Cost-Effectiveness - Implication for Bonneville and Utility Programs

Background

The Council's 5th Plan conservation targets are comprised of measures that were found to be cost effective if the electric system paid all the costs. Council plan conservation targets are based on availability of conservation that passes this Total Resource Cost (TRC) test. Since its first Plan the Council has interpreted the Act definition of cost-effectiveness as requiring comparison of the economics of alternative resources considering all costs and benefits to determine cost-effectiveness of conservation compared to generating resources. Bonneville has indicated that in its Post 2006 conservation programs it will not provide funding for measures that were not identified as cost-effective in the Council's 5th Plan. This policy is consistent with the Act, the Council plan and with regional utility conservation efforts over the last 20 years. This policy does not however, limit utility investments in conservation or other resources that the Council did not find to be cost-effective.

The practical impact of Bonneville's proposed application of cost-effectiveness for conservation programs is to limit the scope of the conservation measures that can be installed under Bonneville's Conservation and Renewable Resources Rate Discount Program (C&RD). The original purpose of the C&RD program was to encourage utilities to "re-engage" conservation efforts that had lapsed or to maintain their conservation infrastructure. As part of the effort to establish the rate discount program in 2001-2006, Bonneville did not require that measures installed through C&RD be cost-effective. The proposal to fund only cost-effective conservation eliminates some of the measures that many utilities had been installing under the original C&RD program. As a result, there has been significant utility resistance to implementing this "cost-effectiveness" limit. Some utilities are also concerned that by restricting the list of measures that are eligible for rate discount credits they will not be able to acquire sufficient savings in their service territories to obtain all of the rate credits they are eligible for and thus end up paying Bonneville more money.

In order to continue to secure savings from measures that do not pass the Council's cost-effectiveness screen, some utilities are asserting that Bonneville and the Council's should adopt an alternative to the Total Resource Cost definition of cost-effectiveness used by the Council. These utilities assert that the Total Resource Cost definition is too broad because it counts "all costs and benefits" not just those paid for or received by the power system. They argue that a conservation measure's cost-effectiveness should be based on a "Utility Cost Test" (UCT). That is, only those costs paid by utility rate revenues and only those benefits the power system receives in the form of electricity savings should be considered in the analysis. Using the UCT, a measure is cost-effective if the present value of the administrative cost and financial incentives paid by utilities are less than present value of the avoided cost of alternative electricity resources avoided by the measure.

The remainder of this memo discusses some of the major issues and implications associated with altering the Council's approach to determining the cost-effectiveness of conservation savings. Accompany this memo are several reference documents. Attachment A is a paper that provides an overview of the five major approaches that have been used to determine the cost-effectiveness of conservation investments across the country. Attachment B is a summary of the Northwest and California state utility regulatory commission and legislative policies regarding the issue of how to determine cost-effectiveness of conservation resources. Attachment C contains statutes and regulatory commission orders on conservation cost effectiveness in the four Northwest states and in California.

The Council's Interpretation of the Act's Definitions

The Act defines "cost-effective" as follows:

"Cost-effective", when applied to any measure or resource referred to in this chapter, means that such measure or resource must be forecast--

> *to be reliable and available within the time it is needed,*[1] *and*
> *to meet or reduce the electric power demand, as determined by the Council or the Administrator, as appropriate, of the consumers of the customers at an estimated* <u>*incremental system cost*</u> *(emphasis added) no greater than that of the least-cost similarly reliable and available alternative measure or resource, or any combination thereof.* [2]

The Act provides further guidance on what "cost" should be considered in the cost-effectiveness determination process by defining "system cost" as follows:

For purposes of this paragraph, the term "system cost" means an estimate of <u>*all direct costs*</u> *(emphasis added) of a measure or resource over its effective life, including, if applicable, the cost of distribution and transmission to the consumer and, among other factors, waste disposal costs, end-of-cycle costs, and fuel costs (including projected increases), and such quantifiable environmental costs and benefits as the Administrator determines, on the basis of a methodology developed by the Council as part of the plan, or in the absence of the plan by the Administrator, are directly attributable to such measure or resource.*[3]

During the development of its first Plan, the Council interpreted the Act's requirement that "all direct cost" be considered when determining resource cost-effectiveness.[4] The Council concluded that this provision of the Act meant that the *total cost* of conservation measures must be used in its evaluation, regardless of whether all or only a fraction of those cost were borne by the power system. The region's utilities strongly endorsed this interpretation because they argued that failure to consider the share of conservation costs paid for by their customers would systematically underestimate the true cost of energy savings when compared to other similarly available and reliable resource alternatives. Using TRC to estimate conservation costs and savings potential also avoids double-counting savings, avoids promoting measures that may impose non-electricity costs on others and allows consideration of measures with quantifiable non-electricity benefits. Each of these attributes is discussed below. All succeeding Council Plans, including the recently adopted 5th Plan have employed this same interpretation.

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[1] Northwest Power Act, §3(4)(A)(i), 94 Stat. 2698.
[2] Northwest Power Act, §3(4)(A)(ii), 94 Stat. 2698.

[3] Northwest Power Act, §3(4)(B), 94 Stat. 2698-9.

[4] Northwest Power Planning Council, <u>1983 Northwest Conservation and Electric Power Plan</u>, Volume 1, Chapter 7, p 7-1.

Total Resource Cost versus Utility Cost-- Why Not Consider Only What Utilities Pay for Savings?

Setting aside the Act's provisions, are there other reasons for including only utility system costs (and benefits) in the Council's determination of "cost-effectiveness?" The "Total Resource Cost" test is designed to ascertain whether an investment is economically justified when all of its costs and benefits are included. However, since the power system does not pay all of these costs, nor does it accrue any of the non-electricity benefits, why should the utilities account for them when determining whether a measure produces cost-effective saving? Why not just consider the utility costs and the utility benefits? There are several reasons considering Total Resource Cost perspective avoids undesirable results of using only a Utility Cost perspective. Specifically, the TRC perspective:

1) Avoids double-counting savings;
2) Directs investment toward measures that optimize investment for the utility and the customers;
3) Avoids promoting measures that may impose non-electricity costs on others;
4) Allows consideration of measures with quantifiable non-electricity benefits; and
5) Reduces likelihood of overestimating cost-effective conservation potential

First, by ignoring the share of the cost paid by program participants, we create the possibility that the region will pay twice for the same savings. For example, assume that an industrial customer is considering whether to install a more efficient electric motor costing $5000 and that saves 5000 kWh per year. The local utility determines that the maximum incentive it can offer and still be cost-effective is $2500 towards the cost of the more efficient electric motor. The industrial customer, after determining that reducing its power bill by 5000 kWh per year will save $2500 agrees to buy and install the more efficient motor and claims the utility rebate of $2500. Both the utility and the customer each believe they made an economic investment (i.e., saving 5000 kWh per year for just $2500). However, "the region" spent $5000 to save 5000 kWh per year. Since the region's consumers have a limited amount of money, the less money they spend on electric energy services the more they can afford to invest in other goods and services that may be of higher value to them or to the region. By ignoring what participating consumer's spend to procure savings the region runs the real risk of over-allocating money to the purchasing electric energy services.

Second, use of the TRC test ensures that the funds collected from all customers are invested in actions that reduce the long-run cost for all customers[5]. Whereas, use of the Utility Cost Test can lead to one group of customers "subsidizing" another group's investments in measures that do not benefit all as much customers in the long run. In addition, using Utility Cost can lead to allocating utility funds to purchase savings from measures that displace those in the Council's plan that are cost-effective using Total Resource Cost. This displacement leaves less funding to accomplish the Plan's conservation targets. During times of budget limitations and rate pressures this displacement is a less valuable outcome for society. Plus, if utility costs for the chosen measure are higher than utility costs for the measure displaced, the utility and its ratepayers are also worse off.

In order to acquire conservation savings, a utility collects funds from all of its customers and distributes these funds (in the form of rebates, low interest loans, or other financial incentives) to those customers who participate in their conservation programs. For example, a utility might collect

[5]These investments also are designed to reduce long-term risks as well.

$600 to pay towards the cost of installing a solar photovoltaic (PV) system that produces 1200 kilowatt-hours a year in savings. The levelized cost to the utility (UCT) of these savings is about 3.4 cents/kWh. From the utility's perspective these savings appear to be cost-effective.[6] However, by spending this $600 on a PV system the utility cannot allocate these funds to the purchase of less expensive savings. The same $600 incentive it is offering for the solar PV system could have purchased 150 CFLs to produce nearly 5,000 kilowatt-hours a year in savings. The utility would have secured four times the savings for the same investment by other ratepayers. Unless utility payments for savings from measures that do not pass the TRC test are limited to less than the difference between current retail rates and the marginal cost of new electricity supplies, some consumers will be charged more for savings that do not reduce their long term costs.[7]

A third aspect of the Total resource Cost test is that it avoids promoting measures that may impose non-electricity costs on others. The Utility Cost perspective ignores costs to others. Funding measures that ignore others' costs can lead to bad outcomes for society. For example, installing wood stoves was at one time, in the 1980s, considered a potential renewable resource that could save electricity. But the cost of air pollution from wood burning stoves was soon recognized as highly undesirable, despite the fact that electric system costs were lower.

