over costs (i.e., a benefit/cost or B/C ratio). A ratio greater than one indicates that a program is cost-effective. Second, they can be expressed as the difference between benefits and costs or net value. A net value greater than zero indicates that a program is cost-effective.

Both forms of expression provide useful information. A B/C ratio is an indicator of leverage; it expresses the "productivity" or "multiplier-effect" of program costs with respect to program benefits. Net value is an absolute measure of worth; it expresses the "bottom line" or overall value of a program.

B. Emerging Cost-Effectiveness Analysis Practices in the Northwest and California

Market transformation is an important element of energy-efficiency program activities in the Northwest and in California. This subsection briefly reviews these activities with an emphasis on the similarities and differences between emerging cost-effectiveness analysis practices in these regions and those recommended in section III.

1. Northwest Energy Efficiency Alliance

In its Comprehensive Review of Northwest Energy Systems, the Northwest Power Planning Council (NWPPC) made several key recommendations regarding administration and implementation of energy efficiency as part of a systems benefit charge. The NWPPC recommended that the four states spend about 3% of revenues on public benefit programs (i.e., energy efficiency, renewables, and renewables-oriented R&D), plus funding to maintain low-income services. For energy efficiency, the NWPPC suggested that about 70% to 75% of the

funds be targeted towards local efforts administered by local utilities, subject to regulatory oversight, and that a nonprofit organization be created to focus on regional market transformation activities.

In 1996, the Northwest Energy Efficiency Alliance (NEEA) was created as a nonprofit corporation governed by an 18-member Board of Directors, which is composed of representatives from investor-owned utilities, Bonneville Power Administration, publicly owned utilities, and public representatives. The Board of Directors is responsible for selecting and approving funding for market transformation projects, reviewing and evaluating results, and providing guidance to staff. With a budget of $65.5 million over three years (1997-1999), NEEA has issued several broad-based solicitations for innovative market transformation proposals.[14]

NEEA's cost-effectiveness analysis draws from years of work conducting these analyses for the Northwest Power Planning Council. NEEA formally screens all proposed market transformation activities for cost-effectiveness using three perspectives: total resource cost, electric utility, and participant (simple payback based on retail rates). The TRC includes savings from all affected energy sources (i.e., both electricity and gas), as well as other non-energy benefits such as water and sewage treatment savings. NEEA does not use a societal test, although it does calculate cost-effectiveness from this perspective for informational purposes. In particular, NEEA does not include environmental externality adders in its analysis. Evaluation is included as a cost associated with specific programs.

Many aspects of NEEA's cost-effectiveness analysis activities share important similarities with those recommended from regional market transformation initiatives (in section III):

- The geographic scope of NEEA's activities is regional, consistent with a long history of regional coordination on energy-efficiency activities through the Northwest Power Planning Council.

- NEEA adopts a multi-year analysis horizon for cost-effectiveness analysis. Programs are generally not expected to be cost-effective in the first year or two due to high start-up costs, but are expected to be cost-effective over a longer time period. Programs are evaluated both over the expected duration of program-sponsored activities (1-5 years) as well as over a longer period (3-10 years) to capture effects that occur "outside" (but still as a result of) these activities after they have ended.

- NEEA relies on a participant-based analysis framework. Efforts are made to capture spillover effects. Treatment of free riders varies. In some programs, efforts are made to screen free riders from the analysis.

[14] See http://www.neea.org.

- NEEA also conducts sensitivity analysis to identify critical program inputs to cost-effectiveness analysis, such as what level of market penetration is needed to make a program cost-effective.

2. California Board for Energy Efficiency

With the passage of electricity restructuring legislation (AB1890), the California Legislature determined that funding for four public-purpose activities would remain an important obligation appropriate for continuing ratepayer support. The Legislature authorized investor-owned utility distribution companies to collect about $1.8 billion to fund energy efficiency, California-based renewable energy resources, public interest RD&D to advance science and technology not adequately provided by competitive and regulated markets, and low-income services between 1998 and 2001 as part of the broader restructuring of the California electricity industry.

