Incorporating Non-Energy Benefits into Cost-Effectiveness Screening: The Vermont Story

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ABSTRACT

Non-Energy Benefits (NEBs)—the positive side effects from saved energy—have long been recognized as valuable byproducts of energy efficiency programs.[1] However, many utility and governmental jurisdictions do not consider these benefits when they screen energy efficiency measures for cost-effectiveness. In February 2012, the Vermont Public Service Board issued an order requiring new cost-effectiveness screening measures for Vermont's energy efficiency programs. This order specified an NEB adder, essentially a factor that acknowledges a measure's value beyond energy savings alone, in cost-effectiveness screening for both thermal and electric energy efficiency programs. The order also specified a further adder to be applied to energy efficiency measures used in low-income programs. This paper examines the Vermont proceeding with regard to potential factors that contributed to this policy change including a growing body of NEB research, incorporation of NEBs into screening in other jurisdictions, and collaboration between different groups to support this change.

Introduction

As energy utilities and regulators continue to place greater emphasis on energy efficiency services in the utilities' portfolios and in utility scale efficiency programs, can research influence the extent to which the less tangible benefits of energy efficiency are counted? With energy efficiency expenditures nationwide now at $7 billion annually (National Housing Trust et al, 2013), what are the real costs of saved energy to ratepayers, and to what extent do real benefits offset those costs? Answers to these questions rest with policy-makers who must decide the validity of efficiency practitioners' claims that resource benefits accrue whenever an efficiency measure is installed. The costs are essentially clearly understood, but the benefits are not.

Nevertheless, policy has changed in some jurisdictions to embrace the concept—and the value—of benefits that are not related to energy savings only. These non-energy benefits (NEBs) have begun to emerge as a way for regulators to apply new thinking about the real cost-effectiveness of energy efficiency. But what drives this kind of policy change? Is there solid research that can inform regulators of the circumstances under which valuated NEBs apply? To the extent to which there might be a domino effect throughout the industry when a single regulatory body adopts a new approach to measuring cost-effectiveness of energy efficiency measures, what factors other than research have played a role?

Non-Energy Benefits (NEBs) are the positive side-effects of energy saved in energy efficiency improvements. Elements like comfort, safety, aesthetics, health, convenience, and economic benefits (beyond energy savings) are often decision-drivers for efficiency program participants (McHugh et al. 2002). But they are often not included as a value in cost-effectiveness screening or program evaluation.

[1] NEBs are sometimes referred to in literature as *Non-Energy Impacts (NEIs), non-energy effects, indirect effects, external benefits, omitted effects, co-benefits, non-resource benefits, ancillary benefits, externalities,* or *Other Program Impacts.* Several of these terms omit the word *benefits* to account for both positive and negative impacts resulting from an efficiency program or measure. This paper refers to *Non-Energy Benefits (NEBs),* because it is the term most widely used historically to recognize energy efficiency effects that are not related to the initial energy efficiency intentions of the program. Also, most of the effects are generally positive, so the term *benefit* is sufficiently accurate to describe the overall effects of these factors.

In 1990, the Vermont Public Service Board established cost-effectiveness guidance for efficiency investments made by utilities with ratepayer funds in Docket 5270, an Investigation into Least-Cost Investments, Energy Efficiency, Conservation, and Management of Demand for Energy. In this docket the Board adopted the Societal Cost-effectiveness Test, which contains monetized benefits from effects of externalities. The Board made this the primary test, because it helps capture benefits beyond energy savings to society as a whole (EPA). Also in this docket, the Board set a 5% environmental externality benefit and a 10% risk adjustment (Vermont Public Service Board, 1990, Docket 5270 at Module 4).