Fourth, in practice, using Total Resource cost allows consideration of measures with quantifiable non-electricity benefits, expanding the list of qualifying measures. Non-electricity benefits figure prominently both in developing conservation estimates and in designing conservation programs. On net, more conservation savings are added to the list of cost-effective measures than removed by the consideration of quantifiable non-electricity costs and benefits. This is primarily because resource potential estimates actively seek measures that save electricity and provide non-electricity benefits. Measures with significant non-electricity benefits include clotheswashers and dishwashers with water, sewer, and detergent savings, and lighting with reduced lamp replacements due to the longer life of efficient models. Program operators take advantage of large non-electricity benefits to reduce electric system costs by getting end-use customers to contribute more to measure installation.

Fifth, if the Council were to use Utility Cost to establish the Plan's conservation targets, these targets would be significantly higher. If the Council were to consider only that share of the cost of conservation that was paid for out utility revenues, then many more measures would become "cost-effective." Historically, utilities have typically paid less than 70 percent of the total cost of conservation measures and in many cases they have paid less than 50% of these costs. Using 70 percent "cost-sharing" would increase the target by approximately 20% or from 700 to 840 average megawatts over the period from 2005 through 2009. The drawback of using "utility cost" for determining cost-effectiveness is that it is impossible to forecast exactly what share of each measure's cost will be borne by the utility system over the course of the Plan. In many cases, utilities may pay higher fraction of a measure's cost in the near term and less over time, particularly if the measure is adopted into state code or federal standards. In other cases, they may find it necessary to pay a higher fraction of a measure's cost in order to achieve higher market penetration over time.

[6] However, from a total resource cost (TRC) this PV system's levelized cost of approximately 35 cents/kWh is far from cost-effective.

[7] The Rate Impact Measure test (RIM) is designed to limit investments in conservation to those measures that do not increase the rates of consumers who do not directly participate in a program. This is done by constraining investments to the difference between the marginal cost of electricity and current retail rates. The RIM test's primary disadvantage is that when retail rates exceed current marginal prices no conservation investments pass this test, even those that can be shown to decrease long-term costs and risks.

Usefulness of the Utility Cost Test

The arguments for using Total Resource Cost do not mean that the Utility Cost perspective is not important or useful. First, Utility Cost is a direct indicator of the value of a conservation effort to the utility system. The lower the cost the better provided overall conservation targets are met. Second, the Utility Cost test is used by most regulatory commissions as an upper limit for utility incentives for cost-effective measures with high non-electricity benefits. For example, a measure like efficient clotheswashers passes the Total Resource Cost test in large part because of significant quantifiable non-electricity benefits in water, sewer and detergent savings. But these non-electricity benefits do not flow to the electricity system. In cases were non-electricity benefits are significant, utility incentives payments are typically limited to no more than the electricity system energy and capacity benefits.

Program Implementation Issues Can Be Addressed Without Altering the Definition of Regional Cost-effectiveness

The staff has identified four issues that have been raised by some utilities that are behind their request to consider an alternative definition of "cost-effectiveness." These are:

1. *Application of Cost-Effectiveness Eliminates Measures Needed to Meet Targets* - Eliminating non-cost-effective measures, which are currently allowed, increases the risk that Bonneville will fail to reach its conservation goal as well as increases the risk that an individual utility will not be able to claim its entire rate credit.
2. *Application of Cost-Effectiveness is Too Specific* - Programmatically, trying to exclude specific applications of measures that are not cost-effective when other very similar applications are cost-effective may result in higher program administration cost as well as consumer confusion.
3. *Application of Cost-Effectiveness is Too General* - The cost-effectiveness of measures in the 5th Plan are based on sub-regional averages, due to local conditions (climate, prices) some measures may be cost-effective in specific utility service territories but they are not identified as such in the plan.
4. *Application of Cost-Effectiveness Ignores Consumer Non-electricity Benefits* - The customer's "willingness-to-pay" for what appears to be a non-cost-effective measure implies that there is a non-electricity benefit not being captured in the Council's Total Resource Cost test. Furthermore, it does not take marketing advantage of customer willingness to pay for non-electricity benefits that are not quantified.

Staff believes that there are solutions to these problems that do not require the use of an alternative definition of cost-effectiveness. Bonneville has set forth a process for working through these and other issues during the development of its fiscal 2007 - 2009 conservation program designs. While staff believes that these issues are best resolved during that process, possible options for addressing these issues are set forth below.

Issue 1 - *Application of Cost-Effectiveness Eliminates Measures Needed to Meet Targets*. Utilities are concerned that there may not be enough cost-effective conservation measures in their service territories to qualify recoup the full value of their rate discount. There are at least two possible solutions to this problem. First, since the targets are based on regional conditions such as the mix between residential, commercial, industrial and irrigation sector loads, it is quite possible that individual utilities do not have an equal share of the remaining conservation potential in their service territory. Therefore, arrangement should be permitted to allow groups of utilities to "pool" their program activity, such as is permitted under Bonneville's current C&RD program rules. Alternatively, a "trading system" could be established that permits utilities with less potential to "market" their C&RD credits to other utilities with greater opportunities.

In addition to permitting pooling and/or trading, Bonneville plans work with individual utilities to assist them in identifying the conservation opportunities that they do have in their service territory. Bonneville also plans to develop a menu of program designs to aid utilities capture savings from markets (e.g. lighting in small commercial buildings) which have had limited program offerings to date.

In addition to these solutions we note that Bonneville is proposing that the rate discount will target somewhat less than half of its conservation target. That remainder will come from utility and third party contracts or Bonneville programs.

Issue 2 - *Application of Cost-Effectiveness is Too Specific.* This issue can be best illustrated by a measure such as the conversion of a home with a forced air furnace to a new high efficiency heat pump combined with sealing of the homes duct system to reduce leaks. In homes where much if the duct system is inside (e.g., in the basement) sealing the ducts does not produce energy savings. On the other hand, in homes where the duct system is mostly outside (e.g. in a crawlspace) sealing the ducts can produce significant savings. Based on the analysis in the 5th Plan, it is cost-effective to convert the home with crawlspace to a high efficiency heat pump when the furnace needs replacement, but it is not cost-effective to do so if the home has a basement. While it is possible that this could present difficulty in the marketing of this measure to consumers, staff believes that consumers are already presented with "eligibility" requirements for many utility offers (e.g., electric heat, minimum existing insulation levels). Therefore, conditioning of an offer on the basis of whether a home's ductwork is inside or outside should not be viewed as overtly confusing.

Issue 3 - *Application of Cost-Effectiveness is Too General.* This issue can also be best illustrated by a measure such as the conversion of a home with a forced air furnace to a new high efficiency heat pump. The 5th Plan contains only one of three possible scenarios where this measure might be used. Each of these scenarios requires a different cost-effectiveness analysis. The simplest and most conservative case (and that used in the 5th Plan) assumes that the existing forced-air furnace is functioning, but that it might be cost-effective to replace it with a high efficiency heat pump. In this case an investment of approximately $4500 for the new heat pump. In the second scenario, the existing forced-air furnace is no longer functioning. In this case the old furnace can be replaced by either a new forced-air furnace or the purchase a high efficiency heat pump. Since the cost of the furnace replacement is approximately $750, the "incremental" cost of converting to a heat pump is only $3750. The third scenario, and in the areas of the region that have very hot summers the most likely, is the case where the home has a forced-air furnace and central air conditioning system. In this scenario, the air conditioning system fails and is about to be replaced. The homeowner could spend $3000 to $3500 just to replace the air conditioning system or $4500 to replace both the furnace and air conditioner with an efficient heat pump. In this case, the incremental cost of the heat pump is only $1000 to $1500 over an existing forced-air furnace plus an air-conditioning system. All of these cases represent legitimate possibilities. While they are not specifically called out in the Council's plan, each should be analyzed for cost-effectiveness in Bonneville's program implementation. The staff believes that through the mechanisms provided for by the Council's Regional Technical Forum (RTF), any utility can request that specific applications be analyzed for cost-effectiveness. Moreover, Bonneville has stated that it will continue to rely on the RTF to perform these analyses and to develop analytical tools that utilities can use to conduct their own "case specific" cost-effectiveness tests.

Issue 4 - *Application of Cost-Effectiveness Ignores Consumer Non-electricity Benefits.* There is always the possibility that significant non-electricity benefits have been overlooked or under-valued in the application of the TRC test. For example, some utilities have asserted that because some consumers are willing to invest nearly $4000 to install a solar water heating system that they must perceive other "non-electricity" benefits because the energy savings alone would not justify the investment. They believe they should be able to offer a small incentive towards the installation of these systems to assure that they are at least installed properly. Staff believes that if significant non-electricity benefits have been overlooked or under-valued they should be incorporated in the cost-effectiveness analysis. However, when a measure's cost-effectiveness is derived largely from its non-electricity benefits, the utility system's "willingness to pay" should be limited by the measure's energy savings benefits. For example, a residential solar water heating system has a total present value cost to the region of $4650, including annual operation and maintenance cost. As a result of its energy savings this system provides approximately $1015 in present value benefits to the power system over its lifetime. Therefore, in order be cost-effective from a TRC perspective in must produce at least $3635 ($4650-$1015) in present value non-electricity benefits. Since the power system does not accrue these non-electricity benefits, utility investments in this solar water heating system should be limited to $1015, with the balance to be paid by the owner of the system.

