ADDRESSING NON-ENERGY BENEFITS IN THE COST-EFFECTIVENESS FRAMEWORK

This paper was prepared by CPUC Energy Division staff, based on research provided by Ed Vine of the California Institute for Energy and the Environment.

1. Introduction

It is widely argued that there are benefits associated with and attributable to utility demand-side programs beyond direct energy savings. There are three classes of these non-energy benefits (NEBs) based on "beneficiary" or "perspective" (Skumatz et al. 2009). Participant NEBs accrue to the program participants (such as reduced building operating costs, increased value, comfort, health, and safety). Utility NEBs are realized as indirect costs or savings to the utility (such as bill payment improvements, infrastructure savings, etc.). Societal NEBs represent indirect program effects beyond those realized by ratepayers/utility or participants, and they accrue to society at large (such as job creation, tax receipts growth, labor productivity, housing value, neighborhood stability, and reduced emissions and other environmental benefits). This paper considers various methods for addressing NEBs in the CPUC's cost-effectiveness tests for demand-side resources.[1]

A cost-effectiveness test is a test designed to determine whether the benefits of a particular program (or measure, project, or portfolio of programs[2]) outweigh its costs. Cost-effectiveness tests are frequently expressed as a ratio of benefits to costs: a result of greater than one indicates that the benefits outweigh costs, while a result of less than one indicates the reverse. The cost-effectiveness of California utilities' demand side programs is measured using the tests defined in the California Standard Practice Manual (California Energy Commission and California Public Utilities Commission, 2001; hereafter SPM). The SPM describes several tests which measure cost-effectiveness from various perspectives, and the Commission uses various SPM tests to evaluate the utilities' demand-side resources. Those tests are the Total Resource Cost (TRC) test, which has the perspective of the utilities and all their customers, the Program Administrator Cost (PAC) test (the PAC is sometimes referred to as the Utility Cost Test, or UCT), which measures costs and benefits to the program administrator (which is generally the utility), the Ratepayer Impact Measure (RIM) test, which measures the impact on rates, and the Participant test, which looks at the perspective of participating customers[3].

The TRC is seen as having the broadest perspective (it is sometimes described as having

1The Commission is examining other cost-effectiveness issues, such as accounting for market transformation impacts of programs; so-called "spillover" that results when program participants and/or nonparticipants adopt measures without obtaining any customer incentive as a result of some exposure to the incentive programs (initially as they relate specifically to energy efficiency) in Phase IV of its energy efficiency proceeding (R.09-11-014). It should also be noted that this paper does not discuss other potential changes to the current cost-effectiveness framework such as avoided costs, discount rates, or measure lifetimes.

2 Unless specifically noted, we use the following terms interchangeably for this paper - measure, project, program or portfolio of programs – even though we know that there are differences when examined in detail.

3 While the California Demand Response Cost-effectiveness Protocols require calculation of all four SPM tests, a recent demand response decision (D.12-04-045) used only the Total Resource Cost (TRC) test to determine whether each demand response program was cost-effective. The energy efficiency portfolios are evaluated based on a dual test which includes both the TRC and the PAC tests. The Self-Generation Incentive Program uses both the TRC and the Participant Test. Finally, the California Solar Initiative cost-effectiveness evaluation considers all four of the SPM tests.

a "societal" perspective) in that it includes both the utilities and all its ratepayers. As such, discussions about adding NEBs to the cost-effectiveness tests often center on proposals to modify the TRC test.

Options for addressing NEBs in CPUC cost-effectiveness tests that are examined in this paper include:

- Quantifying and valuing NEBs and including them in the Total Resource Cost (TRC) calculation, which compares avoided energy costs (the benefits) to the total costs of the program, including both participant and utility costs (Section 2);
- Ensuring that NEBs and any costs associated with achieving them are excluded from the TRC (Section 3); and
- Using exclusively the PAC test – which uses the same benefits as the TRC but considers only costs paid by the utility – to evaluate CPUC demand-side program cost-effectiveness (Section 4).

Section 5 identifies (without elaboration) two other possible options for addressing NEBs – one via an adjusted TRC threshold and the other with the development of a societal test.

2. Quantification and Valuation of NEBs in the Relevant Cost-Effectiveness Tests

One option for addressing NEBs would be to include them in the TRC calculation. This section examines the relevant considerations that would need to be addressed to quantify and value NEBs in the TRC, including (a) relevant research into the quantification of NEBs, (b) the additional non-energy costs that may need to be factored into a test that includes NEBs, and (c) examples of including NEBs in cost-effectiveness tests.

