Addressing Uncertainty in the Evaluation of Market Transformation Activities

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ABSTRACT

This paper describes the methodology and results of an evaluation of the market transformation efforts of the Northwest Energy Efficiency Alliance. The analysis presented here focuses on the methods used to bound the savings estimates attributed to the Alliance portfolio. The approach involved review of evaluation reports and market assessments conducted for about 30 programs over the past six years. From this review, a sample of programs was selected for analysis that was representative of Alliance activities across markets. For each program, the variables that influenced energy impacts were examined to determine which assumptions were pivotal drivers of savings claims. These pivot assumptions fall into one of two categories: field performance of the technology or number of units attributable to program activities.

To dimension uncertainty surrounding pivot assumptions, alternative hypotheses regarding each assumption's value were sought from market actors in the region through an interview process. Combined with current literature on savings attributed to specific technologies, these alternative hypotheses helped establish a range for each variable (e.g., displaced watts for compact fluorescent lighting). A distribution was established for each pivot assumption, and a simulation analysis was conducted using 5,000 random draws from each distribution. Each draw was run through a cost-effectiveness model to produce a distribution for energy savings and a benefit/cost ratio attributable to each program. This process was completed for each program reviewed, and the results were summed to assess the overall energy impacts and levelized costs of the savings attributable to the Alliance portfolio.

Introduction

This paper presents the results of an independent evaluation of market transformation accomplishments of the Northwest Energy Efficiency Alliance (Alliance) efforts. The study was designed to determine if the overall investment in market transformation in the region over the previous six years had transformed enough markets to justify the level of investment relative to other approaches to reducing the region's electricity needs. This key question was investigated by reviewing Alliance activities and the role the Alliance has played in markets where they have had responsibility for managing significant public goods resources over the past several years. This assessment of Alliance activities also takes into account the work of other organizations in these markets and their impact on energy efficiency to avoid double counting market impacts and effects.[1]

[1] The evaluation report, which includes background on the Alliance and details of the evaluation, is available online at http://www.nwalliance.org/resources/reportdetail.asp?RID = 129.

The team used an extensive body of material available on Alliance project activities, including market assessments that were conducted on Alliance projects, market progress evaluation reports, computer model results, and planning documents. Primary data collection involved interviews with staff, evaluators, implementation contractors, market actors, and others to better understand program mechanisms and elicit alternative hypotheses regarding market changes. Data from both primary and secondary sources were used to dimension uncertainty surrounding pivot assumptions, and the assumption distributions were used to calculate probable ranges for program impacts. This process was completed for a set of representative programs [Energy Star Residential Lighting, Energy Star Residential Windows, Building Operative Certification (BOC), and MagnaDrive], and the results were summed to assess the overall energy impacts and levelized costs of savings attributable to the Alliance portfolio or programs.

Methodology

This section outlines the framework used to define the assessment and the approach taken to produce estimates of Alliance-induced market impacts. It begins by describing the basic assessment problem for energy efficiency programs that use market transformation as the approach for encouraging cost-effective investments in energy efficiency technologies and practices by market actors. Then we provide an overview of the process that was used to develop alternative hypotheses concerning the role of the Alliance in promoting increased energy efficiency in targeted markets, and include a brief description of the type of scenario analysis and Monte Carlo analysis that was used as the basis for the in-depth project assessments.

Assessing Market Transformation Projects

Market transformation (MT) projects are typically developed in conjunction with a supporting theory and project logic that allow for the development of market indicators that can provide "evidence" of a change in the market.[2] Real market changes induced by MT programs rely on a variety of promotion, education, and incentive activities. Successful MT initiatives are by nature multifaceted efforts that involve multiple organizations and evolving delivery mechanisms and progress metrics. At the Alliance, MT ventures are designed with a focus on one or more of the following mechanisms: upstream, training, entrepreneurial, and consumer.

In the context of theory-based or hypothesis-driven MT projects, a key component in evaluation is the verification of the validity of assumptions and hypotheses. The assumptions can be as straightforward as the assumed incremental savings associated with installing a high efficiency lamp, compared to standard efficiency options, and they can be complex when they address such things as the behavior of market actors (e.g., architect, builder, buyer interactions).