It should be noted that in this example, if the power system were to invest $1015 in the solar water heating system its "cost of conserved energy" is exactly equal to the cost of purchasing the equivalent amount of power from the market. That is, the regional power system's economic benefits are equal to its costs (benefit-to-cost ratio 1.0). In contrast, a major portion of economic benefit that conservation provides in the 5th Plan is derived from the fact that its estimated *total* resource cost (not just that portion paid for by the power system) is approximately two-thirds the cost of market power purchases. This means, that in order to produce the same economic benefit to the power system, utility investment in measures that derive their cost-effectiveness from large non-electricity benefits must be constrained to less than their present value to the power system.

The rationale for this additional constraint can be illustrated by comparing the solar water heater to a heat pump water heater. A solar water heater must be assumed to have large non-electricity value in order to cost-effective. A heat pump water heater is cost-effective based on its energy savings alone. The 5th Plan estimates that the savings from a solar water heater and heat pump water heater are roughly equivalent (about 1900 kWh/yr). However, the total present value cost of a heat pump water heater is only $925 compared to $4650 for the solar water heater. Therefore, in order for the power system to be indifferent as to whether it saves 1900 kilowatt-hours per year, utility investments in solar water heaters should be limited to $925 (rather than

$1015), since the heat pump water heater at that cost could produce the identical savings at lower cost.[8]

[8] This also assumes that the consumer who purchases the solar water heating system attributes no value to its energy savings. If the consumer also attaches value to the energy savings, utility investments must be further constrained to avoid double counting these benefits.

Misconceptions, Mistakes and Misnomers in DSM Cost Effectiveness Analysis

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In this paper, we take a close look at the standard cost-effectiveness tests used for assessing demand-side management (DSM) investment. We examine the perspective which each test is supposedly reflecting, consider the role that perspective should have in judging DSM, identify the benefits and costs which are reflected in that perspective, and discuss how the test might be applied in a practical fashion. We also include a brief discussion of the "value" tests which have recently appeared in the literature.

We find that the issues in benefit-cost analysis can be grouped into three categories: envelope issues, feedback issues and discounting issues. Envelope issues are those that deal with which costs or actors should be included in, or excluded from, a particular cost-effectiveness perspective. Feedback issues are those that deal with indirect effects of DSM. Discounting issues are those surrounding the selection and application of appropriate discount rates.

We also find that there is often a gap between what should theoretically be and what is typically included in the different cost-effectiveness tests. Some omissions can be resolved easily, such as the full accounting of DSM administrative costs. Others are much less manageable. The elasticity of demand with respect to rate impacts, explicit accounting for the market barrier costs faced by efficiency investment, and the added or reduced value of service produced by DSM measures all have their ideal role in cost-effectiveness analysis, but are troublesome to apply in practice.

Introduction

Over the past fifteen years, a set of standard tests has been developed to evaluate the "cost-effectiveness" of utility-sponsored DSM from a variety of perspectives. The creation and application of these tests has been driven by regulation: state utility commissions needed yardsticks by which to judge DSM programs as beneficial or otherwise. From this need, the set of "standard" cost-effectiveness tests have evolved for use in assessing the value of DSM from a number of different perspectives. In this paper, we take a close look at these cost-effectiveness tests, examining the standpoint which the test is supposedly reflecting and what role that standpoint should have in judging DSM, identifying the benefits and costs which are reflected in that perspective, and grappling with how the test might be applied in a practical fashion. We also include a brief discussion of the "value" tests which have been proposed over the past few years.

We use the California Standard Practice Manual (California Energy Commission (CEC) 1987) as the takeoff point for our discussion of the five most common cost-effectiveness tests: the Participant Test, the Utility Cost Test, the Rate Impact Measure (RIM) Test, the Total Resource Cost (TRC) Test, and the Societal Test. For each of these tests we address the following questions:

1. *What is this test supposed to measure? Why are we interested in it?* Before discussing the intricacies of a test, we first discuss what its results are used for, who is interested in the results, and why.

2. *What are the major issues which must be addressed in applying this test?* Once we have laid out the purpose of a cost-effectiveness test, we discuss the major issues which arise in its application. We find that these issues can be grouped into three categories: envelope issues, feedback issues, and discounting issues. Envelope issues are those that deal with which costs or actors should be included in or excluded from a particular cost-effectiveness perspective. Feedback issues are those that deal with indirect effects of DSM (e.g., elastic consumption reactions to DSM induced

rate changes). Discounting issues are those surrounding the selection and application of appropriate discount rates.

3. *What is the practical application of this test?* In virtually all cases, there is a gap between what theoretically should be included in a cost-effectiveness test and what can realistically be done in practice. After having discussed the more theoretical issues surrounding a cost-effectiveness test, we follow up by discussing how to go about practically implementing the test.

Participant Test

The Participant Test is the measure of the quantifiable benefits and costs to the customer due to participation in a program. (CEC 1987, p 9)

The intent of the Participant Test is to determine if a utility customer is better off by participating in a program, and to a lesser degree, by how much.

The Participant Test has two roles. First, it demonstrates to a utility regulatory commission that the participating customer will benefit from the program. Second, and more important, it is an indicator of the potential success of a program. If a program or measure generates large net quantifiable benefits to the customer, then success is much more likely than if the program generates only marginal net benefits for the participant.

Discussion

If one adheres to the California Standard Practice (CSP) definition of quantifiable benefits and costs (CEC 1987), then the Participant Test potentially can measure what it claims to measure. Bill savings are benefits. The incremental cost to the participant of the equipment (taking into account the rebate) is a cost. Any incremental operating costs (savings) associated with the DSM measure are costs (benefits).

The costs and benefits of the Participant Test are shown schematically in Figure 1. In this figure, and the ones that follow, the different actors in DSM are shown as rounded boxes: participant, sponsoring utility, government, etc. The broad dashed line represents the "envelope" of analysis for the particular test being examined. Since Figure 1 illustrates the Participant Test, the dashed envelope line surrounds the participant box. Arrows show the flow of money. *Arrows pointing out of the envelope* represent money being paid by the participant to an outside actor, and therefore are *costs* as defined by the Participant Test. The arrow from the participant to the equipment dealer points out of the envelope, indicating a cost. *Arrows pointing into the envelope* represent a flow of *benefits*. The bill savings and incentive arrows connecting the utility to the participant point into the envelope. Arrows which remain within the envelope are transfer payments, and therefore are not included in the analysis. Arrows which remain outside the envelope do not enter into the calculations.

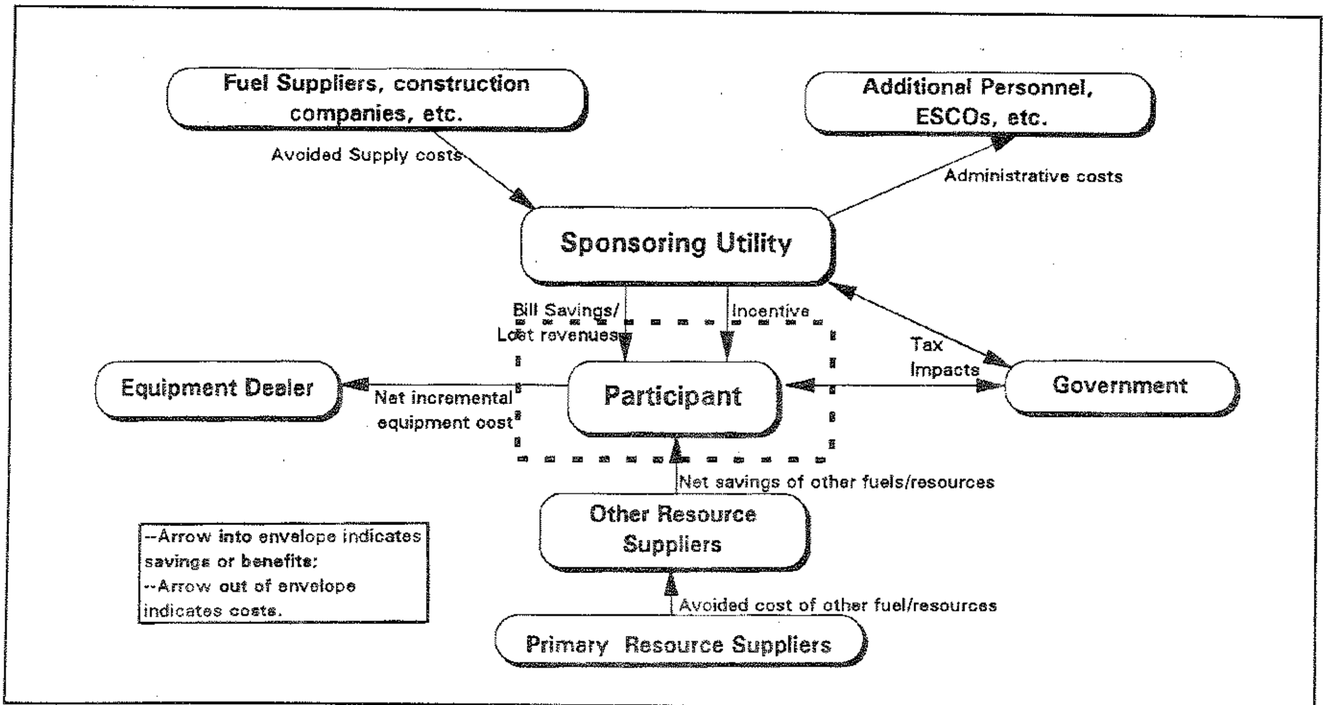

Figure 1. Participant Test

The primary issue in considering the participant perspective is ensuring that all quantifiable benefits and costs are accounted for. Some of the more easily overlooked costs and benefits are impacts on participant resources which are not provided by the sponsoring utility. These might include changes in cooling water demand for differing chillers, or, for a gas utility, the changes in auxiliary electric use for differing gas equipment or appliances.

