

# NON-ENERGY BENEFITS IN THE RESIDENTIAL AND NON-RESIDENTIAL SECTORS – INNOVATIVE MEASUREMENTS AND RESULTS FOR PARTICIPANT BENEFITS

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## ABSTRACT

Two studies were recently completed that quantified the non-energy benefits (NEBs) from a variety of different DSM programs and used innovative methods to measure previously un-estimated NEBs from the participant perspective. The projects covered single- and multifamily programs, as well as a commercial/industrial program. As part of the work, the authors developed program-specific (and customer class-specific) NEBs in 20 categories covering “utility/ratepayer benefits”, “participant benefits”, and “environmental benefits”.

In particular, this paper focuses on one aspect of this research –valuing the participant side benefits. Although many authors have speculated about comfort, noise, productivity, and a wide variety of other customer benefits from programs, the authors found that there was no information available valuing these benefits. This paper presents the results of an innovative survey approach developed and pioneered by the author that was used to develop quantitative estimates of this segment of participant-side NEBs from programs and presents results on the quantitative benefits *as perceived by customer/participants* from a variety of program features and measures.

The results show that for residential programs, the value of participant benefits outweighs the energy savings for a number of measures. The results vary by measure and sector. On the commercial side, we were able to move beyond “case studies” and used data from almost 100 participants to estimate benefits. We found participant benefits from productivity, improved workplace aesthetics and other benefits were valued highly by participants, adding significant value to the programs from the customer point of view. Additional work is being conducted to refine the technique and the estimates.

## Introduction

Although a number of sources in the literature address non-energy benefits in a conceptual way--usually itemizing the list of topics that might qualify as non-energy benefits--few have conducted applied research and developed quantitative estimates to identify the size of these benefits. Certainly, for a number of years, programs have been approved on the basis of energy benefits alone. However, recent changes in industry avoided costs and increased interest in market transformation are leading to an increasing attention on incorporating what was always a logically appropriate component of the benefits and cost analysis --non-energy benefits.

Understanding the magnitude of all program benefits, including non-energy benefits, can help utilities maximize overall benefits from a particular program, or help select between alternative programs, holding program costs constant. By identifying all program benefits—not only to the utility, but also to customers and society—utilities (and policymakers) can conduct more complete benefit cost analyses, can develop programs that improve service to customers by maximizing benefits from programs, and can emphasize the benefits of those services to customers.

In previous work by the authors (Skumatz and Dickerson, 1997, 1998, and 1999),<sup>1</sup> we developed an approach that assessed several dozen categories of non-energy benefits (NEB), sorted into three broad categories or perspectives:

- Utility, or ratepayer: we estimated the benefits from a much broader array of benefits categories than other work (beyond arrears), including reduced liabilities, fewer customer service calls, and many others.
- Participant: the work took the “next step” and developed quantitative estimates of the non-energy benefits accruing to program participants, including health and safety, comfort, economic, housing stock, and a wide range of other benefits.
- Societal: a combination of literature from related fields and primary research was used to “triangulate” on estimates of the societal benefits, including environmental and job benefits, from the range of DSM programs covered in the projects.

Table 1 shows the list of categories of benefits included in these three perspectives. In previous articles, we addressed findings associated with all these categories of benefits, but provided only preliminary information on the last benefit listed (quality, comfort, etc.). The estimates of residential program NEBs – utility-side, societal, and a portion of the participant benefits – can be found in these previous studies. In addition, the previous studies examined the value of participant benefits from fewer terminations, fewer evictions, and other utility savings. This paper summarizes only that portion of the work that developed estimates of what we call here the “*comfort/productivity*” portion of participant side benefits.

## Residential Programs Evaluated

The programs analyzed covered an assortment of audiences and program types. Information on programs offered between 1994 and 1998 were modeled to compare the relative non-energy benefits between different types of programs. Residential programs for the single and multi-family sectors included:<sup>2</sup>

- Refrigerator Rebate Program: This program offered residential customers rebates when they purchased a new energy efficient, CFC-free refrigerator that exceeded Federal Appliance Standard. The program also included a smaller effort that provided incentives directly to salespersons.

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<sup>1</sup> And a very detailed literature review on NEBs is included in several of these previous studies.

<sup>2</sup> In another project, we also examined the non-energy benefits associated with a non-DSM program called “REACH”, a program that provides bill-payment assistance to low income customers “in crisis”, and is funded by shareholder contributions.