A focused project logic model construct can help identify pivot information or assumptions, i.e., what must be true for the project to achieve its target benefits. These pivot assumptions often focus on three factors: 1) baseline assumptions, 2) the performance of technology as it is applied in the field, and 3) the inter-related issue of attribution/causality. Baseline issues involve both market conditions at the start of the intervention and how that market will change over time without the intervention. Technology performance will depend on

[2] Recent work done at the New York State Energy Research Development Authority (NYSERDA) utilizes this approach. Recent publications addressing these topics include NYSERDA (2000, 2002).

field installation and operating characteristics. Attribution and causality issues can often be viewed as aspects of selecting the correct baseline, i.e., the ways in which the market has changed, and would have even if the project had not been offered, and changes which can truly be attributed to the activities of the Alliance. It is nearly impossible to prove causality; instead approaches are focused on providing evidence of attribution/causality.[3]

From one perspective, this assessment can be viewed as an analysis of the investment in the Alliance and the return on that investment. The approach taken by the study team was to develop risk/reward criteria based on scenario analyses of program outcomes, a method that is similar to assessments of investments in research and development portfolios often conducted by private companies.

Data Collection and Development of Alternative Hypotheses

The study team first reviewed approximately 100 market evaluation reports, research reports, and other documents regarding Alliance activities and funding. Another key step in understanding of Alliance activities involved interviews with Alliance staff. These interviews focused on developing a more complete understanding of the assumptions that drive each program. The key themes discussed during the interviews include:

- Role of project planning assumptions in development of program strategy.
- Understanding of baseline assumptions and changes in baselines over time.
- Assumptions regarding in-field performance of measures.
- Selection of market progress indicators and role of indicators in supporting a market transformation story for that program.
- Adaptive management: the role of the market assessment studies and evaluation results in providing a feedback loop back to program implementation staff and contractors.

Following these activities, it was determined that a detailed investigation of four representative programs would be performed. These four programs were Energy Star Lighting, Energy Star Windows, Building Operator Certification, and MagnaDrive.

The process used to assess the Alliances claims for these four programs involved:

- Review of Market Progress Evaluation Reports (MPERs) conducted for the Alliance.
- Review of Alliance Cost-Effectiveness (ACE) model inputs and results.
- Threshold analysis and determination of the pivot assumptions.
- Dimensioning uncertainty around these pivot assumptions.
- Simulating impact results under different values for the pivot assumptions.

The study team's review of the MPERs focused primarily on obtaining inputs that could be used in the investment and cost-effectiveness calculations, specifically, measure savings (i.e., unit savings), costs, and penetration (i.e., number sold or installed). To determine program cost-effectiveness, the Alliance developed a model (ACE) that essentially computes unit impacts and

[3] Discussions of causality in the context of project evaluation include Susser (1973), Huberman and Miles (1998), and Oakley (1997).

unit costs, which are then fed back into the NW Power Planning Councils ProCost model to develop various levelized cost and cost-effectiveness indices. This model served as the foundation of the assessment of the Alliance's claims. It supplied information on the assumptions used to develop these claims, and also was used to measure how alternative assumptions affect these claims.

When reviewing the ACE model for each of the four programs analyzed, the evaluation team itemized the inputs used to compute the program's cost-effectiveness. A threshold analysis was then conducted, which involves determining how much the program's cost-effectiveness changed in response to a change in each input. A list of key variables was developed based on how influential each input was on the final result. This analysis, combined with the review of the models and interviews, led to the development of a series of pivot assumptions for each program. These pivot assumptions represent the key inputs that may have values different from those assumed by the Alliance.

Alternative Hypotheses Elicited and Explored

After determination of the pivot assumptions, the next step in the analysis focused on the elicitation of alternative hypotheses regarding changes in market activity. These alternative views were sought from a range of stakeholders and market actors. The objectives of these interviews included:

- Tracing the quantitative assumptions used for pivot variables in the ACE models.
- Exploring local, regional, and national effects other than those of the Alliance on the specific market being analyzed.
- Gaining general feedback on the value and effectiveness of Alliance activities.