An important consideration is that unlike other demand-side resource quantification and valuation efforts (which rely on a variety of tools including modeling, longitudinal bill analysis, and participant and nonparticipant surveys, on-site metering, utility and market costing and cost forecasts, and a host of other more rigorous quantitative methodologies), the quantification and valuation of NEBs rely largely on self-report via survey responses. The reliability of results based on self-report – particularly related to the monetization of qualitative benefits – is the subject of much debate, and the fact that NEBs have a high degree of variability across participants renders the reliable quantification of impacts particularly difficult.

Quantifying Participant, Utility, and Societal NEBs

Participants can realize a variety of NEBs from participation in demand-side programs. Some of the participant NEBs are due to subjective, non-material impacts, such as "increased comfort," while others – such as improved health or increased property value – are difficult to measure and monetize, although they can be quantifiable, using data from the Program Administrators (PAs), secondary data and algorithms found in the literature, and participant surveys (Amann 2006; NMR and Tetra Tech 2011; Skumatz et al. 2009 – see these references for a discussion of the different methods as well as a lengthy list of NEBs). When measured and monetized, participant NEBs have often found to be quite valuable, often exceeding the value of energy savings,[4] ranging from 50% to 300% of annual household energy bill savings (Amann 2006; NMR and Tetra Tech 2011; Skumatz et al. 2009).

A large share of the NEBs literature in the last decade has focused on bringing more maturity to the methods for measuring participant NEBs (Skumatz et al. 2009). Because these rely on self-report surveys, and represent "hard to measure" benefit categories (comfort, etc.), significant work was needed. More than a dozen measurement approaches with grounding in the academic literature have been studied, and work proceeds on trying to identify methods that are accurate, but also feasible to implement. Each method has pros and cons, and a few studies have compared the performance of different measurement methods. The main purpose of each is to develop monetized estimates of the indirect impacts that can be assigned to the program.

Participant NEBs have been applied to a wide variety of programs – including entire utility portfolios – and NEB results are available for a wide variety of initiatives in the residential, commercial, and multifamily sectors, as well as for renewable, real-time pricing, commissioning, and low-income weatherization programs. Studies of NEBs in these programs have found that the impacts were real, significant and merited continued analysis (Skumatz et al. 2009). The most common, highly valued NEBs varied somewhat by programs and measures. Highly valued residential NEBs tended to include comfort, operations and maintenance, ability to "do good" for the environment, and water savings. Highly valued positive effects for commercial programs tended to include comfort, operations/maintenance/lifetime, "doing good" for the environment, productivity, and performance issues.

In a recent review of participant NEBs for Massachusetts PAs (NMR and Tetra Tech 2011), the authors quantified the NEBs and assessed the *reliability* of the NEB values found in the literature and the extent to which they applied to the PA's low-income and residential programs. They also recommended NEB quantification methods that included deriving values from the literature, from engineering estimates and algorithms, and from data collection through surveys of program participants. They found that they could not recommend quantification for all NEBs for one of several reasons: (1) the NEB was too hard to quantify meaningfully; (2) quantifying the NEB would amount to double counting as the NEB was already accounted for; (3) there was insufficient evidence in the literature for its existence; and (4) the NEB was too intangible. However, they could recommend a long list of NEBs for the low-income and residential programs.

Utilities can also realize a number of NEBs from their energy efficiency programs in the form of financial savings (Skumatz et al. 2009; NMR and Tetra Tech 2011). Energy-efficient technologies often result in reduced energy bills for participants, which can decrease the likelihood that customers experience difficulties with paying their utility bills. In turn, utilities realize financial savings through reduced costs associated with arrearages and late payments, uncollectible bills and bad debt write-offs, service terminations and reconnections, bill-related customer calls, and the bill collections process. Furthermore, utilities may realize savings from their energy efficiency programs due to a reduction in safety-related emergency calls and reductions in energy that is eligible for a rate discount.

NMR and Tetra Tech (2011) found that nearly all utility NEBs resulted from programs targeted to low-income customers. Furthermore, these values were relatively low in value, typically ranging from less than a dollar to nearly $9 per participant. They also noted that utility

[4] Throughout this paper, when we refer to "energy savings" we are referring not only to energy saved by energy efficiency measures, but also demand reductions from demand response customers and energy generated by customer generation which "saves" the utilities from needing to procure it.