Although this environmental externality addressed that type of NEBs to a small extent, this value did not take into account a myriad of other NEBs associated with energy efficiency investments. During the 1990s, many researchers recognized that part of the value of energy efficiency and weatherization programs was not captured in cost-effectiveness screening or in program reporting, even though that perceived value was an important part in people's decisions to participate in programs and was inherently valuable as an outcome of these programs (McHugh et al. 2002). NEBs were subsequently classified by researchers into categories. Schweitzer and Tonn (2002) from Oak Ridge National Laboratory identified and quantified NEBs relating to the Weatherization Assistance Program (WAP). They broke NEBs into three general classifications; Ratepayer Benefits, Benefits to Households, and Societal Benefits. Thorne Amann's (2006) literature review and Skumatz (2010) defined NEBs into three similar categories: Utility Benefits, Societal Benefits, and Program Participant Benefits.

In 1999 in Vermont, Docket 5980 established the structure of a statewide Energy Efficiency Utility. In this docket, the cost-effectiveness screening measures adopted in 1990 were reaffirmed. The Board also asked the Department of Public Service, the Vermont body representing the public interest in energy utility matters to develop externality adjustments for fuel-consuming measures consistent with the electric externality value.

The recognition of the value of energy efficiency beyond terms of energy savings was being addressed in other states as well, particularly with regard to low-income programs. The 2001 *California Standard Practice Manual* recognized that low-income demand-side programs would be "evaluated using a broader set of non-energy benefits." The manual also listed externalities and included "Non-energy benefits for low-income programs."

Because low-income programs required higher levels of economic investment and were more difficult to screen cost-effectively, they became a focus of NEB research. Oppenheim and MacGregor (2002) conducted economic analyses of investments in low-income electric efficiency. They identified economic benefits, beyond energy savings, to participants, society, and the investing utilities calculating that:

> Low-income energy efficiency is one of the most cost-effective investments a utility can make from the standpoint of program participants, non-participant customers, and society as a whole. Nationwide, a one mill per kWh investment will conservatively return more than $26B over the average 16-year life of the investment, a benefit-cost ratio of about 7.

McHugh et al. (2002) approached NEBs from a different angle. They studied five different programs and identified NEBs that would be more appealing to customers in the marketplace than were energy-related and environmental benefits from energy efficiency alone. They recommended that designing programs around both energy efficiency and NEBs would lead to faster market transformation and program participation. Fuchs, Skumatz, and Ellefsen (2004) examined NEBs from ENERGY STAR® programming, in the context of how they affect market acceptance. Instead of seeking a

monetary value for NEBs, these researchers looked at NEB value in the marketplace and as a driver for uptake of energy efficiency programs.

It quickly became evident that the major barrier to utilities' incorporating NEBs into cost-effectiveness screening was determining appropriate values for program elements that are difficult to quantify. Thorne Amann (2006) noted that the efforts to place an accurate value on NEBs use one of three options: computational methods, participant survey methods, or statistical analysis of revealed preferences.

Computational methods are an effective method of quantifying NEBs when it is relatively easy to assign a dollar value to the NEB. For example, an economic benefit to society such as job creation is relatively easy to quantify. Likewise, calculating a utility benefit such as reduction in arrearages, or terminations and reconnections is possible by quantifying the associated costs to the utility. NMR/TetraTech (2011 p.1-7) recommend a value of $.43 annually based on literature quantifying utility costs for terminations and reconnections.

Another example of the use of computational methods for quantifying NEBs by NMR/TetraTech is the recommended value of $3.70 a year for reduced water and sewage costs for energy efficiency dishwashers based on an algorithm. Skumatz (2010 p.19) identifies computational approaches as being, "strong, reliable, and defensible." She identifies the weakness of this approach as being, "expensive, lacks large sample sizes, so applicability and sample sizes are weak, and may only be applicable to a subset of very quantitative NEB categories."
Thorne Amann (2006) agrees that quantifying less tangible benefits, "including comfort, aesthetics, and convenience," is very difficult using computational methods (p.15).