In addition to implementation contractors, staff, and evaluators, the team sought input from retailers, utility reps, industrial energy managers, manufacturers, and national organizations that develop energy efficiency standards. The team provided the ad hoc committee chair and Alliance executive director with a list of the market actors being considered for interviews and asked for additional suggestions. Both Alliance staff and the committee provided additional suggestions for individuals who might share alternative views.

Interviews were scheduled and conducted in person with some individuals, based on their availability. Additional interviews were conducted via telephone after the on-site interviews. In total, 31 individuals were interviewed. All interviewees were assured of confidentiality in that no particular comment would be attributed to them directly, but their name and affiliation would be provided in an annex to the report to the board. While these interviews do not represent a statistical sample, they do represent a cross section of viewpoints on Alliance activities. The study team strived to get balanced input within the time constraints of the project and availability of interviewees. Each interview explored pivot variable ranges (when the individual had knowledge of the specific program variables being considered), alternative hypotheses, and a set of *general* questions regarding the focus and effectiveness of Alliance activities. Information gathered on a specific pivot assumption was combined with information from other resources to bound the ranges for that assumption.

The list below indicates alternative hypotheses explored for one of the four programs, Energy Star Residential Lighting. The key objective of exploring alternative hypotheses was to

dimension any uncertainty around Alliance claims, and analyze the "but for" hypothesis, i.e., what impacts would have happened anyway (without the Alliance) and which impacts could reasonably be attributed to the Alliance.

Alternative Hypotheses for Energy Star Residential Lighting Impacts

1. Energy crisis of 2001 drove sales (energy costs and media awareness = indicators).
2. BPA and local utility coupon program spillover.
3. Field performance is not as anticipated (installation, removal rates, retention, …).
4. CFL stocking practices were driven by other market factors (availability, infrastructure).
5. Relationship to EPA/Energy Star programs drove sales.

Approach to Scenario Analysis

The scenario analysis used in this assessment for the four programs selected for an in-depth examination was designed around the ACE model, which develops estimates of annualized savings using information on unit savings, units purchased or placed in the field, measure life, capital costs, annual O&M, and other factors relevant for an economic assessment. The ACE model is based on the ProCost Model developed by the Northwest Power Planning Council (NWPC), and the inputs to the ACE model follow those developed by the NWPC. However, for any specific Alliance project, the inputs are unique to that project.

The conventional approach to scenario development and sensitivity analysis typically involves picking a "best" or "most likely" case scenario, then high and low cases are developed to bound the results and test the sensitivity of the results to these alternative assumptions.

The distribution approach used in the scenario analyses for the four selected programs attempts to increase the amount of information that is brought to bear on the problem. Specifically, when the interviews are conducted with experts, they are also queried about their opinion regarding the likelihood of the different outcomes. While it may be difficult to answer this question precisely, it is possible, for example, to have an expert tell you that he/she believes that the high scenario is more likely to represent what actually happened (in their opinion) than is the low scenario. Asking general questions about the odds of the high and low scenario occurring may produce responses in which the medium scenario is believed to be the most likely, the high scenario is believed to be more likely to occur than the low scenario, or there is a small possibility that the true outcome is either above the high or below the low scenario.

The assessment of the likelihood of occurrence for the different scenarios adds additional, useful information. Individuals familiar with the market can provide "best" available information on the relative likelihood of occurrence. While incorporating only rough estimates of the likelihood of occurrence, the end result is a better representation of the scenarios being assessed.

Analysis of the Energy Star Lighting Program

This section describes the application of the method to the Energy Star (ES) Lighting Program.

Background

The Alliance initiated a strategy to transform residential lighting markets in 1997 by creating two regional programs in that year, one focused on lamps and the other on fixtures. These two programs (Lightwise and Energy Star Residential Lighting fixtures) were combined in 2000 under the ES platform. Early program efforts worked with manufacturers to accelerate availability of high quality compact fluorescent lighting (CFL) products for the consumer marketplace, then the program began shifting its emphasis to a marketing strategy in the retail arena.

The program strategy is to promote efficient residential lighting through the Energy Star technical specifications and marketing messages. Overall program goals are:

- Encourage consumer purchases of new generation CFL technology.
- Coordinate and leverage utility efforts to promote Energy Star products.
- Encourage the development of new energy efficient lighting technologies.
- Expand the use of Energy Star fixtures in new construction.