NEBs could be monetized relatively easily from the literature or from algorithms using inputs from the PAs. We are not aware of any regulators specifically including utility NEBs in the TRC.

Finally, the quantification of societal NEBs focuses primarily on environmental and economic impacts, as the remaining societal NEBs are sparsely reported and quantified (e.g., equity benefits or reduced societal disparity for low-income populations). In California, the cost-effectiveness tests used for all demand-side programs currently included an avoided cost of GHG emissions, based on the energy savings of each program. TRC tests that include the value of avoided carbon emissions and/or other avoided externalities are sometimes called "TRC plus C" or "enhanced" TRC tests (LeBaron 2011).

Non-Energy Costs

It is important to consider that, in addition to non-energy *benefits*, there are non-energy costs to consumers of demand side measures that may not always be included in cost-effectiveness calculations. Like non-energy benefits, non-energy costs may be incurred by participants, utilities, or all of society. In California, participant non-energy costs are already factored into Demand Response program cost-effectiveness tests, since those costs are considerable and make up the bulk of the costs of the Demand Response participants costs (most Demand Response programs do not require participants to install equipment).

For example, demand response participants experience significant non-energy costs both before a demand response event is called (e.g., developing a load-shedding plan) and during demand response events (e.g., productivity and comfort losses associated with reduced energy services). Because these costs are difficult to quantify, the CPUC current requires utility to estimate these costs as 75% of the incentives received by participants.

Energy efficiency and distributed generation participants may also experience non-energy costs. For example, two hard-to-quantify costs to the consumer of compact fluorescent light bulbs are the dim light some of them produce when first turned on and the need to dispose of them in special collection locations rather than throwing them in the garbage (due to the danger posed by mercury which they contain). These costs are not included in the participant cost calculation for energy efficiency programs, since it is generally assumed that consumers who install energy efficiency measures gain more from the non-energy benefits then they lose from the non-energy costs.

In California, non-energy costs that are incurred by utilities or by society are not currently included in the TRC calculation (except for GHG emissions and environmental permitting costs such as air and water quality permits embedded in other components of the tests). It is generally assumed that if these costs exist, they are very small. It is known that there are some societal non-energy costs in the form of environmental costs. For example, the mercury contained in compact fluorescents is a cost of Energy Efficiency programs. Other environmental costs are incurred by society if demand response customers use backup diesel generators during demand response events, or when birds are injured by wind turbines. However, these environmental costs are relatively tiny compared with the environmental benefits of the avoided energy and capacity associated with demand-side programs.

Examples of Including NEBs in Cost-Effectiveness Tests

In a recent survey of 41 states, 12 (or 29%) states indicated that they included NEBs in their cost-benefit tests (Kushler et al. 2011). Of those using NEBs, 7 states included water and other fuel savings, 2 reduced maintenance (Vermont and Washington), and one had a general adder (Colorado); no states included health, comfort, or improved productivity. Only 13 (or 32%) states indicated that they included environmental externality benefits in their cost-benefit tests, and another 5 states (12%) included "other societal benefits" (excluding environmental benefits) in their cost-benefit tests (Kushler et al. 2011).

In another recent review of selected states[5], NEBs were included in TRC calculations, usually as an "adder" to the benefits side (Daykin et al. 2011), as shown in Table 1.

Table 1. TRC Calculation Requirements in Selected States

State	Year	Non-Energy Benefits
Colorado	2008	10% adder (25% for low-income programs)
Iowa	1999	10% adder for electric; 7.5% adder for gas
Maine	2009	All quantifiable NEBs, including deferred replacement costs
Massachusetts	2009	All costs of complying with foreseeable environmental regulations
Oregon	2008	Carbon ($15/ton); 10% adder
Washington	2008	10% adder

Source: Daykin et al. 2011

Finally, British Columbia's Utility Commission Act on Demand-Side Measures Regulation (effective June 1, 2009) requires the TRC to account for NEBs in the following manner for each measure (British Columbia 2008; Muncaster 2011):

- Via quantification (i.e., acceptable evidence of the existence and size of the NEB), or
- Via a deemed adder for programs or measures where no quantification is available (for example, a program with $100,000 in energy benefits and a 15% deemed adder, has $115,000 in total deemed benefits).