Participant surveys are better at capturing values of less tangible NEBs. There are several types of surveys currently employed for this purpose including: willingness to pay surveys, comparative valuations, labeled magnitude scaling, reported motivations, and ranking-based surveys (Thorne Amann 2006; Skumatz 2010). In Massachusetts, surveys revealed that participants place an annual value of $125 on higher comfort levels for non-low-income residential retrofits (NMR/TetraTech 2011 p. 1-6).

While surveys are better at identifying values for less tangible participant NEBs, they can be confusing to survey participants depending on administration and survey design and, like computational methods, they can also be expensive.

Statistical analysis of revealed preferences combines program data with survey results. While this approach has the potential to produce more robust results than comparative valuation surveys alone, it is both time consuming and expensive (Thorne Amann 2006).

Recent studies measuring the values on NEBs have the benefit of incorporating values derived through the use of these methods in earlier studies. NMR/TetraTech drew heavily on existing literature in the quantification of non-energy impacts in their 2011 study of Massachusetts programs. Their methodology included using the median values reported in recent NEB research and adjusting them to 2010 dollars using a rate of inflation (page 1-5).

According to Woolf, et al. (2012), the two preferred methods of incorporating NEBs into efficiency program cost-effectiveness screening include quantifying individual NEBs or incorporating a NEB adder into screening. There are several benefits to using a NEB adder instead of quantifying individual NEBs. The primary benefit of using a NEB adder is that, while the quantification might not be exact, the cost of determining an appropriate adder through existing literature is significantly less than the expense of conducting computations or surveys to determine values of individual NEBs.

A Case Study: Vermont

Vermont also faced the challenges of quantifying NEBs. In 2008, Efficiency Vermont, the name of Vermont's statewide energy efficiency utility, began providing thermal energy efficiency services in addition to electrical energy efficiency services. The Vermont Legislature allocated revenues from participation in the Regional Greenhouse Gas Initiative (RGGI) and the regional transmission organization's Forward Capacity Market (FCM) to pay for thermal efficiency measures. Prior to 2008, energy efficiency in Vermont was electric energy efficiency. With the introduction of funding for thermal energy efficiency programming, stakeholders began questioning the appropriateness of the methodology and the assumptions used for electrical energy efficiency cost-effectiveness screening applied to thermal measures.

In response to these questions the Vermont Public Service Board scheduled a workshop in 2009 to open the discussion about cost-effectiveness screening of "heating-and-process fuel" measures. In the course of the proceeding, it became evident that to justify incorporating NEBs into cost-effectiveness screening, more research was needed. Riley Allen, Utilities Analyst for the Vermont Public Service Board recommended in a Status Memorandum that:

> This issue (valuation of non-energy factors) relates to the array of benefits that have not been traditionally captured through the techniques applied through the screening of regulated fuels. They include factors that may be subjective, difficult-to-quantify, and variable (person-to-person). Given the examples provided, they also appear to be much more pronounced and potentially significant for unregulated fuels than for regulated ones.
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> While I agree that these factors may be potentially significant, it is difficult to place a clear value without more and better information, and ***potentially research*** *(italics mine)*. I am therefore inclined to recommend that the parties simply apply the stop-gap factor of 5% across-the-board to building shell and related improvements that are likely to produce such benefits.
>
> While I agree that further research is needed, I am concerned that the challenges presented by the research appear formidable. Further, the research has relevance to energy efficiency programs that extend well beyond our borders. Limited funding support from one small state may yield results that prove inadequate to the task. I encourage the Department and VEIC to explore partnerships beyond our borders that can be leveraged for more material impact and to defray concerns that such research efforts by Vermont alone may be inadequate to benefit Vermont ratepayers. I do not recommend that Vermont embark on its own research efforts without the participation of other states or regions that could benefit from such research. That said, I believe the research is potentially valuable and should be considered by this Board if there are sufficient resources that can be leveraged outside the state to support it. (Allen 2009)

In response to the memorandum, stakeholders in the proceeding reached out to other parties and thus expanded its scope. This expansion included the Weatherization agencies, affordable housing organizations, and the Vermont Department of Education. In December 2009, seven organizations

including utilities, energy efficiency providers, nonprofits, housing organizations and economic opportunity organizations submitted joint comments to the Board supporting the incorporation of a NEB adder into the State's heating-and-process fuel efficiency screening tool.