Another easily overlooked cost or benefit of participation in a DSM program is its tax implications to the participant. DSM benefits are generally not taxed directly, but can affect property taxes (by increasing the assessed value of the home), personal income taxes, businesses' income taxes (who write off utility payments as a business expense), to name a few.

Moving beyond the strict restriction of "quantifiable" benefits and costs, a benefit not accounted for in the Participant Test (or other tests for that matter) is a potential increase in the value of the service provided by the DSM measure. A well weatherized home not only saves on heating bills, but is less drafty and more comfortable, too. This kind of increase in value to the participant is not accounted for in the CSP method, but is nevertheless quite real.

Market barriers to energy efficiency are the prime example of non-quantifiable costs: information costs incurred by customers as they become more familiar with the technology; risk-adverse purchasing behavior or skepticism on claimed savings; the hassle of dealing with a program or changing to a new, unfamiliar technology, etc. On the other hand, a well designed DSM program can serve to decrease many of these "transaction costs" or barriers associated with installing efficient equipment. Chamberlin and Herman (1993) include the reduction in such "unaccounted for" costs in their "value test" for DSM cost-effectiveness.

Another potential non-quantifiable cost of DSM is a *decrease* in value due to the DSM program. The compact fluorescent lamp is an example. Color rendition, time delay as the lamp warms up, and awkward lamp sizes are all "costs" paid by the program participant which are not normally accounted for in the participant cost analysis.

Since the Participant Test is generally presented as the present value of the net benefits (discounted benefits less discounted cost) or as a ratio of discounted benefits to discounted costs, the use of an appropriate discount can be very important. The sponsoring utility's weighted average cost of capital is not an appropriate proxy for consumer discount rate. What an appropriate discount rate should be from the participant perspective is a more difficult question. It can be argued that the marginal cost of capital to the participant is an appropriate discount rate. For residential customer, this is often taken to be a credit card rate, a home-equity loan rate, or, in the case of a new construction program, the mortgage rate. For commercial customers, the discount rate can be taken to be the rate at which the company can borrow money or some minimum rate of return on investment. Others argue that the rate of return on a savings account or certificate of deposit is an appropriate proxy of a consumer discount rate.

Practical Application

Understanding the participant perspective is very important in DSM program design, but it is not a critical factor for program or measure screening. DSM programs (except load building) generally have no difficulty passing the Participant Test, often even without any utility incentives. If a measure fails the Participant Test, it is not likely to pass the TRC Test and would probably be impossible to market. Market research (e.g., focus groups), may provide better information about customer acceptance than the "Participant Test" calculation.

Utility Cost Test

The Utility Cost Test measures the net costs of a demand-side management program as a resource option based on the costs incurred by the utility (including incentive costs) and exclude the net costs incurred by the participant. (CEC 1987, p 17)

The Utility Cost Test measures the impact on utility revenue requirements. In fact, it was referred to as the Revenue Requirements Test in the 1983 version of the CSP (CEC 1987, p vii). As we will discuss, the Utility Cost Test does not really reflect the interests of the utility, and therefore is of only marginal interest to utility planners. The net impact on revenue requirements of DSM is of only passing interest to commissions, which when evaluating DSM, are more interested in a program's total benefits, costs, and its impact on rates[2].

Discussion

As shown in Figure 2, avoided resource supply and demand costs are counted as benefits in the Utility Cost Test. Costs paid by the utility for incentives, program delivery and administration are counted as costs (Figure 2). Lost revenues are by definition not included in the analysis.

Assuming that the purpose of the Utility Cost Test is to measure impact on revenue requirements, then the test measures what it is supposed to do. However, the title of the test is misleading. The perspective of the utility, as

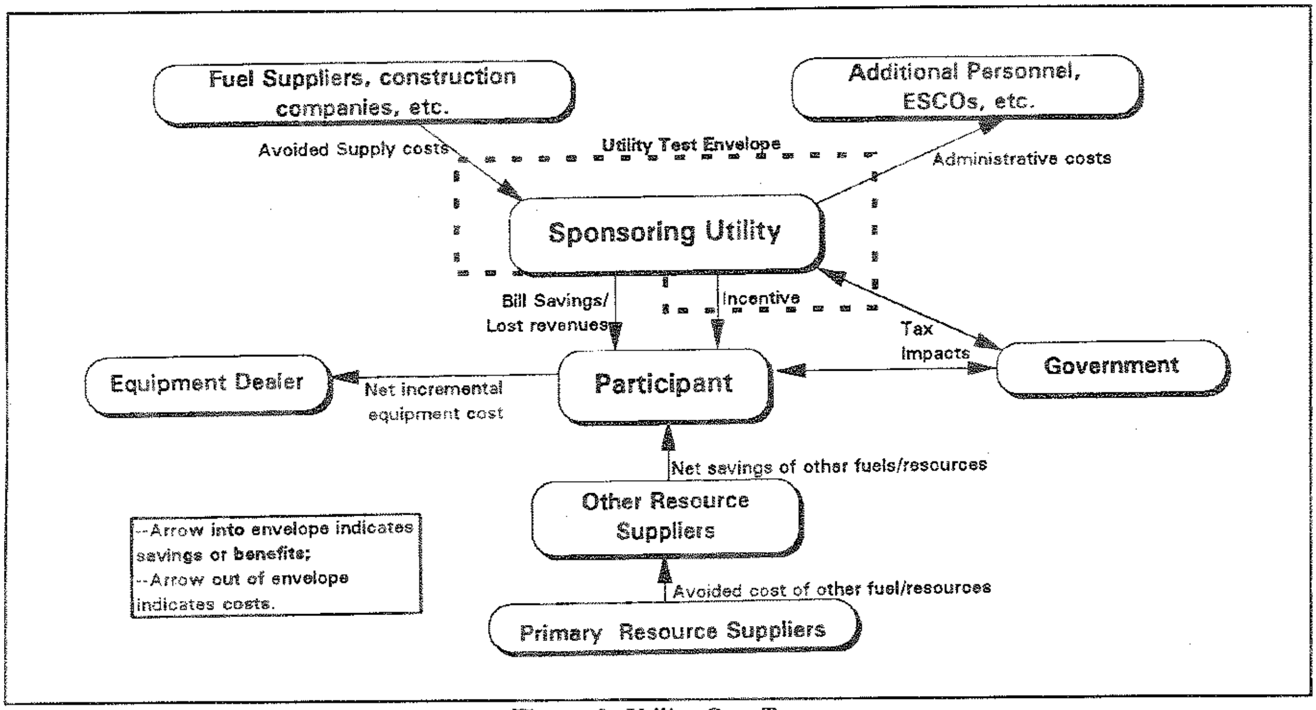

Figure 2. Utility Cost Test

expressed by typical utility management, is not the minimization of revenue requirements. We see a utility perspective better reflected in the interests of the utility investors, who are generally more interested in maximizing their return on investment. Minimization of revenue requirements can contribute to this, in that it eases regulatory burdens (commissions can see the utility is doing a good job) and can contribute to lower rates. However, reduced revenue requirements is not a primary or an explicit goal. Increased sales between rate cases and larger rate bases upon which to earn returns would better reflect the absolute interests of utility investors. However, we are not saying that the test should be changed to reflect the interests of the utility. Utilities already have at their disposal many more sophisticated methods of evaluating investments, including those in DSM, than what we could hope to propose.

Avoided Supply Costs. On the benefits side, the avoided costs must be calculated correctly, both for the Utility Cost Test, and for their pivotal role in the more important TRC and Societal Cost Tests. In order to accurately calculate avoided costs, one must develop two optimized system plans. The first plan is without the DSM program, and the second one with a decrement to load representing the DSM program. The load decrement must be designed to reflect the characteristics (e.g., size and timing) of the DSM measure being considered. The annual differences in cost between the two plans are the costs that could be "avoided" by the DSM program. Although straightforward in concept, calculating avoided cost is quite difficult. Care must be taken to develop reasonable system plans, in order that the DSM program's effect upon the capacity and energy mix is accurately represented.

Administrative and Delivery Costs. A complete accounting of costs paid by the utility to implement the program must be included. Joskow and Marron (1992, 1993) suggest that a full accounting of all the utility costs associated with DSM would result in costs much higher than are generally reported. In their 1991 survey, only two of thirteen utility DSM programs provided to their satisfaction a full accounting of DSM administrative costs. According to Joskow and Marron, the factor generally most neglected was the cost of monitoring and evaluation. If the costs to monitor and evaluate DSM programs are significant, then they should be included in the cost-effectiveness analysis. However, care must also be given that the framework of cost accounting is consistent with that used to evaluate supply resources.

Practical Application

We believe that changing the name to better match the actual intent of the test, such as to the older Revenue Requirements Test, would be more appropriate than changing the calculation of the test to reflect a "utility perspective." While the Utility Cost Test in isolation is only marginally interesting, the inputs going into it are critical inputs to cost-effectiveness analysis from other perspectives.

Rate Impact Measure Test

The Rate Impact Measure (RIM) Test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program. (CEC 1987 p. 17)

Discussion

The RIM test is supposed to test for cross-subsidy: non-participants paying for benefits accrued by participants through higher rates. It attempts to accomplish this by comparing utility spending on DSM and lost revenues to avoided supply savings. If supply savings exceed utility spending plus lost revenues, the program passes the RIM Test; if not, it fails.