- **Air Conditioner Rebate Program:** This program offered rebates for the purchase of high efficiency central air conditioners.
- **Lighting Rebate Program:** This program offered rebates for purchases of efficient lights for common areas of multi-family buildings.
- **Financing Program:** A pilot residential third-party low interest loan program designed to address price-related barriers to high efficiency measures for single-family dwellings.
- **Venture Partners Pilot Program (VPP):** A pilot low-income weatherization and education program.
- **Low Income Weatherization Program:** A program offering free weatherization of homes, energy education services, and energy efficient refrigerators. Mandatory weatherization efforts include attic insulation, water heater blankets, energy efficient showerheads, door weather-stripping, caulking, and minor home repairs that affect infiltration. Non-mandatory measures were also offered through the program.

**Table 1. Categories of Non-Energy Benefits Included in the NEB Analyses**

Utility or Ratepayer Benefits	Societal Benefits	Participant Benefits
<p><b>Bad debt/credit</b></p> <ul style="list-style-type: none"> <li>• Reduction in size of bad debt written off</li> <li>• Decreased number of bad debt accounts written off</li> <li>• Fewer notices</li> <li>• Reduced customer calls</li> <li>• Fewer shutoffs and reconnections for delinquency</li> <li>• Reduced collection costs</li> <li>• Carrying cost of reduction in arrearages</li> </ul> <p><b>Gas Emergency Items</b></p> <ul style="list-style-type: none"> <li>• Reduction in emergency gas service calls</li> <li>• Reduction in flex connector replacements</li> <li>• Fewer emergency calls from flex connectors</li> <li>• Utility self insurance savings</li> </ul> <p><b>Other</b></p> <ul style="list-style-type: none"> <li>• Transmission and distribution savings</li> <li>• Rate subsidies avoided</li> </ul>	<p><b>Economic and Environmental</b></p> <ul style="list-style-type: none"> <li>• Health and safety</li> <li>• Other externalities</li> <li>• Economic impact (direct and indirect employment)</li> <li>• Environmental preservation</li> </ul> <p><b>Water and transfer payment savings</b></p> <ul style="list-style-type: none"> <li>• Water and wastewater (avoided)</li> <li>• Reduced public transfer savings (unemployment)</li> </ul>	<p><b>Fewer Service terminations</b></p> <ul style="list-style-type: none"> <li>• Value of service</li> <li>• Cost to re-start</li> <li>• Lost rental value</li> </ul> <p><b>Associated benefits from lower bills/lower evictions</b></p> <ul style="list-style-type: none"> <li>• Housing stock (reduced evictions, health, fire)</li> <li>• Housing stock value, neighborhood preservation</li> <li>• Reduced mobility / education /income losses</li> </ul> <p><b>Other utility savings</b></p> <ul style="list-style-type: none"> <li>• Water/sewer savings (some measures)</li> </ul> <p><b>Comfort, health, quality, and other benefits</b></p> <ul style="list-style-type: none"> <li>• Fewer illnesses</li> <li>• Reduced transactions costs (limited measures)</li> <li>• Quality, comfort, aesthetics, productivity, and other participant-side non-energy benefits<sup>3</sup></li> </ul>

<sup>3</sup> These benefits are addressed in more detail in the following sections of the paper.

## **Commercial/Industrial Program Evaluated**

The authors evaluated a commercial and industrial program that offered a joint audit program – covering energy and water measures. This program was called the Operations Resource Assessment Program (ORA). The audit was followed up with a report including recommended retrofit or O&M changes that would lead to savings for the customers, and an action letter. The utility also offered financial assistance for some of the recommended modifications. The program offered a wide range of possible measures, including HVAC and duct systems, air compressors, lighting, water deduct meters, VSDs, power factor recommendations, insulation, metering, refrigeration systems, and numerous other capital and O&M measures. As part of the program evaluation, SERA conducted interviews with more than 100 participants, examining satisfaction, measures implemented, reasons for not implementing measures, and many other questions. As a special add-on to the project, SERA undertook to develop an estimate of the participant side benefits realized from the program. This would provide a more complete view of the overall benefits from the program, and could provide information for the utility to better target and market the program in the future.