Other Jurisdictions Consider Non-Energy Benefits

In Vermont, in 2009, the question of quantifying NEBs to be used in cost-effectiveness screening again became the critical question researchers and energy efficiency providers in other jurisdictions concurrently faced the same question. In Maine, the Public Utilities Commission outlined the cost-effectiveness guidelines for Efficiency Maine Trust, determining that the Modified Societal Test would pertain:

> Non-resource benefits, including customer benefits such as reduced operation and maintenance costs, deferred replacement costs, productivity improvements, economic development benefits and environmental benefits, ***to the extent such benefits can be reasonably quantified and valued*** (emphasis added). (Maine PUC, 2009)

This language leaves open the option of counting NEBs, therefore the question arose regarding the quantification and value of NEBs. In Oregon, the Cost-Effectiveness Policy and General Methodology for Energy Trust of Oregon specifies that NEBs will be quantified, but relies on the Energy Trust of Oregon to provide supporting research. The need for an accepted method of quantifying NEBs was called out once again:

> Non-energy benefits will be quantified by a reasonable and practical method. Unless and until the OPUC develops an alternative approach, Energy Trust may use proxies for these benefits where research shows that the benefits are large, they cannot be practically quantified, and they clearly influence consumer decisions. (Energy Trust of Oregon, 2011)

In Colorado in 2008, the Public Utilities Commission grappled with the similar issues in the measurement of non-energy benefits:

> Staff testified that non-energy benefits are difficult, if not impossible, to measure accurately. It further contends that efforts to internalize the value of non-energy benefits entail equity issues, in terms of the proper allocating of benefits and costs. (CO PUC 2008)

In its decision, the Colorado PUC referred to NYSERDA research, another jurisdiction trying to answer the question of NEB value. Although NYSERDA's research provided specific quantification of individual NEBs to be included in screening, Colorado rejected this approach, and instead decided on an NEB adder. However, by referencing this research, Colorado indicated a link between the value of research for guidance (even if not accepted in its entirety).

> We find the NYSERDA data regarding such quantification is interesting, but that it yields values that exceed the bounds of reasonableness. We concur with the logic exemplified by EEBC's (Energy Efficiency Business Coalition's) move in its position away from the

> NYSERDA data to the use of a percentage adder as a means to incorporate non-energy benefits.
>
> Consequently, we find that the percentage adder approach is supported by the record and that an adder value of 10 percent shall be used within the TRC calculation to represent the non-energy benefits resulting from DSM. This percentage is to be applied to the sum of the other quantifiable benefits, and is to be used when calculating TRC values for specific DSM programs and the overall portfolio. (CO PUC 2008 at 27)

In 2008, the CO PUC adopted a NEB adder of 10% for electric programs and a 20% adder for low-income electric programs.

As NEBs began to gain traction among energy efficiency programs, several authors and organizations either demonstrated that incorporating NEBs into cost-effectiveness screening was a best practice, or recommended it as an important consideration in accurate benefit-cost tests. Other publications recommended guidelines for how to best incorporate NEBs into screening. The *2008 National Action Plan for Energy Efficiency,* published by the U.S. Environmental Protection Agency (EPA), defined NEBs as linking policy and cost-effectiveness:

> Non-energy benefits (NEBs): Energy efficiency measures often have additional benefits (and costs) beyond energy savings, such as improved comfort, productivity, health, convenience and aesthetics. However, these benefits can be difficult to quantify. Some jurisdictions choose to include NEBs and costs in some of the cost-effectiveness tests, often focusing on specific issues emphasized in state policy.