As shown in Figure 3, the RIM envelope is clearly drawn around the utility: avoided costs are benefits, incentives paid to participants are costs, administrative and delivery costs are costs, and lost revenues are costs. The issues brought up in the discussion of the Utility Test also apply here: all costs associated with utility DSM activity and all avoided supply costs must be accounted for correctly.

The RIM Test does not provide the regulator or the utility planner with enough information discern any of the major cross-subsidy issues. The more important questions to be asked when addressing rate impacts and cross-subsidization issues are (1) whose rates are going to go up and (2) by how much? Net present values and benefit cost ratios do not provide this information. Additional data are needed: are costs expensed or rolled into rate base? Are costs going to be collected exclusively from the rate class for which the program is aimed, or spread over all ratepayers?

Additionally, the RIM Test is not even an accurate indicator of the presence of a rate impact. Consider a program whose RIM benefits—avoided costs—equal exactly its RIM costs—incentives, administration costs and lost revenues. Such a program passes the RIM test—its benefit-cost ratio equals 1.0—but still will raise rates. This is because the decrease in sales resulting from the program will result in the fixed cost component of rates being allocated over fewer kilowatt hours or therms.

Practical Application

The application of the RIM Test, as currently applied, is an inappropriate arbiter of DSM. Public policy makers are always having to address issues of cross-subsidy: benefits accruing to some portion of the population at a cost to the whole. To put it another way, Pareto optimality is not, and for practical purposes cannot be, a strict criteria of public policy formulation. This is not to say equity and wealth distribution issues are not important; they are. Rather, they should not be the primary criteria for DSM program acceptance or rejection.

The RIM Test is too crude a tool to discern the cross-subsidy impacts of interest to regulators and utility

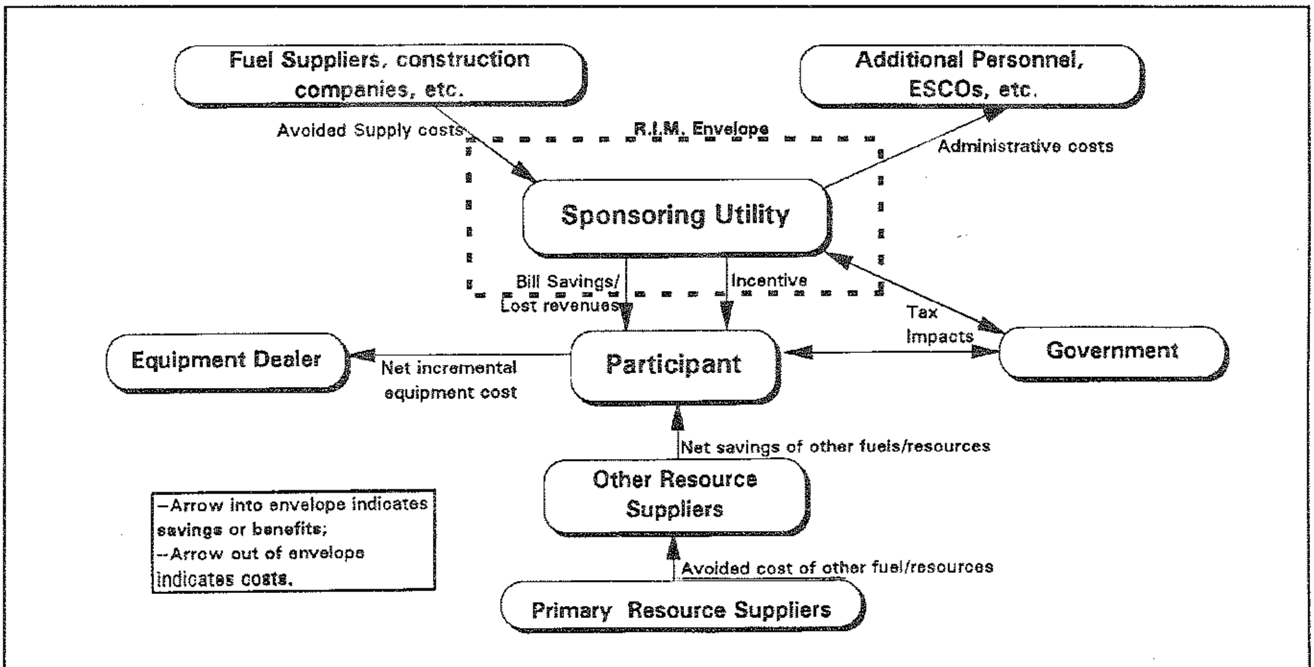

Figure 3. Rate Impact Measure (RIM) Test

planners, who are interested in which rates will be affected, by how much, and what this impact means for market position. Therefore, it is necessary to take the extra step and identify, as specifically as possible, who will be affected, by which rate schedules, and by how much their bills will be affected. With this information, regulators can make informed decisions on rate impacts. Utility planners, as well, can more fully assess how the DSM program will affect their product in the marketplace.

Secondly, when thinking about rate impacts, the impact of a DSM program in isolation is virtually meaningless. The retail rates associated with a utility system resource plan are an important characteristic of the plan, but they are influenced by all of the DSM programs taken together, along with myriad other variables (e.g., fuel prices, load growth, capacity expansion options and plans). By and large, it is the overall level of rates that matters to policymakers, not the incremental rate impact of DSM activities, or worse, the incremental rate impact of a single DSM program.

For example, in a recent planning exercise in Colorado, a cap of three percent was adopted as a limit upon the acceptable impact of a utility's DSM programs. The utility then rejected a DSM program with estimated present value savings of $231 million (in 1993 present value) because it exceeded the three percent cap by 0.1 percentage points in the year 2005 (Woolf 1994). We believe that the rejection of this program was inappropriate, because the utility failed to consider uncertainty or alternative program designs. These could have allowed the cost-effective program to remain in the plan, without exceeding the rate cap. Thus, even if one believes a strict rate cap to be appropriate, it should not be employed mechanically to reject otherwise attractive DSM opportunities.

Total Resource Cost TEst

The Total Resource Cost (TRC) Test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs. (CEC 1987, p. 25).

The TRC Test measures the sum of the RIM and Participant Tests—the perspective of the utility plus the participants. Primarily because it serves as a prelude to the Societal Cost Test, the TRC Test provides the back-bone to DSM decision making. A DSM portfolio may pass the RIM Test, but if its programs fail the TRC and/or Societal Cost Tests, the portfolio still should fail.

Discussion

Envelope Issues. The definition of the TRC Test quoted above contradicts its application in practice. The CSP definition quoted above clearly indicates that the "envelope" is drawn around the participant and the utility (or, indirectly, around the participants and non-participants). This is shown in Figure 4 as the longer dashed envelope line. Strictly interpreted, this means that

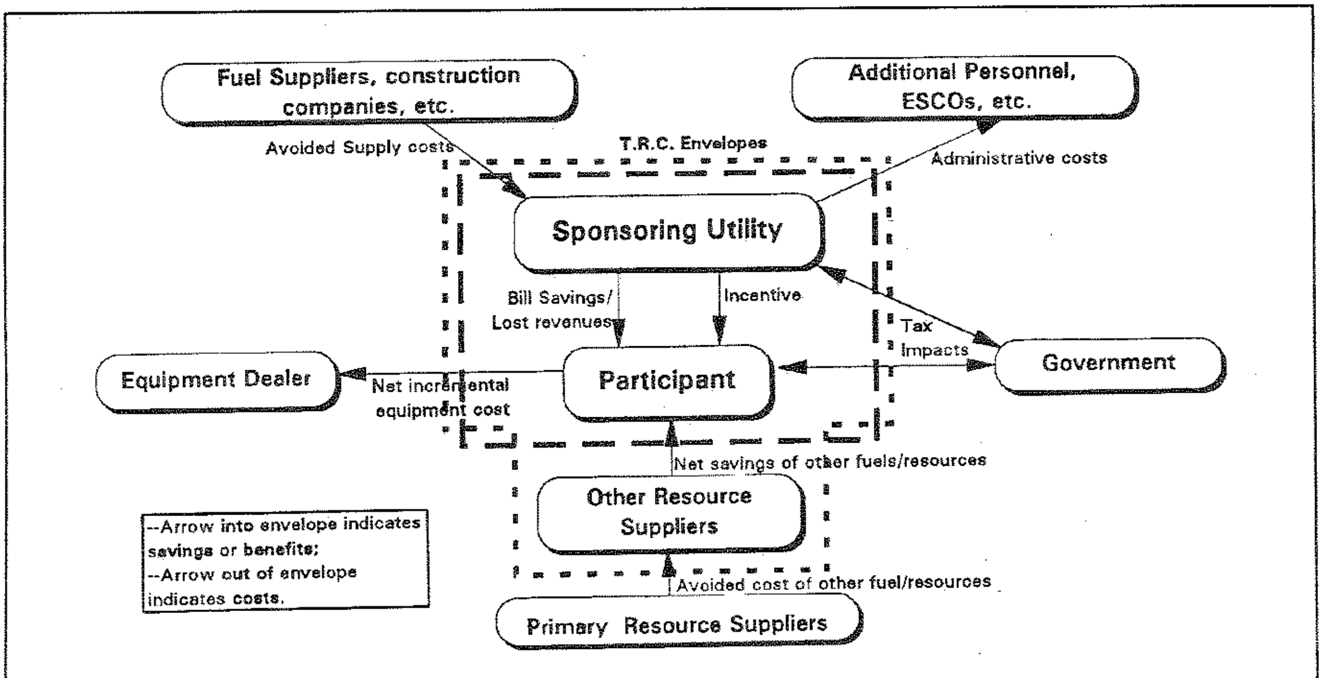

Figure 4. Total Resource Cost Test

all other resources affected by the program, such as water or some other fuel in the case of a fuel switching program, would be valued at the price seen by the participant/utility entity: retail rates. This is the application of the "Chapter 380" cost-effectiveness test in Maine.