In order to implement the Legislature's goals for energy efficiency, the CPUC created a nine-member independent advisory board (called the California Board for Energy Efficiency or CBEE), charged with developing and overseeing a competitive process to select program administrators to manage the delivery of energy-efficiency programs and services. The CBEE was also given the responsibility for recommending changes to existing policy guidelines and program rules in order to carry out the CPUC's objectives of market transformation.

The CBEE recommendations for changes to the CPUC's existing DSM policies were adopted by the CPUC in mid-1998. Among other things, the new policy rules include a requirement that all programs must be cost-effective on a prospective and ongoing basis. The policy rules refer to and describe modifications to the Societal perspective for this purpose.

As of mid-1998, the CPUC's new policy rules have yet to be applied. Early in 1998, the CBEE's Technical Services Consultants prepared draft guidelines for implementation of the cost-effectiveness requirements in the new policy rules.[15] These guidelines have not been finalized, endorsed by the CBEE, or formally recognized by the CPUC. Nevertheless, they provide important insight on the directions under consideration for cost-effectiveness analysis.

Several of the directions (in addition to reliance on a Societal perspective) proposed in the draft implementation guidelines are consistent with those proposed in this report:

- Multi-year analysis is accepted as a way of capturing the full set of costs and benefits associated with an integrated set of activities that lasts more than one year and has effects that are expected to last after formal program activities have ceased.

- Programs are being implemented statewide, which for a state the size of California is often consistent with the size of the markets the programs seek to influence. Coordination with

[15] See http://www.cbee.org.

other regional entities is in progress. Reliance on statewide estimates for avoided electricity generation costs is proposed. In addition, out-of-state benefits and costs may be considered in the analysis.

C No recommendations have been proposed on the use of market penetration modeling, but none preclude reliance on this approach. To date, attention has been focused only on ensuring that whatever analysis approach is taken it is one that captures the incremental impact of the programs on the market.

C There is explicit recognition of the role of market effects in providing the appropriate basis for ongoing monitoring and evaluation activities to measure progress toward market transformation objectives.

C Finally, the guidelines deal extensively with treatment of uncertainty, including a recognition of the role of scenario analysis in identifying important sources of uncertainty and initiating strategies for managing uncertainty.

C. Technical Issues for Cost-Effectiveness Analysis

Practices vary in the Northeast region for estimating benefits and costs for inclusion in assessing cost-effectiveness from these various perspectives. This subsection reviews selected aspects of these practices which have special relevance for regional market transformation initiatives. These include: (1) treatment of free riders and spillover; (2) estimation of avoided energy costs; (3) inclusion of environmental and non-energy benefits; (4) treatment of customer costs; and, briefly, (5) treatment of performance incentives paid to the utility.

1. Determining Program Net Impacts: Treatment of Free Riders and Spillover

Treatment of free riders and spillover highlights the tension between first principles and practical necessity in cost-effectiveness analysis. Current practices have sharpened understanding of the principles involved, but some of the practical implications of these principles remain untreated. Free riders are recipients of energy-efficiency program services that would have engaged in the activities promoted by a program in the absence of the program. Spillover effects are energy-efficiency activities that take place “outside” a program and would not have occurred but for the program.

In principle (e.g., in the California Standard Practice Manual), the benefits and costs associated with spillover are included and those associated with free riders are not included in both the TRC or Societal perspectives. Both perspectives are intended to capture the net impacts of energy-efficiency programs. By definition, free riders do not contribute to net impacts; usually they are not included in the TRC and Societal perspective. Utility payments to free riders are usually considered transfers between utility ratepayers and the free riders; society is no better nor worse

off. For this reason, the utility costs associated with free riders are included in the Utility Cost perspective. Spillover represents a net increase in benefits for all three perspectives, but only increases costs in the TRC and Societal perspectives.