## **Estimating Participant Side Benefits**

Based on our previous work in NEBs, we determined that the participant-side benefits were an area that had significant potential for additional benefits. However, in our review of previous research work, we found this area had been virtually unstudied. We found virtually no work on the residential side examining this issue beyond the conceptual stage – listing hypothetical lists of types of benefits. On the commercial side, we found several interesting papers that had developed estimates of productivity increases for specific programs in individual firms. The research summarized here provided an opportunity to develop valuations from a larger number of participants and variety of measures and program types.

In our previous modeling efforts for the Venture Partners Pilot (VPP) program (Skumatz and Dickerson 1997, 1998, 1999), we attempted to estimate the impacts from a few important categories of participant benefits using “reasonable” assumptions, for the current study, we were interested in exploring possible ways to develop more refined estimates of important auxiliary participant benefits.

## **Developing Innovative Alternatives to “Willingness to Pay”**

Arguably the most direct method of assessing the value of non-energy benefits to customers would be to ask them directly. However, the most direct form of the question (e.g., “what is the dollar value of the reduction in drafts in your home after it was weatherized”) can be difficult for program participants and residents to answer and can lead to unreliable results. This is a “willingness to pay” approach, and there is considerable literature establishing the validity, usefulness, and constraints of this approach (Mitchell and Carson, 1989). However, on a practical side, we find customers have difficult times assigning dollars to softer types of benefits. It can be a difficult concept for customers to grasp, and when administering surveys, respondents often seem to be “guessing” at specific dollar figures.

The authors were concerned that potentially valuable benefits were being unrecognized. As a result of this concern, SERA, Inc. developed an innovative approach for obtaining customers' self-reported valuation of non-energy benefits that we hoped would be easier and more reliably answered by participants. We found promising results. Our basic idea was to ask customers to characterize the value of the non-energy benefits *relative to* the energy savings on their monthly energy bill.

We found that customers were quite willing to talk about these benefits and were readily able to answer our questions about relative values. Because we had estimates of the average bill savings from each of the programs, we could then attribute a dollar value to the non-energy benefits after the fact. This approach seemed to get past the customer barrier of having to assign a specific dollar to any kind of benefit, but particularly to these types of softer benefits. This approach opened the door to discussions about the measures, the positive and negative aspects of program actions, and provided benefits that we could readily translate to dollar amounts.

### **Data Gathering and NEBs for Residential Participant Benefits**

As a first step, we reviewed the literature on benefits and assembled a list of possible comfort/productivity benefits that had been previously mentioned or hypothesized for each measure included in the programs. Then, we added a number of potential benefits that we believed might arise in interviews. These were used as the possible pre-coded responses. We also left many blanks so we could record customer responses that didn't fit into the pre-coded categories. This was put in a spreadsheet format that was used to guide the interviews and perform the calculations.

A sample of participants from each of the studied programs was contacted by telephone. As a first step, respondents were asked to enumerate the non-energy benefits they recognized from the program, then asked whether they valued that benefit *more than or less than* the bill savings benefit from the program. Then, for each of the benefits they mentioned plus a list of 30 benefits we had prepared ahead of time, we asked respondents to tell us "*how much more [less] valuable*" they felt the benefit was to them than the bill savings they experienced (or expected) as part of the program. These answers gave us a specific value multiplier to use in the non-energy benefits model (e.g., "about half as valuable as the bill savings," or "about three times as valuable as the bill savings," "about the same as the bill savings," etc.<sup>4</sup>) As a final step, we asked whether, in total, the non-energy benefits associated with the specific measure were more valuable, less valuable, or about the same value as the energy savings. This last item let us "scale" responses if customers provided a higher sum through the individual items.

We also asked respondents a question about the relative *importance* of each of the "comfort/productivity..." benefits. We reviewed the list of benefits and for each item asked respondents to indicate how important the benefit was to them on a scale of 1-5 (with 5 being a very important benefit). Totaling these numbers enabled us to develop a "score" for each

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<sup>4</sup> We only asked residents to get as specific as "about the same", about half again as valuable, about  $\frac{3}{4}$  as valuable, etc. and then ran the numbers past them. This approach only required residents to get as specific as we felt they could be on this type of issue (we wouldn't expect an answer like 37% as valuable!) and so individual responses were answers like 100%, 125%, 50%, 25%, etc. Average were then calculated from these values, and we rounded these averages in this paper.

type of benefit and to compare the relative importance of the benefits associated with each program. Following a similar procedure, we also asked about negative effects of the program, which were usually “none”, but did provide a few interesting comments. We completed a total of almost 100 surveys with program participants, allowing us to develop preliminary estimates of participant-reported value of these “comfort/productivity” NEBs.