However, in practice elsewhere, and in the discussion and example in the CSP manual, the avoided supply costs of the fuel not chosen (in the case of fuel switching) is used in the analysis. This is in spite of the fact that these cost are not experienced by either the utility or the participant. This is shown as the shorter dashed envelope line in Figure 4. Since avoided costs can differ significantly from tariffs (for regulated fuels) or prices (for market fuels), the choice of convention can be the difference between a measure passing or failing the TRC Test.

Using the "switched-from" fuel's avoided cost in the analysis is intuitively comfortable. It places all fuels on an equal avoided cost footing. But it begs other questions. Should water savings be valued at its avoided cost? What *is* the avoided cost of water? If other resources, such as a refrigerant, are reduced, should their savings be valued at some "avoided cost" or at the market price? Or even the equipment associated with the DSM measure being installed? When does pursuing this line or reasoning become ridiculous?

These avoided cost versus market cost questions introduce the second envelope issue. How are costs paid by actors other than the utility or participant accounted for in this test? Both in definition and in practice, costs paid by actors outside this envelope are treated exogenously. For example, the tax credits given by the State of Hawaii for the purchase of solar water heaters—well over $1000 per unit—are netted out of the equipment cost prior to the calculation. Given the Hawaiian electric utilities' DSM programs, Hawaiian taxpayers may potentially be paying tens of millions of dollars for DSM which will not be accounted for in the TRC Test. However, excluding tax credits is inconsistent with the use of avoided costs for outside-the-envelope-fuels.

Discount Rate Issues. One potential issue arising with the TRC Test is that the two actors involved, the participant and the utility, will likely have very different discount rates. Should the costs and benefits to the participant be discounted at one rate while the costs and benefits to the utility be discounted at another? In other words, do we draw a single large envelope around both the utility and the participant, or do we take the sum of two smaller envelopes, one around the customer and one around the utility. If the latter is the case, then the implicit transfer payment of customer bill savings and utility lost revenues will no longer cancel each other out. Assuming that the customer has a higher discount rate than the utility, the present value of $40 per year of bill savings to the customer will be less than the present value of $40 per year of lost revenues to the utility.

Practical Application

For conservation programs, many of the envelope issues do not arise. Only the sponsoring utility's resources are impacted, and there is no outside actor involved. However, for fuel switching programs, programs that affect other resources (e.g, water savings or auxiliary fuels), or programs with tax implications, the envelope issues become quite real.

In these cases where envelope issues arise, we recommend calculating the TRC Test in two ways. The first is the "All Ratepayers" test: draw the envelope around the participant and the utility (e.g., non-participant), and strictly account for only costs and benefits which directly cross the envelope. Tax credits are taken as cost reductions. Other resources are valued at their market price. Picking and choosing which outside-the-envelope costs to include leads to methodological inconsistencies and redrawing the envelope to include all of the other costs results in the Societal Test.

Even with that said, we recommend a second method more in the spirit of the present application of the TRC Test. Tax credits are taken as cost reductions, and other tax implications taken as given. Avoided costs for resources other than those provided by the sponsoring utility should be used rather than tariffs or market prices. Discretion is still needed in deciding where using avoided costs rather than actual prices is appropriate. Fuels switched away from, and if significant, water savings, should be valued at avoided costs. Reduced cooling tower chemicals should probably be valued at the cost paid, rather than at some concocted avoided resource cost.

In performing either of these variations of the TRC Test, we recommend using the utility's weighted average cost of capital as the discount rate throughout the analysis. Logical anomalies can arise when different costs or benefit streams are valued at different discount rates.

Societal Test

The Societal Test is structurally similar to the Total Resource Cost Test. It goes beyond the TRC test in that it attempts to quantify the change in the total resource costs to society as a whole rather than to only the service territory (the utility and its ratepayers). (CEC 1987, p. 27)

The intent of the Societal Test is to measure the net impacts of a DSM program on society. While still considering equity issues, the Societal Test should be the ultimate test of DSM cost effectiveness. If a DSM program benefits society as a whole, then it is reasonable to pursue it. If it harms society as a whole—that is, it incurs net costs to society—then is should not be pursued.

Discussion

The authors have yet to see a truly comprehensive Societal Test performed, nor have they ever performed one. The best we can do here is to identify specific items which, in theory, should be included, and discuss how and to what degree can these factors can be considered in the Societal Test.

An important question to ask, and to answer, is where do you draw the envelope? Which of these factors can one reasonably include in a filing before a utility commission? In this section we will discuss each major "envelope" issue, pointing out where it might be reasonable to include it in an analysis, and where it is better left alone. (See Figure 5.)

Tax Effects—Is the Government in the Envelope? The critical question to consider here is whether taxes are a transfer payment between the government (e.g., all citizens) and the entity paying the taxes. If this is the case, when the government offers a tax credit for a DSM technology like a solar water heater, the tax credit should be viewed as a transfer payment between all taxpayers to participants. The full cost of the DSM technology is included in the analysis.

Nevertheless, including the "government" in the envelope has further implications. With the government in the envelope, *all* tax effects of DSM would need to be accounted for: property tax effects, income tax effects, etc. For the utility, all the tax burdens paid by the utility are built into the revenue requirement. With the government inside the envelope, the tax effects would have to be teased out of the revenue requirements, so that no transfer payments are included as costs.

Avoided Costs. Opening the envelope to include society as a whole has two implications for avoided cost. The first is the tax issue discussed above. The second implication involves the regional, pooled nature of electric supply. Are avoided costs calculated at the utility level, or at the pool level? As a practical matter, if transactions within a pool are reasonably fluid, and the power pooling agreement is reasonably structured, there will not generally be large differences in avoided cost among individual members of a pool.

Environmental Impacts. Much of the discussion on the Societal Test has been on the treatment of environmental impacts. In theory, one should calculate the reduced damage from the marginal emissions saved by the DSM program. This is more easily said than done. We are not advocating any particular method of monetization

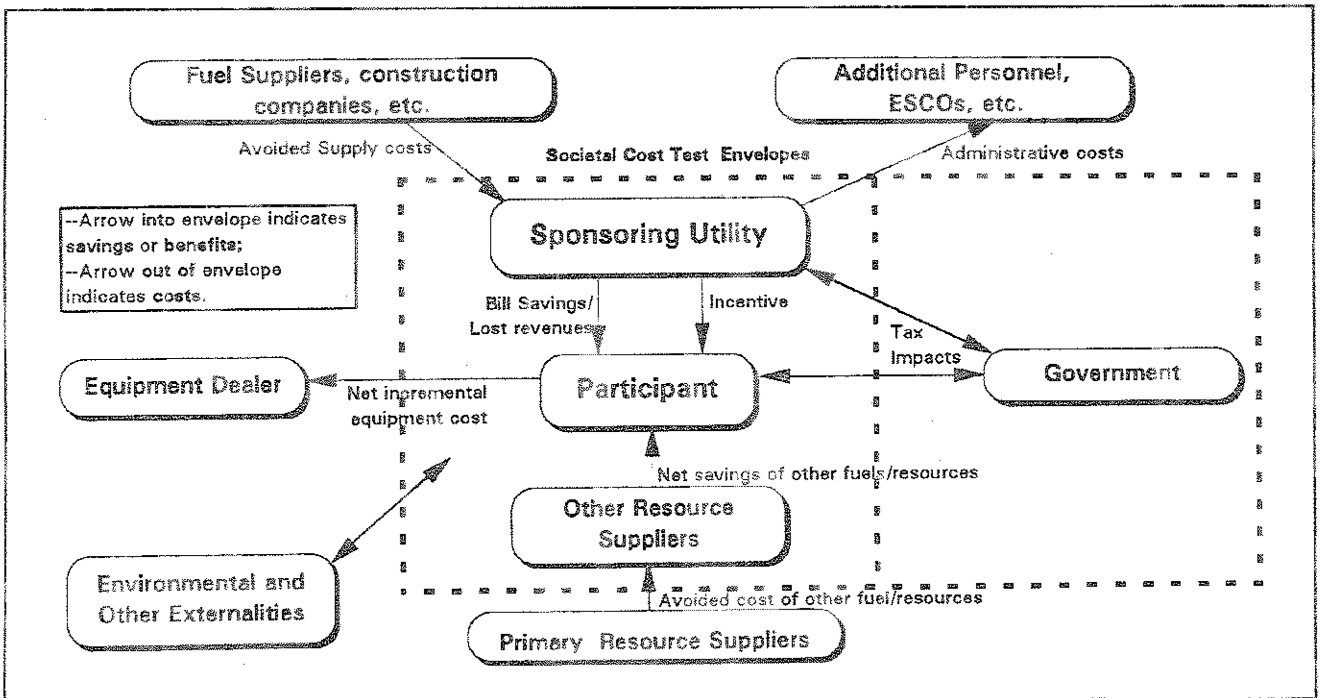

Figure 5. Societal Cost Test

(although the authors do have their opinions). In any event, the costs of at least the most important environmental externalities *must* be included in the Societal Test.