The Northwest saw a dramatic increase in sales of CFLs during 2001, partially driven by the energy crisis in California and the resulting media coverage, utility coupons, rate hikes, and retail advertisements (Grover, Cohan & Ton 2002). The ES Lighting Program played an active role in facilitating the jump in interest in CFLs through development of cooperative efforts between the Alliance, BPA, the region's utilities and retailers. The program adapted to the changing market conditions in the northwest by coordinating marketing messages and materials for retailers, and through outreach to new partners in the region. The implementation contractor for the Alliance also managed the coupon program funded directly by Bonneville Power Administration (BPA) and some of the region's utilities during the same time period. While the coupon campaign was not part of the ES Lighting Program, it did take advantage of the retailer network already established by the Alliance (Ecos Consulting 2003).

The Alliance has worked through its program cooperative agreements to develop a tracking system that accumulates quarterly sales data from participating retailers in the region. These data are then used as the basis for estimating sales at nonparticipating retailers, and total sales in the region. When data regarding coupon sales and utility giveaway programs are backed out of total regional sales, the Alliance estimates of CFL sales attributed to program efforts remain.

Pivot Assumptions

The first step in assessing the accomplishments of the ES Lighting Program is determining the key assumptions required for quantifying the chosen metrics. The evaluation team focused its attention to those inputs that may be subject to a relatively high degree of uncertainty or had a significant impact on the outcome. These key assumptions are denoted as "pivot" assumptions. For lighting, the pivot assumptions can be broken down into two groups:

1. Assumptions required to compute the annual kWh savings of each CFL sold.
2. The number of CFLs sold because of the efforts of the Alliance.

Based on previous experience with other lighting retrofit programs and a review of the ACE model, the evaluation team determined that the pivot assumptions involved in computing the *annual kWh savings associated with each CFL* are:

- The displaced wattage (the difference in wattage between the new CFL and the incandescent bulb being replaced).
- The hours that the CFL is used each day
- The average lifetime (in run-time hours) of the bulb.
- The installation and removal rate. This includes both those CFLs that were purchased but not installed and those bulbs that were removed and not replaced with another CFL.
- The price of the bulb (which does not affect the kWh savings, but is important for the cost-effectiveness of the program from the total resource perspective).

There are essentially two pivot assumptions for *the number of CFLs sold* because of the efforts of the Alliance. The first pivot assumption involves determining how many of the over 8 million CFLs sold in 2001 were due to the efforts of the Alliance versus how many were due to the California energy crisis, the BPA coupon program, and utilities' giveaway programs. The other pivot assumption is the degree that this explosion in CFLs sales affected the baseline (i.e., non-Alliance influenced sales) going into the future.

Alternative Hypotheses

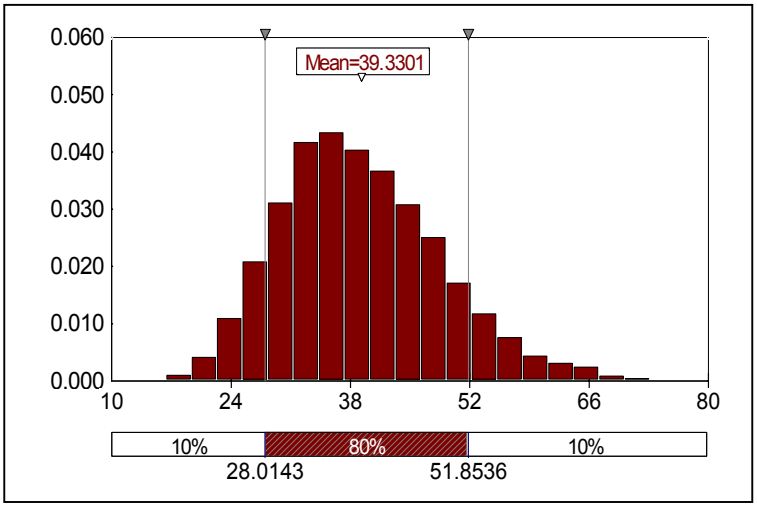
After identifying the pivot assumptions associated with the ES Lighting Program's accomplishments, the next step was to identify both meaningful alternatives to these assumptions and their likely occurrence (i.e., their probability distribution). This section presents the values for the alternative hypotheses and the source of this information. Note that in general the pivot assumptions associated with the kWh savings per bulb are measurable and there is a fair amount of research on these assumptions. However, the pivot assumptions associated with the numbers of bulbs sold because of Alliance influence are based on information in the evaluation reports reviewed that were designed to address the attribution of effects to the Alliance activities, and the judgment of the experts interviewed.