In California, NEBs are calculated for Low Income programs, but are used in non-SPM cost-effectiveness tests which have been designed specifically for Low Income programs. NEBs are not currently included in any of the cost-effectiveness tests used for non-Low Income Energy Efficiency, or any other demand-side programs.

3. Removing All NEB-related Costs from the TRC Participant Costs

Another method for addressing NEBs in CPUC cost-effectiveness tests is to ensure that only costs or benefits related to energy savings are included in the TRC calculation, so that any participant costs associated with achieving NEBs are omitted and the TRC calculation becomes purely energy-related cost-effectiveness test. The CPUC currently attempts to separate the various elements of energy efficiency program participant costs. For example, if people who have their homes retrofitted are motivated to a large degree by benefits other than saving money on their utility bill, such as increased comfort, desire to be "green," and improved aesthetics, we attempt to calculate that portion of their retrofit expenditure which was incurred with the goal of achieving those particular benefits and take that portion of the project cost out of the TRC participant costs. This is the approach is taken in the calculation of "net-to-gross" ratios which

[5] **BC Hydro** and **New Hampshire** also use an adder to reflect all NEBs (Skumatz et al. 2009). And **New Mexico** allows avoided carbon emissions to be included in the TRC (personal communication with Howard Geller, Southwest Energy Efficiency Project, January 21, 2012).

measure the extent to which incentive programs *cause* participants to install energy efficient equipment, an analysis that is performed to eliminate "free-ridership" (the extent to which customers would have installed the equipment even in the absence of an incentive) from the cost-effectiveness calculation. The net-to-gross calculation may already be resulting in reasonably accurate accounting of the cost of California's energy efficiency programs and elimination of that portion of program costs that do not result in energy savings. However, the net-to-gross calculation may not be completely accounting for the costs associated with NEBs for energy efficiency programs, and is not currently applied to other demand-side programs.

In addition it has been recognized that it is important to only count the energy efficiency *incremental* costs to upgrade to higher efficiency models of the products the customer would have purchased without the program intervention in the TRC. Some states include "all costs regardless of who pays," and include all the costs of the equipment upgrade. This practice results in the inclusion of costs that are not affiliated with the energy efficiency decision. Similarly, labor costs should include only those costs, if any, associated with installing the more energy efficient version of a product (Hall 2012).

4. Substituting the PAC for the TRC

A third alternative for addressing the fact that NEBs are not included in the current TRC test would be to cease to use the TRC and rely solely on the PAC test. The TRC is intended to show whether and to what degree a program is cost-effective from the point of view of the ratepayers (program participants and nonparticipants) and the utility, so its cost includes full cost of the measure, paid by the participant and/or the utility. In contrast, the PAC uses the same set of benefits as the TRC, but its cost calculation only includes incentives paid by the utility and no participant costs (see Table 2 for the various components of the TRC and PAC tests).

Table 2. PAC and TRC Tests in California

Test	Benefits	Costs
TRC	• Avoided supply costs for transmission, distribution and generation • Avoided cost of GHG emissions	• Program administration • Measure costs (incremental equipment costs paid by participant, utility, or both)
PAC	• Avoided supply costs for T&D and generation • Avoided cost of GHG emissions	• Program administration • Incentives paid to participants.

Consider programs whose participant costs are much greater than any available incentives received (e.g., energy efficiency programs such as Energy Upgrade California, and demand response programs such as Permanent Load Shifting). These programs usually have much lower benefit-cost ratios on the TRC than on the PAC, but it may be that a portion of the participant cost included in the TRC is incurred not to obtain energy savings, but to receive NEBs. For example, utility customers may invest in whole house retrofits to receive additional benefits beyond energy savings that are not included in TRC calculations (reducing noise levels and temperature gradients throughout their homes, to be seen as "greener," etc.). To the extent that the TRC includes the full cost of the measure, then arguably all of the realized benefits – energy and non-energy – should also be included in the test. Since the PAC excludes the participant cost, using this test obviates the need to identify or quantify other potential benefits that the participant may be deriving from the measure.

Neme and Kushler (2010) also point out that using the TRC to determine the cost-effectiveness of demand side programs results in inconsistent treatment of energy reduction and some forms of customer generation resources, since the TRC attempts to include all participant costs, while other types of distributed generation resources that utilities procure (e.g., power purchased from CHP systems) do not include a payment for the customer costs. When procuring those other resources, what the regulator looks at is the 'price paid' for the resource. Similarly, the "cost" in the PAC is essentially the 'price paid' for the resource (via the incentive payment and program administration costs).