In practice, there are significant measurement costs (and to some extent theoretical issues) associated with implementing these principles consistently. Substantial evaluation efforts have been devoted to estimating program energy savings attributable to free riders, and more recently to spillover. However, evaluations of free riders have typically been limited to those free riders who would have adopted reasonably contemporaneously with a program offering (i.e., for a particular program year). Treatment of dynamic free riders - those whose decision to adopt was accelerated by the program offering - has been inconsistent in utility evaluation studies of free ridership. Similarly, spillover estimation methods are also in their infancy; there have been few systematic attempts to incorporate spillover into cost-effectiveness analysis. In particular, little work has been done to forecast (let alone verify) the long-run effects of spillover, which may be especially significant for market transformation initiatives. A final practical limitation has been that evaluation methods have tended to address only the benefits-side of the equation. Little attention has been paid to evaluating the net costs associated with free riders and spillover and to ensuring that these costs are treated consistently with energy savings.

Market transformation initiatives share the basic programmatic concern, which underlies current treatments of free riders and spillover, that knowledge of the net impacts of energy-efficiency programs is of the upmost importance. Section III describes methods for addressing these concerns in market transformation initiatives that stem naturally from the market-based analysis orientation recommended for cost-effectiveness analysis of these initiatives. These methods include articulation of explicit program baselines and adoption of multi-year planning horizons. Adoption of the recommendation to focus on market penetration as the unit of analysis, in fact, makes more transparent some of issues associated with identifying the net impacts of market transformation initiatives (although, important analytical challenges remain).

2. Estimating Avoided Energy Costs in a Restructured Electricity and Gas Industry

Administratively-determined avoided electricity and gas costs traditionally have been the primary measures of value for energy-efficiency programs. Restructuring eliminates the need for some of these calculations and introduces new complexities into others. Recent practices, which have begun to address these complexities, provide important guidance for cost-effectiveness analysis for market transformation initiatives. Avoided electricity generation and gas costs are discussed separately from avoided electricity transmission and distribution costs.

The introduction of wholesale competition into the electricity and gas sector has fundamentally changed the basis for utility resource planning. In place of utility-planned options for construction of new electricity generation, a market for electricity generation has been created. These electricity and gas markets, not utility rate departments and regulators, determine the price of

electricity and gas. As such, it is this market, not cost-of-service studies, that establishes the value of energy avoided by energy-efficiency programs.

Changing the reference point for establishing the value of electricity and gas from a single utility to the as-yet-undefined "market" adds substantial complexity to the estimation of avoided electricity and gas commodity costs. In addition to the need to now address basic conceptual issues such as the geographic scope of the market and its evolution over time, there are also significant practical questions regarding the availability of information to support long-run estimates of future electricity and gas commodity prices.

Stakeholders in Massachusetts have begun grappling with these issues in ways that we believe are consistent with the needs of cost-effectiveness analysis for market transformation initiatives. First there is agreement that the New England Power Pool now represents the relevant geographic scope for the electricity generation market. Second, there is also agreement that an average of several different forecasts of pool prices is appropriate for the use in energy-efficiency program planning. These estimates have been expressly agreed to solely for the purposes of energy-efficiency program planning. There is an understanding that estimates of long-run pool prices for energy-efficiency planning purposes need not have any implications for other purposes (e.g., stranded cost recovery). Underlying this understanding is the recognition that, since overall program budgets have been set by relying on other considerations, the specific use of these estimates in cost-effectiveness analysis lies solely in comparing programs against one another in order to evaluate proposals for allocating resources among them within a single utility's portfolio.

Under most future scenarios of a restructured electricity industry, the transmission and distribution (T&D) sectors of the industry continue to be rate-regulated as natural monopolies operated in the public interest. Least-cost planning is expected to remain as the appropriate organizing principle for T&D resource planning and operation. Administratively-determined marginal costs for T&D will continue to play an important role in resource planning and rate design. A variety of methods are used by different states and utilities to estimate these costs.

Section III recommends methods for estimating avoided electricity costs for market transformation initiatives that draw directly from these emerging practices.