Annual savings per lamp. Details of the alternative hypothesis, and distribution ranges used in the analysis for displaced wattage, hours of use, lamp lifetime, installation rates, and price per lamp are in the evaluation report cited earlier. The mean of the distributions for each of these variables is presented in Table 1, and the resulting distribution of annual unit savings per lamp resulting from the analysis of each of these variables is shown in Figure 1.

The net result of these alternative hypotheses on the kWh savings per bulb is a change from the Alliance's original 66 kWh per bulb to an average of 39 kWh per bulb.[4] Figure 1 shows the distribution about this result based on the probability distributions of the underlying pivot assumptions. It is noted that, independently of this evaluation, the Alliance recently updated projections associated with savings per lamps based on input from NWPPC, and will be using approximately 39 kWh/lamp/year to project savings for the CFL program going forward.

[4] Interview notes indicate that PGE uses 55 kWh/year for their estimate of per lamp impacts.

Figure 1. Distribution for Annual Savings (kWh)



2001 sales due to the Alliance. In 2001, sales of CFLs in the region increased significantly, from 650,000 lamps to over 8,350,000 lamps (based on Alliance data). This large jump was due, in part, to the California energy crisis, a BPA coupon program, and a free lamp giveaway program sponsored by several area utilities. Annual Alliance reporting states, "In 2001, the region captured 31 aMW of savings through market effects including Alliance programs, utility marketing campaigns, price elasticity's and retailer and manufacturer marketing efforts (Northwest Energy Efficiency Alliance 2002)." When CFLs that were purchased with utility or BPA coupons and those given away by utilities are subtracted, about 4.2 million lamps remain. The pivot assumption in this area is the number of these bulbs due to the Alliance's ES Lighting Program. The Alliance cost-effectiveness calculations assume that all of the bulbs that are not purchased by a coupon, or given away by utilities, are credited to Alliance activities. This results in over 4.2 million CFLs being credited to the program in 2001.

Since the evaluation team could not directly measure who was responsible for each bulb sale, it relied on responses in its interviews from retailers, utility program managers, and other knowledgeable individuals to develop an estimate of the 2001 sales due to the Alliance. The team consistently ran into two divergent opinions. One was that the Alliance was responsible for these 4.2 million bulbs and may even be responsible for some of the remaining 4.1 million bulbs because of their work in developing the necessary infrastructure to support such a large demand for CFLs. The other group believed that the Alliance was not as influential in the market, and was responsible for a significantly smaller fraction of the total sales. In addition to input from those in the region on this attribution question, the evaluation team can compare changes in sales volume in the northwest to what occurred in other parts of the country during the same time period. Nationally, sales of CFLs tripled between 1999 and 2001, and then almost doubled again in 2002. While the northwest may have seen sales numbers increase tenfold from 2000 to 2001, sales increased fourfold in California during the same period (Nadel et al. 2003).

To accommodate the disparate regional views, the evaluation team constructed two alternative scenarios. The "high influence" alternative assumes that on average, the Alliance was indeed responsible for 4.2 million CFL bulbs in 2001, and may even be responsible for some of the coupon sales. The other assumption is that the Alliance is responsible for only half of the non-coupon sales, or approximately 2 million bulbs.

2002 baseline. Given the huge increase in CFL sales in 2001, the remaining pivot assumption is the degree to which the lighting market has been transformed by this event; i.e., what are the baseline CFL sales going into the future? Before the 2001 crisis, the Alliance assumed that the baseline sales of CFL were about 40,000 per year, and after this event the baseline increased to 100,000 per year. Following the two alternative viewpoints presented above, the evaluation team again assumed a "high influence" baseline, which was consistent, on average, with the 100,000 number. The "low influence" baseline assumed that the baseline for 2002 going forward was increased to 200,000 units, on average.