Replacing the TRC with the PAC may have certain advantages. The primary advantage is the relative ease of implementation. PAC benefit cost ratios are already routinely filed in CPUC proceedings which require cost-effectiveness analysis. Another advantage is that it is a simpler and less costly alternative to modifying the TRC.

However, there are some disadvantages to replacing the TRC with the PAC test. The PAC measures cost-effectiveness only from the utility perspective, and cannot fully account for many of the benefits (and costs) of demand-side programs, including those benefits which may provide customer motivation to participate in these programs, such as non-monetized environmental benefits. Also, if budgets are limited and only the most cost-effective programs within a certain budget range are to be approved, using the PAC rather than the TRC as a basis for decision-making may not result in the most optimal results, from a combined ratepayer and utility perspective. This would create a significant policy dilemma – if customers are willing to invest in a technology because they perceive there to be large non-energy benefits, is it necessarily good public policy to incentivize that investment?

The answer depends largely on who accrues those non-energy benefits – the customer, the utilities, or society as a whole. It may be difficult for the CPUC to determine under what circumstances ratepayer money should be used to provide incentives to those ratepayers who choose to participate in certain programs. In California, it is generally agreed that it is appropriate to use ratepayer funds to improve the health, comfort and safety of low income customers, but determining policies when higher-income customers are benefiting is likely to be more difficult.[6]

5. Other Options

There are several other options for addressing NEBs in cost-effectiveness tests that will not be developed in this paper but are worthy of mention. One is to simply lower the benefit-cost score needed to be considered cost-effective. This approach has the advantage of being simple to administer, but its disadvantage is that it is a blunt, simplistic solution to the problem. Each measure has its own unique list of hard-to-quantify benefits and costs, yet one number is used for all (and determining the correct number may prove difficult). This approach may also cause public confusion in that it appears to approve "failing" programs (i.e., programs with calculated net benefits of less than 1.0). This is similar to valuing NEBs, as discussed in Section

6 In a recent survey of 41 states on their use of cost-effectiveness tests (Kushler et al. 2011), the primary test used in those states was: TRC (29 states, 71%), Societal (6 states, 15%), UCT/PAC (5 states, 12%), and RIM (1 state, 2%). There are a few exceptions. In 2009, Utah required all programs to pass the PAC test, rather than the TRC – primarily for screening programs (Daykin et al. 2012). And in 2008, Michigan passed Public Act 295, adopting the PAC as the cost-effectiveness screening test.

2, except that this method avoids the expense associated with customer surveys and other research required to attempt to quantify the various NEBs.

Another approach would be to develop a societal test, as described in the SPM as a variation of the TRC test, that includes NEBs and uses a societal discount rate. This test would be available for decision-makers in addition to the TRC, which could still be refined as needed to ensure that it only costs and benefits associated with energy savings as described in Section 3, and the PAC.

6. Comparing the Different Options

Table 3 below provides a comparative example of a project analysis which considers the various alternatives discussed in this paper. The "TRC Participant Cost Adjusted" column takes into account decreased participant costs, based on an estimate that 50% of the benefits of the project were incurred for "non-energy reasons." The "TRC w/ NEBs" column adds an estimate of $6000 as the value of this participant's non-energy benefits. The "net benefits" row shows that, in this example, the project is considered cost-effective based on the PAC, or on a TRC which is adjusted either by adding NEBs or decreasing participant costs, even though the project would not be considered cost-effective using a traditional TRC test.

The difficulty with this analysis is, of course, the difficulty of estimating reasonable values for either participant NEBs or the participant's motivation for investment, especially for large programs involving many different types of participants. For example, in the table below, the 50% cost adjustment is applied to the total measure cost ($7,500) rather than only to the participant's out-of-pocket costs ($5000). Customer surveys have to be precisely worded and carefully interpreted to ensure that the resulting attributions are correctly understood and applied.