3. Inclusion of Environmental and Non-Energy Benefits in the Societal Perspective

The Societal perspective differs from the TRC perspective primarily in its recognition of the appropriateness of including both environmental and non-energy benefits (and costs) in analyzing the cost-effectiveness of energy-efficiency programs. There is general acceptance of the principle that there are important environmental consequences of electricity generation that are currently not wholly captured in the market prices for electricity. Similarly, there is also wide-spread recognition that customers purchase and other market participants offer energy-efficient products and services only to the extent that they perceive value in doing so. The value they perceive is

influenced by a host of considerations, many of which have nothing to do with the economic value of energy savings (e.g., improved utility, convenience, comfort or aesthetic considerations). Finally, energy-efficiency programs have important consequences for broader regional economic and energy security issues.

Preferences for the TRC perspective over the Societal perspective in conducting cost-effectiveness analysis sometimes hinges on a practical consideration: It may be difficult or, in view of the uncertainties involved in estimation, not particularly meaningful to try to incorporate environmental externalities and non-energy considerations individually into cost-effectiveness analysis.[16] Opponents of this practice argue that exclusion of these quantities is equivalent to assuming that they have a value of zero, which they submit is certainly incorrect.

A practical compromise is stipulation to a non-zero adder that serves as a proxy for quantities whose measurement may be difficult, controversial or imprecise. As practices in Massachusetts and New Jersey make clear, there is general agreement that a stipulated adder should not be confused with a stipulated value for these quantities. Yet, as with reliance on an average of forecasts of pool prices, there is also general agreement that a stipulated adder represents a pragmatic basis upon which to proceed in conducting cost-effectiveness analysis. That is, stakeholders accept that the alternative - time-consuming (and probably still controversial) studies - while perhaps more theoretically sound, is simply not consistent with the need to make decisions in a timely fashion. Stipulating to the use of an adder represents a practical compromise that, most important of all, allows analysis to proceed.

Section III draws upon this practical experience in describing the importance of and methods for capturing both environmental and non-energy impacts in cost-effectiveness analysis for market transformation initiatives.

4. Appropriate Treatment of Customer Costs Depends on the Baseline

Analytical treatment of cost-effectiveness elements on the cost-side of the equation has received less attention than those on the benefit-side. Treatment of customer cost is one such area because appropriate treatment of these costs depends on the baseline assumed in the analysis. Confusion arises when the baseline for customer costs is not made explicit.

The principle for inclusion of customer costs in cost-effectiveness analysis is straightforward: All incremental costs associated with the acquisition, installation, and operation of an energy-efficiency product or service should be included. If, for example, the baseline condition is that the customer already planned to replace an energy-using device (i.e., planned replacement), then the incremental costs would are only those associated with the additional capital cost of the more energy-efficient device compared to the device that would have been purchased in the absence of

[16] There are also important ideological reasons for preferring the TRC perspective over the Societal perspective, as described earlier in this section.

the program. If, however, the baseline condition is that the customer had not planned to install a new device and the program induces the customer to make this installation now (i.e., pure retrofit), then the entire cost of the installation should be included in the cost-effectiveness analysis (less any salvage value from removal of the existing equipment).

While these distinctions appear to be straightforward, they are often difficult to make in practice. For example, as discussed earlier in the context of dynamic free riders, energy-efficiency programs may simply accelerate the timing of decisions to replace or upgrade equipment with newer, more energy-efficient equipment. Elements of both planned replacement and pure retrofit are present in this case and allocating costs between them is challenging.

Section III recommends a consistent approach for estimating customer costs as well as energy savings that relies on formal development of a program baseline. While the issues of causality or attribution remain important analytical challenges, explicit articulation of a program baseline clarifies exactly what assumptions are being made and, therefore, provides a basis for ongoing monitoring and analysis to determine the accuracy of these assumptions.