Environmental impacts of DSM go beyond avoided power plant emissions. DSM measures often have environmental benefits and costs of their own (EPRI 1992, Bernow et al. 1992, Hanser and Weaver 1991). To the degree possible, these impacts should be at least considered, and if found to be significant, quantified and valued in a manner consistent with that used for valuing environmental impacts on the supply side.

Market Barrier Costs. The purpose of the utility sponsoring a DSM program in the first place is to overcome the market failures associated with investment in energy efficiency. Therefore, one can argue that a portion of the delivery costs and rebates/incentives is counteracting the various transaction costs felt by consumers (information costs, hassle costs, uncertainty, etc.) These costs can be seen as transfer payments between the utility and the participant, staying inside the Societal Test envelope, and therefore removed from the Societal Test analysis.

If this is the case, what fraction of these costs are overcoming market barriers? Some of the administrative and delivery costs do not overcome any market barriers. The costs spent on customer tracking, monitoring and evaluation are real costs, imposed by regulation, and are not overcoming any market barriers. Customers do not all face the same barriers. Some face minimal barriers; others greater ones. Clearly, costs spent educating the educated customer are real and not a transfer payment from utility to participant.

These costs are very amorphous and vary from customer to customer and program to program. Therefore, more as a practical matter than a theoretical one, we recommend counting administration and delivery costs as "crossing the envelope" and should be included in the Societal Test.

Increased or Reduced Customer Value. In theory, the added (or reduced) value associated with DSM program should be included in a societal cost effectiveness analysis, including snap-back effects. The difficulty is quantifying these costs/benefits. Again, because these costs are amorphous, and vary significantly from customer to customer and program to program, we believe it is impractical to try to include them in an analysis.

Social Discount Rates. In analyzing DSM, it is typical to have an initial investment followed by a stream of benefits occurring over the operating life of the measure. In order to express the future benefits on a comparable basis to the costs, the "present value" of the benefits is computed. For a societal perspective on DSM, it would appear obvious that a societal discount rate be used, in order to reflect society's rate of time preference. This rate will tend to be lower than the utility's cost of capital and lower than the individual discount rates of most of the utility's customers.

In practice, the use of a societal discount rate in a utility planning context raises a number of interesting difficulties (see, for example, Cator 1993). These are, however, questions directed to the appropriateness of the societal perspective for utility policy making, as much as they are directed to the discount rate per se. We believe that for a societal perspective analysis, a societal discount rate should be used.

Dealing with Uncertainty. A deciding factor in many of our opinions as to whether to include a cost or a benefit in the Societal Test is pragmatism. Many of the factors which should theoretically be included in a Societal Test are subject, to a greater or lesser degree, to the values and opinions of the analyst performing the calculations. For example, how big are the market barriers to energy efficiency? There are nearly as many views on this as there are economists thinking about the issue.

However, uncertainty is a poor reason not to try to account for some of the more difficult issues. The valuation and monetization of environmental externalities are prime examples of this. Even though there is a lively debate in the energy planning an policy community on how to value environmental impacts in utility planning, many states are moving ahead in setting policies, even though they do not have complete knowledge or consensus among interested parties.

Some Other Cost-Effectiveness Tests

Recently, some tests have been developed to represent notions of customer value which go beyond these standard cost-effectiveness tests. These tests include a "Most Value Test" proposed by Hobbs (1991), a "Value Test" proposed by Chamberlin and Herman (1993), and a "Net Economic Benefits" test proposed by Braithwait, Caves and Hanser (1993).

What these tests have in common is the intent of basing DSM cost-effectiveness analysis upon what Braithwait, et. al. refer to as "traditional measures of changes in economic benefits and costs." Specifically, they attempt to quantify the impacts of DSM upon "consumer surplus" as defined in welfare economics.

Within the abstract realm of welfare economics, the policy objective of maximizing consumer surplus is a sound one.

In application, however, the value tests face some practical difficulties. Pigou (1920) welfare economics, quoted Leonardo da Vinci, "Theory is the general; experiments are the soldiers" and then pointed out that "economic science has already well-trained generals, but, because of the nature of the material in which it works [living and free men], the soldiers are hard to obtain." (p. 9) Unfortunately, three-quarters of a century later, we are still long on theory and short on data. The application of economic science to utility system planning remains constrained by practical considerations and lack of data. Specifically, values for some of the variables necessary for the application of the value tests are quite uncertain.

For example, the Value Test proposed by Chamberlin and Herman is equivalent to the TRC Test in the case where the following four conditions are satisfied: "no free riders, no take back, all unaccounted for costs are eliminated by the program, and the price elasticity of demand for electricity is zero." (p 236). It is in the relaxation of these four conditions that the Value Test takes on its theoretical attractiveness, but also becomes difficult to apply. For example, quantification of the value of the "take-back triangle" depends not only upon the amount of take-back, but on the "slope of the demand curve" of an individual participant for the energy service being saved (e.g., BTUs of cooling). Accounting for "unaccounted-for costs" requires explicit quantification of the costs of the customer "becoming aware of the existence of energy efficient equipment", the costs "customers incur in gathering enough information . . . to make an informed decision", the costs of making sure the equipment is "installed and operating", the differential financing cost (i.e., the "amount by which the participant's cost of capital exceeds the utility's cost of capital"), and "all of the costs implied by customer perceptions of risk." (p 233)

Finally, the Value Test's analysis of "iterative rate effects" requires an estimate of price elasticity, another controversial topic. The price elasticity of electricity depends upon many factors including time frame, location, available substitutes, and customer inclinations. For residential electricity demand elasticity, Bohi (1981) concluded that:

> A great deal of effort has been expended on the analysis of residential demand for electricity, but it is evident that understanding of the characteristics of consumption behavior is less than complete. There is unanimous agreement that the price of electricity is important and that price has an inverse relationship with consumption. Beyond that, there is considerable disagreement about the responsiveness of consumption behavior. (p 77)

Bohi found that "[t]here are relatively few studies of commercial electricity demand" (p 79) and that "[t]he considerable instability in the industrial components, both across industries and over time, indicates that the overall estimates are subject to aggregation and locational biases." (p 90)

Advocates of value tests must also recognize the need for a consistent "objective function" for use in the various aspects of IRP. Hobbs, to his credit, also applies his Most Value Test to analysis of supply planning and environmental externalities (Hobbs and Heslin 1991).

While these obstacles to the application of innovative "value tests" for DSM planning are considerable, we should not let such practical difficulties stand in the road of progress. Planners and theoreticians who wish to broaden the TRC Test are well advised to think carefully about the territory to be annexed. We believe that incorporating environmental costs into utility IRP, including DSM cost-effectiveness analysis, ought to be a higher priority than attempting to quantify changes in consumer surplus.

Conclusions

We see the Participant Test as useful to demonstrate to a commission that a DSM program or measure is beneficial to the participant, but that the test really cannot capture the participant perspective.

We find the Utility Cost Test to be misnamed. The test measures the impact on revenue requirement, which is only a small part of a "utility perspective." Because we see regulators being more interested in the total costs of a program and in overall rate impacts, we do not see the results of this test as particularly relevant or useful.

Understanding the rate implications of a utility activity, including a DSM plan, is important. But the RIM test, when expressed as an NPV or as a benefit-cost ratio, provides little useful information. When considering rate impacts, it is better to look at which rates will be affected, and by how much, rather than rely on RIM Test results.

We do not believe that the RIM Test should be the primary arbiter of DSM. Public policy makers are always having to address issues of equity. Pareto optimality (no-losers) should not be the guiding criteria in utility regulatory policy.

The stated perspective of the TRC Test is that of the participant and the utility as a unit. In practice, this definition tends to be stretched, particularly in the case of programs which affect multiple fuels.

We believe that the Societal Test should be the primary criteria for DSM cost-effectiveness. However, the test is evolving, as commissions, utilities, and advocates grapple with some of the more difficult issues surrounding a societal perspective. We believe that at minimum, the Societal Test should include monetized environmental impacts and be conducted at a social discount rate. If other factors such as rate feedback are considered, the full IRP perspective should be taken, and the factors applied to the evaluation of supply-side investment, too.

The "value" tests are interesting in that they approach the cost-effective analysis from a welfare economics perspective. We find this approach theoretically interesting, but because they rely on parameters which are highly uncertain and difficult to qualify, we are concerned about their practical applicability in the near term.

Endnotes

1. For indoor air quality reasons, particularly tight weatherization might require special ventilation and air exchange equipment at additional cost (EPRI 1992).

2. When addressing supply side investment, the focus has been on the minimization of revenue requirements, which implies lower average rates.

3. For an interesting discussion of the RIM test, the role of the Pareto optimality criteria, and the formulation of public policy see Deegan 1993.

4. Chamberlin et al. correctly point out that these costs can be "eliminated through good program design". (p 235)

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Attachment B

Summary of Regional Policies on Cost-effectiveness of Utility Conservation

Overview

Over twenty years of successful conservation development in the Pacific Northwest has left a long history of policies addressing conservation cost-effectiveness. These policies are manifested in statute and in the proceedings of regulatory commissions, which are discussed below. While there are nuances differentiating policies, all share a common theme: use a Total Resource Cost (TRC) perspective as the primary measure of conservation cost-effectiveness.