Table 1 summarizes the above values the evaluation team assumed for the pivot assumptions, as well as the value for these assumptions used by the Alliance in their cost-effectiveness model.

Table 1. CFL Pivot Assumptions

Assumption	Alliance	Team
Displaced wattage	74 watts	58 watts
Hours on per day	3 interior 5 exterior	2.75 interior 4 exterior
Lifetime	7,000 interior	7,500 interior
Installation/removal	12%	28%
Price per bulb	$8 @ 2003 $6 @ 2007	$5 @ 2003 $3 @ 2007
Alliance influence on 2001 sales	4,253,827	High case: 4,261,314 Low case: 2,064,454
2002 baseline sales	100,000	High case: 100,000 Low case: 200,000
kWh/bulb/year	66	39

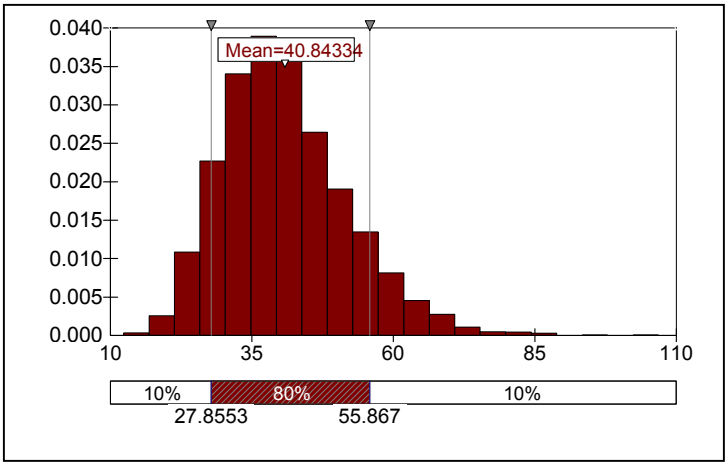
CFL Program Assessment Findings

This section reviews the results of the simulation of the ACE model using the above alternative hypotheses on the pivot assumptions. To determine these impacts, the evaluation team used the ACE model[5] appropriate for this program, and altered the input assumptions as discussed above. Using a simulation tool, @Risk, the evaluation team ran 5,000 simulations of the ACE model, which pulled observations randomly from the distributions developed for the pivot assumptions. Since this is a retrospective review of the Alliance's performance, the evaluation team focused on the implication of these alternative hypotheses up to and through the venture period, as defined by the Alliance.

The impact of these alternative scenarios on the cumulative aMW savings through 2002 due to the ES Lighting Program is presented in Figure 2 for the high influence scenario.

[5] CE-C97-023C-ES-Lighting-Post-Crises-Ext.xls, with a run date of June 7, 2002.

Figure 2. Distribution for 2002 Cumulative aMW



For the *high influence scenario*, the cumulative savings through 2002 drop from the Alliance's estimate of 70.4 aMW to a mean value of 40.8 aMW. This reduction in savings is due primarily to the decrease in the annual kWh savings per bulb. The savings at risk[6] (at the 80% quantile) is approximately 13 aMW. Further, for the *low influence scenario*, the cumulative savings to 2002 drop further to 30.3 aMW, with a savings at risk of 10 aMW. This implies a 10% likelihood that the cumulative savings were below 21 aMW for the ES Lighting Program.

The evaluation team's review of Alliance documents and interviews conducted for the evaluation provided numerous insights on the ES Lighting Program, and helped bracket the savings estimates. A summary of relevant comments and findings is provided below:

- The Alliance has contributed to increased awareness of CFL technology and the Energy Star brand in the Northwest over the past several years, and thus was a key contributing factor to the overall increase in sales in the region in 2001-2002. Recent sales data suggest the market for CFLs in the region will not drop back to pre-crisis levels, but an adjustment to baseline levels should be considered by the Alliance to reflect post-crisis conditions.
- The Alliance's collection of actual sales data from a majority of the region's lamp retailers is commendable.[7]
- Ongoing, innovative, comarketing activities with major retailers are important to the future success of the program. The Alliance has a reputation for bringing new ideas to the table when working with participating retailers. It is important to assure that ongoing marketing activities meet the needs of a broad cross section of retailers.