The survey but illustrated some of the benefits that residents recognized from these programs, and provide preliminary quantitative estimates of participant-side benefits to use in the model. Our list included many dozens of possible benefits for each measure, many of which were mentioned at least once by one or more respondents. The types of benefits reported most frequently by respondents (in decreasing order of mention) are summarized in Table 2.

**Table 2. Residential Participant-Side Non-Energy Benefit Categories By Type of Measure or Program** (Source: Skumatz Economic Research Associates, Inc. surveys)

Central A/C	Window measures	Refrigerators	Weatherization Measures	Multifamily Lighting
<ul style="list-style-type: none"> <li>▪ Higher value in house, house nicer</li> <li>▪ More features, bigger, faster</li> <li>▪ Save money, lower bill, use less energy</li> <li>▪ House less drafty – more comfort</li> <li>▪ Quieter</li> </ul>	<ul style="list-style-type: none"> <li>▪ Higher value in house / house nicer</li> <li>▪ Save money / lower bill / use less energy</li> <li>▪ Feel good about environment</li> <li>▪ House less drafty / more comfort</li> <li>▪ May not have to move</li> <li>▪ Less worried about bills</li> <li>▪ Easier to clean</li> <li>▪ Windows now open and didn't before</li> <li>▪ New coatings reduce upholstery fading</li> </ul>	<ul style="list-style-type: none"> <li>▪ More features, bigger</li> <li>▪ Save money / lower bill, use less energy</li> <li>▪ Quieter</li> <li>▪ Kitchen nicer</li> <li>▪ Expect less repair</li> <li>▪ Environmental</li> </ul>	<ul style="list-style-type: none"> <li>▪ Insulation was ranked in order with less drafty, environmental, save money, and higher house value.</li> <li>▪ CO monitors – very strong feelings of improved safety</li> <li>▪ Weather-stripping and caulking: greater comfort and fewer drafts, quieter</li> <li>▪ Greater awareness / learned strategies from weatherization programs</li> <li>▪ Lower bill</li> <li>▪ Better water flow from new bath/faucet replacements</li> </ul>	<ul style="list-style-type: none"> <li>▪ Building is nicer</li> <li>▪ Replacing less frequently</li> <li>▪ Better safety was ranked with high value (especially in common areas)</li> <li>▪ Bill savings was ranked high by this sector</li> <li>▪ Environmental benefits</li> </ul>

When interviewing residents and owners to gather information on their estimated NEBs, we found that for HVAC measures, several interviewees were invalids and valued comfort very highly. We also asked customers if they had experienced negative effects from the programs or measures. The vast majority of respondents reported no negative impacts. Those that were reported are enumerated in Table 3. Refrigerators elicited the majority of comments.

### Non-Residential (C/I) Data Collection Efforts and NEB Categories

These questions were asked as part of longer telephone interview that were addressing a range of topics, including:

- Satisfaction with specific program elements,
- Program strengths, weaknesses, and suggested enhancements,
- Decision-making issues,
- Measures implemented as part of the programs, and outside the program, and
- Reasons for not implementing measures,
- Costs and assistance received for each measure implemented, and
- A variety of other questions.

**Table 3. Residential Participant Reports of Negative NEBs** (Source: Skumatz Economic Research Associates, Inc. surveys)

<p><b>Refrigerators</b></p> <ul style="list-style-type: none"> <li>• Not delivering savings promised</li> <li>• Noisy, or icemaker is noisy</li> <li>• Smaller, not as good as old machine</li> <li>• Exterior material doesn't seem as strong as old metal</li> <li>• Doesn't fit in the space</li> <li>• Have to bend a lot to use refrigerator because freezers on top are larger than before</li> <li>• Cold spots in the back</li> <li>• Freezer light freezes "off"</li> <li>• Machine too tall to clean the top easily</li> <li>• Side by side hard to store things in and "boxes you in"</li> </ul>	<p><b>HVAC</b></p> <ul style="list-style-type: none"> <li>• Bill went up</li> <li>• Not delivering savings promised</li> <li>• Noisy</li> </ul> <p><b>Windows</b></p> <ul style="list-style-type: none"> <li>• Contractors didn't finish on time</li> </ul> <p>Majority listed no negative comments</p>
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Because it was part of a longer survey, the time that could be allocated to the special added section on participant benefits was relatively short. Therefore, we were not able to ask about the value of each type of benefit associated with each measure installed; rather, for each measure installed, we asked the participant to:

- Enumerate the list of non-energy benefits they felt they received/ realized in association with the measures
- Tell us whether the sum of all the non-energy benefits was more valuable or less valuable to them than the energy savings for the measures. We then asked them to assess how much more or how much less valuable the NEBs were, using multipliers.

In the case of the commercial/industrial benefits, each participant had relatively reliable and convenient estimates of the level of energy benefits expected with each measure. This was provided in the detailed report each participant received enumerating expected costs and savings for each recommended measure. Therefore, in the non-residential case, the link between value of energy savings and NEB value would be even closer to the respondent's consciousness than the residential estimates.

Commercial and industrial participants were surprisingly willing to provide feedback on the non-energy benefits that they received from the variety of operational and capital measures implemented over the course of the last two years. These results are summarized in Table 4.

Other measures were also addressed, but fewer were installed, so their results are not separately reported here. However, many of the same types of benefits were mentioned for variable speed drives and other equipment.

**Table 4. Commercial / Industrial Participant-Side Non-Energy Benefit Categories By Type of Measure** (Source: Skumatz Economic Research Associates, Inc. surveys)

Lighting measures	HVAC measures	Water measures	Refrigeration
<ul style="list-style-type: none"> <li>• Better lighting</li> <li>• Safety/security</li> <li>• Lower maintenance</li> <li>• Improved work environment</li> <li>• Better aesthetics</li> <li>• Reduced glare, eyestrain</li> <li>• Improved productivity</li> <li>• Better control</li> <li>• Other</li> <li>• No extra benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Lower maintenance</li> <li>• Longer equipment lifetimes</li> <li>• Greater comfort</li> <li>• Better air quality, airflow, quality</li> <li>• Better productivity</li> <li>• Higher tenant satisfaction</li> <li>• Better aesthetics</li> <li>• Better control</li> <li>• Environmental benefits</li> <li>• No extra benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced water losses and bills</li> <li>• Greater efficiency and control of water use</li> <li>• Reduced over watering of landscaping</li> <li>• Labor savings</li> <li>• Better aesthetics</li> <li>• Greater tenant/ guest satisfaction</li> <li>• Better water flow</li> </ul>	<ul style="list-style-type: none"> <li>• Lower maintenance</li> <li>• Longer equipment lifetimes</li> <li>• Reduced noise</li> <li>• Greater control of equipment, temperatures, etc.</li> <li>• Greater product life, lower losses of product</li> <li>• Reduced water use</li> <li>• Better aesthetics</li> </ul>

#### Value of Participant-Valued Non-Energy Benefits

The savings estimates from the participant assessments are presented in Table 5 below. The results are presented as percentage multiples to be applied to energy savings from the programs. Multiplying by the energy savings for the measure provides an approximation of the participant value of the comfort, and as potential extra value in dollar terms. The benefits are presented generally by measure, not by program, so they can be added or not as programs include or exclude particular measures. The models we developed allow us to adjust the savings based on the percent of customers receiving particular measures in the programs.

**Table 5. Estimated Value of Participant-Reported Non-Energy Benefits – Extra NEB Value as a Percent of Energy Savings from the Measure** (Source: Skumatz Economic Research Associates surveys)

End Use	Commercial	Residential
HVAC	100%	120%
Window measures	-	110%
Refrigerators	25%	100%
Washers	-	50%(small sample*)
Weatherization	-	60%
Lighting	40%	100% (multifamily only)
Education, associated with measure programs	-	10%(small sample*)
Water measures (comm'l)	60%	-
Overall measures—all end uses	50%	-



The results of the interviews made it clear that customers recognize a significant non-energy value to the measures implemented – beyond those traditionally recognized by program planners and regulators.

We find that the estimates by residential customers were consistently higher than those provided by commercial/industrial participants. There may be several reasons for this result. The commercial study was completed after the residential one, and our techniques and clarifications with the customers had improved somewhat.