Shortly thereafter, a European paper observed that "the omission of [NEB] values severely distorts the results" of traditionally claimed energy savings, "and therefore is of utmost importance to consider these in global and national policy-making and target-setting" (Urge-Vorsatz, Novikova & Sharmina 2009). In short, consensus was building that NEBs contribute more value to an energy efficiency project than the energy savings themselves.

Vermont Considers a Decision

By the end of 2009, the cost-effectiveness screening proceeding in Vermont had lapsed and became inactive. For almost two years, no progress was made in this proceeding and no filings were made. In September 2011, the Board requested that, in light of the time lapse in the proceeding, parties could file additional information prior to a Board decision. Parties subsequently recommended that in light of further research in topic areas, another workshop would be warranted and additional comments should be received from parties by the Board. The Board agreed to receive additional comments and hold another workshop on the cost-effectiveness screening requirements.

Between 2009 and the reactivation of the Vermont proceeding in 2011, researchers continued to publish literature regarding the regarding the quantification and inclusion of NEBs in cost-effectiveness screening. During this time, studies by Skumatz (2010), NMR/TetraTech (2011), and the National Home Performance Council (2011) addressed this ongoing question. In a 2010 study of low-income programs in California, Skumatz suggested:

More than 45 studies on NEBs have been included in the major energy journals since 2001. The studies address one or several of the following topics:

- methods for estimating specific (or groups of) participant NEBs,
- participant NEB estimation results for specific programs,
- recommendations for additional research participant NEBs, and
- recommendations for appropriate uses for participant NEBs.

Woolf, et al. (2012) recommend six options for valuing and incorporating program impacts beyond energy savings: (1) Developing estimates of all NEBs, prioritized and including only the most significant or relevant factors in cost-effectiveness screening; (2) incorporating only "readily-measurable" NEBs in screening; (3) a sensitivity analysis of impacts; (4) incorporating an NEB adder; (5) reducing the cost-benefit threshold of programs with significant impacts; and (6) hybrid approaches that combine the other five suggestions. Methods for incorporating NEBs in cost-effectiveness screening is also addressed by Daykin, Aiona, and Hedman (2010), who recommend using a benefits adder of 10% of avoided costs to account for externalities other than carbon impacts, which they recommend be included directly in the avoided costs.

The State & Local Energy Efficiency Action Network's *Impact Evaluation Guide* (2012) also addresses the challenges of quantifying NEBs continuing research and progress in that area:

> … a common impact evaluation approach to NEBs is to list them as possible or probable benefits and not to quantify them. This is typically because of program administrators' (and sometimes evaluators') unfamiliarity with methods for quantifying these benefits, the cost of quantifying them, and the sense that the majority of economic benefits are associated with saved energy costs. However, the methods for documenting NEBs are improving and expertise in this area is increasing. And, perhaps most important, it is becoming increasingly clear that NEBs can have very high value for those making decisions about efficiency projects and to society as a whole.

Taken together, these publications point policy-makers to a consistent approach when evaluating NEBs in cost-effectiveness screening of energy efficiency programs.

In fact, the research has provided additional support for states and utility jurisdictions in making a case for including NEBs in their cost-effectiveness screening. The research was particularly valuable in Vermont's recent regulatory proceeding and decision regarding cost-effectiveness screening.

In 2011, in light of these additional resources about the valuation and inclusion of NEBs in cost-effectiveness screening, comments by parties in the Vermont proceeding provided additional information to support a higher NEB adder to be used in cost-effectiveness screening. The joint commenters referenced research by Skumatz (2010), Hall and Riggert (2002), and Urge-Vorsatz et al. (2009), indicating the valuation of NEBs as being at least 30% of the project value. The joint commenters recommended an NEB value of at least 30% and requested the use of energy efficiency utility funds (ratepayer funds from a systems benefit charge) to support research to help quantify this in Vermont.