Table 3. Example of Fixes to TRC – Home Performance*

	Scenario	TRC Today	Participant Cost Adjusted TRC	TRC with NEBs	PAC
Costs					
Measure Costs	$7,500				
Rebate	33% - $2,500	$2,500	$2,500	$2,500	$2,500
Participant	67% - $5,000	$5,000	$5,000	$5,000	
Administration		$1,500	$1,500	$1,500	$1,500
Customer Attribution of Costs					
Energy Reasons	50%				
Non-Energy Reasons	50%				
Cost Adjustment	($3,750)		- $3,750		
Total Costs		$9,000	$5,250	$9,000	$4,000
Benefits					
Energy-Avoided Costs	$6,000	$6,000	$6,000	$6,000	$6,000

Non-Energy	$6,000			$6,000	
Total Benefits		$6,000	$6,000	$12,000	$6,000
Net Benefits		-$3,000	$750	$3,000	$2,000
		FAIL	**PASS**	**PASS**	**PASS**

*See Kushler (2011)

6. References

Amann, J. 2006. *Valuation of Non-Energy Benefits to Determine Cost-Effectiveness of Whole-House Retrofits Programs: A Literature Review*. Washington, DC: American Council for an Energy-Efficient Economy

British Columbia, Utility Commission Act. 2008. *Demand-Side Measures Regulation*, Nov. 7, 2008 (B.C. Reg. 326/2008). Available at: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_326_2008

California Air Resources Board. 2011. *California Air Resources Board AB32 Climate Change Scoping Document*. Available at: http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm

California Energy Commission and California Public Utilities Commission. 2001. *California Standard Practice Manual – Economic Analysis of Demand Side Programs and Projects*. San Francisco, CA: California Public Utilities Commission. Available at: http://www.energy.ca.gov/greenbuilding/documents/background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF

Daykin, E., J. Aiona, and B. Hedman. 2011. "Picking a Standard: Implications of Differing TRC Requirements," presented at the Association of Energy Services Professionals National Conference.

Daykin, E., J. Aiona, and B. Hedman. 2012. "Whose Perspective? The Impact of the Utility Cost Test," presented at the Association of Energy Services Professionals National Conference.

Hall, N. R. Ridge, G. Peach, S. Khawaja, J. Mapp, B. Smith, R. Morgan, and P. Horowitz. 2008. "Reaching Our Energy Efficiency Potential and Our Greenhouse Gas Objectives – Are Changes to our Policies and Cost Effectiveness Tests Needed?" *Proceedings of the 2008 AESP National Conference,* Association of Energy Services Professionals, Phoenix. AZ.

Hall, N. 2012. Personal communication between Ed Vine and Nick Hall, January 4, 2012.

Knight, B., L. Lutzenhiser, and S. Lutzenhiser. 2006. "Why Comprehensive Residential Energy Efficiency Retrofits are Undervalued," *Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, DC: American Council for an Energy-Efficient Economy.

Kushler, M. 2011. "Benefit-Cost Tests for Energy Efficiency: National Survey Results and Some Related Concerns," presentation to the NEEP Regional EM&V Forum, Annual Public Meeting, Oct. 12, 2011.

Kushler, M., S. Nowak, and P. Witte. 2011. *A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs (draft),* Washington, DC: American Council for an Energy-Efficient Economy.

LeBaron, R. 2011. *Getting to Fair Cost-Effectiveness Testing: Using the PAC Test, Best Practices for the TRC Test, and Beyond,* National Home Performance Council, Sept. 19, 2011.

Muncaster, K. 2011. "Demand-Side Measures Regulation," Demand-Side Measures Regulation Workshop, December 12, 2011.

National Action Plan for Energy Efficiency (NAPEE). 2008. *From Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy Makers*. Available at: http://www.epa.gov/cleanenergy/energy-programs/suca/resources.html .

Neme, C. and M. Kushler. 2010. "Is it Time to Ditch the TRC? Examining Concerns with Current Practice in Benefit-Cost Analysis," *Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, DC: American Council for an Energy-Efficient Economy.

NMR, Inc. and Tetra Tech. 2011. *Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation*. Madison, WI: Tetra Tech.

Skumatz, L., M. Khawaya, and J. Colby. 2009. "Lessons Learned and Next Steps in Energy Efficiency Measurement and Attribution: Energy Savings, Net to Gross, Non-Energy Benefits, and Persistence of Energy Efficiency Behavior," available at: http://uc-ciee.org/energyeff/energyeff.html.

Vine, E., N. Hall, K. Keating, M. Kushler, and R. Prahl. 2010. "Emerging Issues in the Evaluation of Energy Efficiency Programs: The US Experience," *Proceedings of the 2010 International Energy Program Evaluation Conference*, Paris, France.