Generally, there are five perspectives used to measure cost-effectiveness. These are discussed in detail in the attached paper from the Tellus Institute "Misconceptions, Mistakes and Misnomers in DSM Cost Effectiveness Analysis" and in the California Standards Practice Manual. The perspectives are:

1. Customer Perspective, which measures costs and benefits to the end user participating in a conservation program.
2. Total Resource Cost, which measures all quantifiable costs and benefits regardless of to whom they accrue.
3. Societal Test, which is the same as the Total Resource Cost test but typically includes environmental or other externalities.
4. Utility Cost, which measures quantifiable costs and benefits that accrue only to the utility system as a resource option. It excludes participant costs and other non-utility costs.
5. Rate Impact, which measures the net change, due to conservation programs, in the electricity bills or rates due to changes in utility revenues and operating costs. It includes rate impact on all utility customers including those that do not directly participate in the conservation program.

The Regional Act

The Act that created the Council prioritizes the development of cost-effective resources. The Act provides a definition of cost-effectiveness that has guided the Council since its inception.

> "Cost-effective", when applied to any measure or resource referred to in this chapter, means that such measure or resource must be forecast to be reliable and available within the time it is needed, and to meet or reduce the electric power demand, as determined by the Council or the Administrator, as appropriate, of the consumers of the customers at an estimated incremental system cost no greater than that of the least-cost similarly

> reliable and available alternative measure or resource, or any combination thereof."
>
> "System Cost" means an estimate of all direct costs of a measure or resource over its effective life, including, if applicable, the cost of distribution and transmission to the consumer, waste disposal costs, end-of-cycle costs, and fuel costs (including projected increases), and such quantifiable environmental costs and benefits as are directly attributable to such measure or resource"

The key phrase here is "…all direct costs of a measure over its lifetime…". The Council has interpreted the Act's provisions to mean that in order for a conservation measure to be cost-effective the discounted present value of all of the measure's benefits should be compared to the discounted present value of all of its costs, regardless of who pays the costs. This interpretation was adopted in the Council's 1983 Plan and has not been modified. The reason for this interpretation is that we cannot know before hand, how much of the cost of a measure will be paid by the utility system and how much by the customer, or others. So we look at all the reasonably quantifiable costs and benefits.

<u>Oregon Public Utility Commission (Oregon PUC)</u>

In 1994, docket UM 551 resulted in Order 94-590 "The Calculation and Use of Cost-Effectiveness Levels for Conservation". The order addresses 15 issues around cost-effectiveness as used in least-cost planning and in program design and implementation. Relevant policies adopted in this order include:

- Total Resource Cost Test is adopted as the cost-effectiveness test measures and programs must pass. The TRC test includes utility and participant costs, significant quantifiable non-energy costs and benefits, administrative and evaluation costs. The TRC calculation excludes lost revenues because they are transfer payments.
- But, utility ratepayers should not subsidize the cost of measures that exceeds the value of the electricity system savings. In other words, if a measure passes the TRC test because of significant non-energy benefits (such as water or sewer savings), utility incentives should not exceed the benefits to the electric system. This assures that the ratepayers are not paying for benefits that do not accrue to the electric system.
- Conditions where measures that are not TRC cost-effective may, upon demonstration, be included in utility programs:
    - Inclusion of the measures will increase market acceptance and is expected to lead reduced cost for the measure
    - The measure is included for consistency with other DSM programs in the region
    - Inclusion of the measure helps increase participation in a cost-effective program provided that other factors offset the extra costs of including non-cost-effective measures
    - The package of measures cannot be changed frequently, and the measure will be cost-effective during the period the program is offered
    - The measure or package of measures is included in a pilot or research project intended to be offered to a limited number of customers

    - The measure is required by law or is consistent with Commission policy and/or direction
- In planning set conservation targets to minimize TRC. If rate impacts are considered as a reason to reduce planned conservation targets from levels that minimize TRC, a series of conditions must be justified in the Least-Cost Plan

Oregon Legislation

Oregon statute establishes that cost-effectiveness be considered in state agency decision-making relating to energy sources, facilities or conservation, and that cost-effectiveness be considered in all agency decision-making relating to energy facilities (ORS 469.010). The statute defines cost-effectiveness similarly to the way it is defined in the Regional Act: "Cost-effective" means that an energy resource, facility or conservation measure during its life cycle results in delivered power costs to the ultimate consumer no greater than the comparable incremental cost of the least cost alternative new energy resource, facility or conservation measure.

Washington Utilities and Transportation Commission (WUTC)

There is no formal Commission order on cost-effectiveness policy for conservation. WUTC generally uses California Standard Practice as guidelines for cost-effectiveness. (See below)

Washington Legislation

The "Don't Bankrupt WA" initiative that became law in early 1980s established policy to prioritize and define cost-effective conservation for any public utility district, joint operating agency, city, county, or any other state governmental agency, entity, or political subdivision.

- Washington statute RCW 80.52.080 lists priorities for planning future cost effective energy expenditures with conservation given top priority.
    - "In planning for future energy expenditures, public agencies shall give priority to projects and resources which are cost-effective. Priority for future bond sales to finance energy expenditures by public agencies shall be given: First, to conservation; second, to renewable resources; third, to generating resources utilizing waste heat or generating resources of high fuel-conversion efficiency; and fourth, to all other resources. This section does not apply to projects which are under construction on December 3, 1981."
- Washington statute RCW 85.50.030 defines cost-effectiveness as it is defined in the Regional Act.

Idaho Public Utility Commission (Idaho PUC)

In 1989, Commission Order 22299 addressed electric utility conservation standards and practices. The order recognizes the usefulness of different cost-effectiveness tests and does not make any specific findings about when to use specific cost-effectiveness test. The order identifies that the maximum a utility could pay for a conservation measure is the avoided cost because utility-funded efficiency efforts should be compared as resource alternatives to supply-side options. It rejects the "no-losers test" or rate-impact test as a cap on what utilities could pay for conservation, but does not reject it from being considered in program development.

Practically speaking, approval of recent Integrated Resource Plans and rate cases give examples of how policy cost-effectiveness policy is implemented in Idaho. In the case of Avista Utilities, the policy has been to generally followed the California Standard Practices approach with regard to cost-effectiveness determinations doing four different tests to give four perspectives: Participant, Rate Impact, Utility Cost and Total Resource Cost. In the case of Idaho Power, two tests have been used Total Resource Cost and Utility Cost.

Montana Public Service Commission (Montana PSC)

Integrated Resource Plan Guidelines established in the 1992 for vertically integrated utilities in a non-restructured environment. These guidelines set forth that the cost effectiveness of all resources, including conservation, should be determined with respect to long-term societal costs. The Total Resource Cost test is used to measure cost-effectiveness. In Montana it is termed Total Societal Cost. (38.5 Sub-Chapter 20)

More recently, the Montana PSC adopted rules for restructured utilities that provide default supply service. Those rules do not specify use of a particular conservation cost effectiveness metric, but stress the importance of demand-side resources to a balanced and environmentally responsible supply portfolio with a focus including development of least-cost conservation. Default supply utilities are encouraged to implement sustained investments in demand-side resources over the long-term, and are discouraged from measuring cost effectiveness using Rate Impact tests. (38.5 Sub-Chapter 82).

California Standard Practices Manual

Developed in 1983 and undergoing periodic revision since. This manual is quite extensive and is used by many other jurisdictions around the country. The manual provides the methodology and the cost-benefit calculations only. Key aspects of the 2001 Standard Practice Manual:

- Specifies four separate tests of cost-effectiveness: Participant, Rate Impact, Total Resource Cost and Program Administrator Cost
- Recognizes tradeoffs between the tests. For example, the results of tests that measure efficiency, such as the Total Resource Cost Test, and the Program Administrator Cost Test, must be compared not only to each other but also to the Rate Impact Test which measures impacts of the program on customers bills and rates
- Identifies strengths and weaknesses of the tests
- Specifies formulae and input and output expressions for all the tests in a total of 34 pages

California PUC Energy Policy Manual

While the "practices" manual above identifies the specifics of the cost-effectiveness tests, the "policy" manual describes how the California PUC uses the tests in regulating California investor-owned utilities. The policies like the practices evolve over time. But for both the 2003 policies and the draft post-2005 policies Total Resource Cost is the primary cost-effectiveness test. The rationale for this choice is that ratepayer-funded energy efficiency should focus on programs that serve as resource alternatives to supply-side options. The TRC test measures the net resource benefits from the perspective of all ratepayers by combining the net benefits of the program to participants and non-participants. The benefits are the avoided costs of the supply-side resources avoided or deferred. The TRC costs encompass the cost of the measures/equipment installed and the costs incurred by the program administrator.

Key policies in 2003 include reliance primarily of the Total Resource Cost test and Participant tests. But in the draft document for post-2005 policies this changes to reliance primarily on the Total Resource Cost Test and the Program Administrator Cost (PAC) or utility cost test. For PAC costs are defined to include the costs incurred by the program administrator (including financial incentives or rebates paid to participants), but not the costs incurred by the participating customer. The purpose of the dual TRC and PAC test is to ensure that program administrators and implementers do not spend more on financial incentives or rebates to participating customers than is necessary to achieve TRC net benefits. This provision is similar to that expressed in Oregon's UM 551 and limits utility incentives for measures that pass TRC cost-effectiveness due to non-electricity benefits. Finally, the draft 2005 policy acknowledges exceptions to the dual (TRC and PAC) test including programs designed to demonstrate or commercialize promising emerging energy efficiency technologies or structurally change the marketplace.