> Regarding the issue of the use of EEU funds to conduct a survey that would produce a better estimate of the value of non-energy benefits, we ask that the Board not recommend against the use of a reasonable level of EEU resources for this purpose. We believe that such research is essential to provide a better basis for appropriately valuing non-energy

> benefits in Vermont. Given the large potential magnitude of non-energy benefits suggested in the literature we have reviewed, we believe the cost of a modest survey project to better assess the appropriate value to use in screening is more than warranted (Hamilton et al., December 4, 2009, p. 5).

Another factor that supported the incorporation of NEB values into cost-effectiveness screening in Vermont was that in 2011, the Colorado PUC revisited their existing NEB adder and decided to increase their NEB adder from 20% for low income electric programs to 25% for the screening of both low-income gas and electric programs. In this case, multiple stakeholders supported the change including utilities and energy-efficiency programs.

The joint commenters in the Vermont proceeding referenced this Order in their recommendation of a 15% NEB adder for screening metrics and an additional 15% NEB adder for low-income metrics. The commenters, including the Public Service Department recommended that this cost-effectiveness screening metric be used not only for heating-and-process fuels, but also for electric measures with the following justification:

> While the NEBs that accrue to participants from electric and thermal fuels may differ, the Department believes there is sufficient evidence to recommend that the 15% adder apply equally across fuel sources. NEBs such as increased comfort, or safety, may apply more to the thermal fuels than to electricity. On the other hand, productivity and electric utility-related benefits may apply more to the electric sector. On balance, the Department finds it useful to apply these values equally (Poor 2011).

In its order, the Board discussion included a reference to recent literature and the increasing focus on non-energy benefits of energy efficiency.

> Recently, the energy efficiency industry has begun to focus on energy efficiency's non-energy benefits, and how to incorporate those into cost-effectiveness screening. We found the updated information presented in 2011 on this subject to be particularly helpful in understanding what non-energy benefits encompass, their potential magnitude, and the uncertainties associated with those estimates (Vermont Public Service Board Order dated 2/7/2012 at 26).

The Board continued by acknowledging uncertainty regarding the value of NEBs, but found a 15% adder to be a conservative estimate that would prevent the error of not counting NEBs at all.

> While there is a high degree of uncertainty surrounding the magnitude of non-energy benefits, it is clear that the current value of zero is incorrect, and that 15 percent is on the lower end of the range of estimates. It is appropriate to start with a conservative estimate, and to revisit the estimate in the biennial EEU avoided-cost proceedings, with 15 percent serving as a rebuttable presumption (Vermont Public Service Board Order dated 2/7/2012 at 27).

Conclusion

In February 2012, the Vermont Public Service Board adopted an NEB adder of 15% for energy efficiency screening for all fuel types, including electricity, as well as an additional 15% NEB adder for low-income energy efficiency programs. The Board ordered that the presumptions in this proceeding, including the NEB adders for both electric and heating-and-process-fuels would be treated as rebuttal presumptions and would be revisited on a biennial basis as part of the Energy Efficiency Utility avoided-cost proceedings. Thus in 2014, these values will be reviewed.

The decision to incorporate an NEB adder was brought about by a combination of factors. The combination of variables—primarily the quantity and nature of available research, the growing number of states and jurisdictions which use NEBs in cost-effectiveness screening, and the collaborative effort by stakeholders in Vermont—contributed to this policy change.

The growing availability of research identifying NEBs, developing methodologies for quantifying NEBs, and recommending best practices for incorporating NEBs into efficiency cost-effectiveness screening provides evidence to parties exploring how to accurately account for NEBs in energy efficiency programs. Regulatory proceedings in jurisdictions where NEBs are currently accounted for also provide a resource for incorporating NEBs. Finally, collaborative efforts of organizations and stakeholders dedicated to energy efficiency and economic and community development support the transformation to a more complete accounting of the benefits of energy efficiency.

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