[6] The savings at risk is the lowest expected savings under these assumptions at a given level of probability, in this case, 27.8 aMW at the 80% quantile.

[7] The Alliance did not conduct a coupon program in the region, but the program implementation contractor managed these programs for BPA and some regional utilities. The use of a coupon fulfillment process for administering lamp rebates is expensive. Most large retailers now have sophisticated inventory control systems built into their operations that allow for accurate tracking of lamps (or other products) sold. For future resource acquisition programs, these data could be used to simply reimburse retailers for Energy Star lamps sold. This process has been used by some utilities in California.

- A number of comments were made regarding CFLs being used in the wrong applications by many customers, leading to dissatisfaction with lamp performance. Both consumers and retailers need to be better educated on proper selection and use of CFLs.

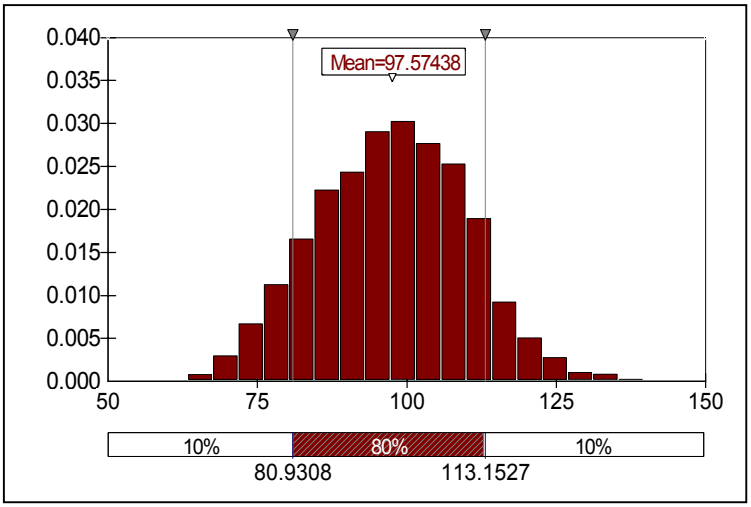
Summary

A key question associated with the analysis is how the results of the investigation into alternative scenarios for the four programs affect the overall Alliance investment perspective. To address this issue, the levelized cost from the Alliance perspective through 2002 was used as the metric. The levelized costs consider all costs incurred by the Alliance, and the savings reflect only those attributable to the Alliance, not those from other market effects. The calculation used for this is:

$$\frac{\text{Total \$ spent to date on all programs}}{\text{Levelized savings to date}}$$

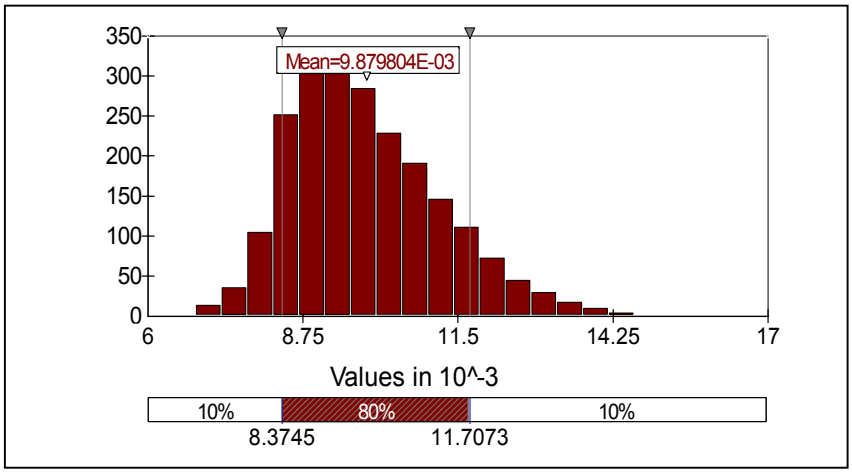
The study team's analysis of the savings associated with the ES Lighting, the ES Windows, BOC, and MagnaDrive programs, when combined with the Alliance claimed savings for other programs, produces an average cumulative savings to date of 98 aMW for *all* programs – using the *low influence scenario* for the ES Lighting Program (compared to the Alliance's original estimate of 134 aMW). The distribution for the total savings to date is presented in Figure 3.