5. Treatment of Performance Incentives as a Cost to Society

Performance incentives paid to program administrators (e.g., utilities) for successful implementation of energy-efficiency programs has been an important regulatory tool for stimulating utility interest in effectively implementing these programs. Payment of these incentives increases utility revenue requirements and so inclusion of these incentives in the UC perspective is not controversial. Some debate exists, however, over the appropriateness of including these incentives in the TRC and Societal perspectives.

Some believe incentives paid to utilities are a transfer payment between ratepayers and utility shareholders. Others believe they are a net cost to society. If they are a transfer payment, they should not be included in the TRC and Societal perspective. If they are a net cost, they should be included.

Resolution of these differing views is clear in principle, but difficult in practice. In principle, whether or not an incentive payment is a transfer payment or a net cost to society depends on whether the payments are consistent with a normal management fee that would be paid to an organization for running a program. Management fees are a net cost to society. However, it is appropriate to view incentives payments as management fees paid to the utility only to the extent one would have to pay another entity these fees in order to have the programs run. Incentive payments in excess of what would be considered a normal management fee are transfer payments. In practice, however, there has been little experience estimating "normal" management fees for the administration of energy-efficiency programs.

For market transformation initiatives, this issue only arises in situations in which program administrator compensation is linked in some fashion to objective measures of the administrators performance in conducting energy-efficiency programs.

V. Summary and Conclusions

Regional market transformation initiatives for energy efficiency recently have received regulatory support in Northeast states. NEEP was organized to develop and coordinate such initiatives across jurisdictions. Cost-effectiveness analysis is an important tool for policymakers and program planners in designing and choosing among these and other ratepayer-funded energy efficiency programs. Given the long-term goals and objectives, and the regional nature of market transformation initiatives to create lasting changes in the marketplace (i.e., to establish high efficiency products as a competitive, standard product offering), it is useful to conduct a regional cost-effectiveness analysis that reflects these special attributes. Such an analysis considers from multiple perspectives the costs and benefits of a strategy over a multi-year, regional framework tied to the intended market effects relative to a market absent the program. In this context, the potential for societal benefits - including non-energy benefits - is an important threshold for policy support.

Over the next several months, regulators and other policymakers in the Northeast region will address the requirements for cost-effectiveness analysis for ratepayer-funded energy efficiency programs in the context of a post-restructured utility industry. As they do so, it is hoped that the concepts and recommendations herein will assist the development of an improved and common understanding across jurisdictions of an analytic framework for cost-effectiveness that is appropriate to the intended goals and objectives of regional market transformation initiatives.

VI. Discussion of Comments on the Draft Report

A draft of this report was prepared for presentation at a NEEP workshop held in September 1998. Comments on the draft were offered both during the presentation and in written comments submitted following the workshop.

For the most part, the comments on the draft and its presentation were very positive. There is broad acceptance of the continuing importance of cost-effectiveness analysis for regional market transformation initiatives in a restructured electricity industry. There is also general acknowledgment that new analytical challenges must be addressed in order to conduct comprehensive cost-effectiveness analyses of these initiatives in this new industry. In this regard, the recommended enhancements to traditional approaches for analyzing cost effectiveness are recognized as valuable enhancements to traditional approaches.

Specific comments addressed issues both within and external to the scope of the report; where appropriate, they have been incorporated into the final report. With no exception, these comments sought to highlight or further amplify (rather than contradict) aspects of the draft. The two most important of these, which bear repeating, are summarized below:

1. Cost-effectiveness analysis is an important tool for energy-efficiency program decision making. However, there are many other legitimate considerations that also should be included in making these decisions. In some cases and for some decisions, these other consideration (such as risk, leverage, and opportunity) will be as or even more important than cost-effectiveness analysis.

2. The recommendation to shift the unit of analysis from the traditional focus on participants to a focus on market adoption represents an elegant approach for by-passing the significant analytical challenges associated with estimating free riders and spillover. However, the proposed alternative (in particular, the need to develop a no-program baseline from which to estimate net program effects) also presents important analytical challenges.