Another difference is that the commercial customers had ready access to estimates of the dollar value of the estimated energy savings from the measures; in fact, most had the report in their hands as they had just been asked other questions about the proposed and implemented measures. The residential customers did not, and many may have been unaware of the savings from particular measures or programs. The values reported by participants may be influenced by whether or not they have a recollection of the dollar size of energy savings. Some may feel this is a concern, and we are planning to revisit and test this on the residential side. However, if dollars are used as the ultimate unit into which all values are translated, and if we know the value of the energy savings to the customer in bill savings (even if the customer doesn't), and if the customer feels comfortable reporting the relative value they place on comfort benefits relative to the energy savings, the value should be a relatively appropriate estimate, regardless. However, as we mentioned, we are testing whether differences arise in the field.<sup>5</sup>

Finally, it may be that the values are different. Residential customers may be less bottom-line oriented than commercial businesses and/or they may place higher value on these comfort benefits.<sup>6</sup>

### **Variability in Responses and Other Issues**

Customers were very willing to respond to these questions, and we were able to keep their focus throughout our battery of value-related questions and requests for problems (or “negative benefits”). On the residential side, there was some variation in the ranges of benefits assigned to specific measures. We found that those homes with invalids (we had several in our sample) tended to value the comfort /draftiness and temperature control aspects of HVAC systems more highly than other customers. There were several customers who reported exorbitant values from some of the measures. We had one multifamily building report that the safety aspects of the lighting were worth “100 times” the savings (even after we pressed for another value). Another thought the HVAC system benefits were 10 times more important than the savings.<sup>7</sup> Excluding these responses, the greatest variation came from HVAC (.2 to 3 times the value) and window measures (1-4).

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<sup>5</sup> One reviewer also suggested that the results might differ by average bill savings or bill amount. This is an interesting hypothesis, but we did not have customer bill information to conduct this analysis. It would be an interesting exploration for future work.

<sup>6</sup> This may especially be true for segments with invalids, etc. A few of these were captured in our surveys.

<sup>7</sup> In these types of cases, we assigned their multiplier value as equal to the next highest value in calculating the averages.

We provided an opportunity for customers to value individual benefits, but the categories they provided were not always clearly exclusive of other benefits.<sup>8</sup> For that reason, the numbers used in this paper are based on their responses to the final question – overall, what would you say was the relative value of the total of NEBs compared to the energy savings. This approach should have reduced the problems associated with double-counting individual benefits.

### **Effects on Assessment of Program Costs and Benefits**

**Residential.** These participant “comfort/productivity” benefits represent significant value when translated into dollar terms. Depending on the program, we found these values ranged from about \$10 to more than \$80 to the customers. Presumably, since these benefits do not go away,<sup>9</sup> these would translate to annual benefits.

Detailed estimates of the NEBs from each of the roughly 30 categories were computed for each of the single- and multi-family programs of interest and were presented in other work (Skumatz and Dickerson, 1999). Included in these estimates were participant side benefits above and beyond these “comfort/productivity” benefits, such as savings from reduced mobility, fewer disconnection hassles, among others. We find the following effects on total NEB values and computations by including these additional participant benefits:

- Added 60% to more than 100% to the previous estimates of participant side NEBs, depending on program.
- Consistently represented between 20% and 30% of the total NEBs for the programs modeled, combining societal, utility, and participant perspectives.
- Led to significant improvements in overall payback calculations when all benefits were included.

**Commercial/Industrial.** Seattle City Light staff prepared a detailed analysis of program energy and water savings, and a detailed payback analysis of the ORA program (Coates, Pearson, and Skumatz, 2000). Using these figures, we find the following dollar effects from the inclusion of these types of NEBs.

- Estimated NEB savings from the program in terms of value to the customers were on the order of \$170,000 per year, or \$2.7 million over the measure lifetimes.

### **Marketing and Transformation**

This work is especially important because it provides evidence on those non-energy factors that participants value most from these programs and measures. In previous survey

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<sup>8</sup> As one reviewer pointed out, air conditioning benefits reported included “higher value in house, nicer house”, which seemed to incorporate many of the other comments. However, generally, customers assigned values either to the encompassing comment, or to the individual components of that benefits, not both. In addition, we asked them to value their overall perception of (all the) non-energy benefits relative to energy savings, and these are the numbers used in this paper. This step should have excised this double-counting issue.