Figure 3. Distribution for Overall Cumulative Savings Through 2002



Using this distribution for total savings through 2002, in the above levelized cost equation, the probability distribution for levelized cost shown in Figure 4 is obtained.

Figure 4. Distribution for Levelized Cost, Alliance Venture Period Perspective



The revised analyses, when combined with Alliance estimates for other programs, result in a study team total levelized cost estimate for *all* the Alliance's activities (from the Alliance Venture period perspective) of 0.99 cents/kWh, with a 90% probability that the cost is 1.17 or less, and a 10% probability that the cost is less than 0.83 cents/kWh. While this is an increase in the estimated levelized cost (the Alliance numbers from the 2002 MAR for the costs and savings from *all* programs produces a levelized cost of 0.7 cents/kWh), it is still well below the avoided cost of power in the region.[8]

While there are several reasons for the differences between the results developed by the study team and the Alliance estimates, the two key areas of difference are the assumed baseline for CFL sales (e.g., how many CFLs would have been sold in the absence of Alliance efforts) and the estimates of the savings per unit or application (e.g., savings per lamp or savings attributable to each person participating in the BOC training). As a result of the analysis performed during this retrospective evaluation, the Alliance has reviewed and updated their cost effectiveness model inputs for estimated savings during 2003, and adjusted savings reported for 2001 and 2002 as well.[9]

Acknowledgements

The authors would like to thank the staff, stakeholders, and Retrospective Committee members of the Northwest Energy Efficiency Alliance who participated in this evaluation. The utility staff, trade allies, program evaluators, and implementation contractors who we spoke with provided thoughtful and candid information and viewpoints on program impacts.

[8] It should be noted that the study team's analysis looked at the four programs from a retrospective perspective. Other than making an adjustment to the future consumer replacement cost of CFLs, no other future costs, or estimated future savings were modified. Nor did the study team analyze local utility costs, or consumer O&M costs related to the programs. The cost estimates used by the Alliance for regional costs other than their own could have an effect on the levelized cost from a total resource cost (TRC) perspective, and should be reviewed periodically.

[9] A recent internal memorandum to the Alliance Cost Effectiveness Committee (Hermenet 2004) indicates the adjustments made to model inputs.

References

Ecos Consulting. 2003. Northwest Energy Efficiency Alliance Residential Energy Star Lighting Program, Annual Report 2001-2002. Portland, Oreg.: Ecos Consulting.

Hermenet, Susan. 2004. "Revisions to Cost Effectiveness Models for the 2003 Market Activities Report." Northwest Energy Efficiency Alliance memorandum.

Huberman, A. and M. Miles. 1998. "Data Management and Analysis Methods." In *Collecting and Interpreting Qualitative Materials*, Denzin et al. (eds.). Thousand Oaks, Calif.: Sage Publications.

Northwest Energy Efficiency Alliance. 2002. 2001 Market Activities Report. Portland, Oreg.: Northwest Energy Efficiency Alliance.

NYSERDA. 2000. "Chapter 3: Program Design Logic." In *New York Energy $mart Program Evaluation and Status Report*.

NYSERDA. 2002. "Chapter 5: Causality Approach." In *New York Energy $mart Program Evaluation Report.*

Oakley, A. 1997. "Confronting Causation." In *Metascience.* 12:149-152.

Stephen Grover, David Cohan, and My K. Ton. 2002. Saturation, Penetration, Transformation: How Do You Know When a Market Has Changed? Teaming for Efficiency, ACEEE Summer Study on Energy Efficiency in Buildings.

Steven Nadel, Jennifer Thorne, Harvey Sachs, Bill Prindle, and R. Neal Elliott. 2003. "Market Transformation: Substantial Progress from a Decade of Work." In *American Council for an Energy Efficient Economy,* Report Number A036.

Susser, M. 1973. *Causal Thinking in Health Sciences: Concepts and Strategies,* Oxford, UK: Oxford University Press.