<sup>9</sup> Although they may decay as measures begin to leak or become noisier over time, which might lead us to reduce the value of the benefits over time. However, the energy savings tend to similarly decay, so the multiplier values may remain appropriate.

work, we found that market actors (e.g. contractors) insist that customers “don’t buy efficiency”. Instead, they buy services and other things. It may well be that “efficiency” is not something that some customers are very interested in buying – and this survey showed a number of features that they recognize that they did buy. Speaking in participant value language – comfort and noise on the residential side and aesthetics, productivity, maintenance, and workplace quality on the commercial side – may resonate much more highly with customers. Although they may receive many of these benefits whether or not they pick efficient models, it may be important to emphasize that efficient models bring all these benefits *along with* the energy savings.

In addition, de-emphasizing “efficiency” in marketing programs, and instead focusing on some of the benefits categories identified as important in this research may be a useful tool in helping convince participants to upgrade equipment – especially when the equipment isn’t yet broken. Efficiency may sell “green” customers, but some businesses may be much more swayed in their decision-making by factors like maintenance and breakdown issues, product losses, etc. Again, all new equipment brings these savings, but showing total savings from the customer’s point of view using some of these comfort/productivity multipliers and adding the energy savings as well may help make the case more fully to decision-makers.

The research also gives service providers with information that can help in program marketing and customer retention. They can emphasize these benefits when they market the programs, can design the mix of measures to maximize benefits at a fixed program budget, and can target programs to those customers that might gain greatest benefits. The work also helps provide an estimate of the value of additional services provided to customers.

## Summary

This specialized research fills in one of the gaps in the assessment of non-energy benefits for DSM programs. For some time, program planners have asserted that customers gain benefits from the programs that go beyond the direct energy savings (e.g., greater comfort, improved features, lighting quality issues, etc.),

In the residential sector, comfort-related benefits were cited, and on the commercial side, a few studies have indicated there may be productivity and workplace benefits. However, few studies estimated the value of these benefits.

In this research, efforts were made to move beyond “conceptual” lists of benefits. SERA developed and applied an innovative approach to deriving measures of these benefits, and estimated the participant benefits for a variety of programs covering single-family, multi-family, and commercial/industrial customers.

The research demonstrates that important benefits accrue not only to the utility and its ratepayers, but the results indicate that participating customers realize large benefits above and beyond the basic energy savings they enjoy from programs. These revised and total NEB impacts can be examined from the utility / ratepayer, participant, or societal perspective, and the effect on program payback and other metrics is high.<sup>10</sup>

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<sup>10</sup> The primary purposes of this exploratory work were to identify whether the approach could work, and to develop orders of magnitude or better estimates of the value of these types of benefits to customers. The level of the reported value to customers is high, and even if the estimates are reduced to be conservative (since we did not have very large sample sizes), the dollar value to customers is significant.

These benefits could potentially play an important role in program targeting and outreach. Rather than continuing to focus on “efficiency” in marketing efficient measures and programs, the marketing might instead focus on those features that are highly valued by the participants themselves, and mention efficiency as an additional bonus. This may be more effective in achieving turnover to efficient equipment.

In addition, the estimates provide useful information for program design and targeting. The work, and the scenario and modeling approaches described for the programs can be used to optimize programs by examining program design alternatives to maximize benefits to customers,<sup>11</sup> keeping program costs constant.

Finally, based on the results of the estimation process, we have identified areas that we are pursuing in continuing work in this area of NEBs. As part of the remaining project efforts, we are focusing on:

- Refining the survey approach and refining the customer participant survey to test different versions of the valuation to variations in the way in which the questions are phrased.
- Testing whether residential valuation responses would vary if customers were provided with average dollar values for savings from the measures.
- Modeling additional programs, including education/information programs.

This survey approach showed good promise for getting reasonable estimates of comfort/productivity benefits – in both residential and commercial/industrial sectors. Customers seemed to be comfortable providing “relative” values, and we can “benchmark” by using the average energy savings for the program participants. The value of the benefits is significant, and makes it clear that customers see good benefits from these programs that go well beyond the energy savings.

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<sup>11</sup> Or the utility could work to maximize combined benefits to society, the utility and participants if these results are combined with the estimates of benefits from other perspectives presented in previously published work (Skumatz and Dickerson, 1999)