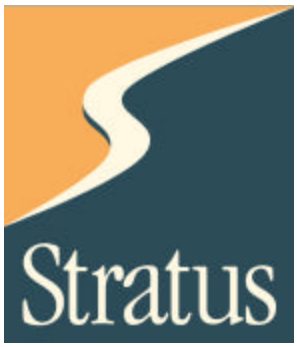


FINDINGS AND REPORT

RETROSPECTIVE ASSESSMENT OF THE NORTHWEST ENERGY EFFICIENCY ALLIANCE

Final Report

Prepared for:

Northwest Energy Efficiency Alliance

Ad Hoc Retrospective Committee

Chair – Mark Kendall, Oregon Office of Energy
Ken Keating, Bonneville Power Administration
Darlene Nemnich, Idaho Power
John Savage, Oregon Public Utility Commission
Ken Canon, Industrial Customers of NW Utilities

Portland, Oregon

December 8, 2003

Daniel M. Violette, Phd
Michael Ozog, Phd
Summit Blue Consulting
Boulder, Colorado
Phone 720-564-1130
dviolette@summitblue.com

Kevin Cooney, MS, PE
Stratus Consulting Inc.
Boulder, Colorado
Phone: 303-381-8000
kcooney@stratusconsulting.com

CONTENTS

9 Issues, Findings, and Recommendations

Appendices

EXECUTIVE SUMMARY

This report presents the results of the independent evaluation of market transformation accomplishments through Northwest Energy Efficiency Alliance (Alliance) efforts since 1997. This retrospective evaluation effort was initiated by an ad hoc committee appointed by the Alliance board of directors[1] for the primary purpose of determining whether the Alliance has transformed enough markets to justify the costs of the Alliance. This key question was investigated by looking at Alliance activities, and the role the Alliance has played in markets where the Alliance has spent significant resources over the past several years. This assessment of Alliance activities also takes into account the work of other organizations and their impact on energy efficiency markets to avoid double counting market impacts and effects. This evaluation was initiated in April 2003, and the work effort spanned approximately four months.

The evaluation team employed an interactive process with the ad hoc committee chairman and the executive director of the Alliance, as well as meetings with the committee at key project junctures to ensure that the evaluation was proceeding in a manner consistent with committee objectives. The team used the extensive body of material already available on Alliance project activities, including market assessments that were conducted on Alliance projects, market progress evaluation reports, computer models, and planning documents. Primary data collection activities focused on interviews with staff, evaluators, implementation contractors, market actors, and others to better understand program mechanisms and elicit alternative hypotheses regarding market changes.

E.1 Over-Arching Themes from this Assessment

The study team reviewed the information from the assessment and developed six over-arching themes that represent the high level findings. Each of these themes is addressed in greater detail in the concluding chapter of the main report.

[1] The ad hoc committee consisted of both Alliance board members and non-board representatives, as listed on the cover of this report.

THEME 1: The Alliance business culture is characterized by open communications, a focus on the planning and delivery of programs, and no discernable bias. The Alliance has developed a culture of adaptive management and continuous learning that has been communicated throughout the organization. Alliance personnel were open and direct in its communications with the study team. The project interviews with evaluators and implementers indicated that the Alliance worked with them to reach appropriate answers, and to continue to make the Alliance a "learning" organization.

THEME 2: The Alliance has been successful at transforming, or contributing to the transformation of markets. The study team reviewed Alliance program evaluations, and interviewed researchers who conducted program specific evaluations, as well as other regional stakeholders and market actors involved in energy efficient markets in the northwest. Based on the information gathered, the study team determined that the Alliance made substantive contributions to transforming regional markets for energy efficiency equipment and practices. Specifically, the MPERs addressing the Energy Star Windows program were compelling in their documentation of Alliance market influence in terms of the increase in the number of active manufacturers of high efficiency windows in the region. Both the MPERs and national data indicate market penetration of Energy Star windows in the Northwest are more than twice the national average. Interviews with industry experts also supported the contention that Alliance activities have permanently impacted the windows market.

Other markets where there was considerable evidence of market transformation included clothes washers and CFLs. For clothes washers, the market penetration of Energy Star washers in the NW are significantly higher the national average (see chapter 7). The market for CFLs changed more dramatically in the NW than other regions of the country, even when the West Coast energy crisis is considered (see chapter 3). The magnitude of the impact of the Alliance on these markets was a subject that not all market actors in the region agreed upon, but there was a more general agreement that permanent changes had taken place in these markets and were at least partially the result of Alliance activities.

THEME 3: Market Progress Evaluation Reports tended to focus on the program delivery process and on providing feedback for program design and implementation improvements. This met an immediate need for Alliance personnel responsible for program implementation, and these reports improved the delivery and implementation process. This trend towards process analyses and providing feedback for program improvement fits well with the Alliance's goal of adaptive management, but the estimates of impacts and the ability to substantiate claims of Alliance-induced market effects would have been enhanced by having the MPERs more directly address savings per unit and the issue of attribution within each study. In general, the MPERs were not structured to provide information on attribution or savings per unit for energy efficiency equipment (or applications) influenced by Alliance activities.

THEME 4: Cost-effectiveness analyses were difficult to replicate and the current processes used are cumbersome. Cost-effectiveness models and analysis efforts form the basis for projecting market impacts from programs under development by the Alliance and they are used as the basis for the Alliance claims of cost effectiveness as presented to the public in the MAR.

The initial pressures on the Alliance have been to develop and implement programs in the field. The study team commends this past focus, but is emphasizing the need for improvement in this area going forward. The magnitude of claims made by the Alliance as its portfolio of programs has grown will result in new challenges related to accountability that may not have been present (or needed) during the start-up phase. As a result, a more streamlined and transparent process for estimating and modeling program cost-effectiveness is needed.

The study team traced Alliance claims of energy savings as presented in the MAR and developed alternative scenarios, which were subsequently run through the CE models. These analyses resulted in lower estimates of overall Alliance impact claims as compared to the numbers reported in the 2002 MAR (from 134aMW to 98aMW). Most all of this adjustment came in one program – the ENERGY STAR® Residential Lighting program – with adjustments in other programs examined being much less significant. The numbers used in this adjustment are from the "low influence scenario" for CFLs (see Chapter 3).

THEME 5: Benefits of the Alliance have exceeded costs. Even with the study team's adjustment to estimated Alliance energy savings estimates, the analysis of program impacts shows the benefits from Alliance activities have exceeded its costs. In fact, the team analysis indicates a levelized cost for the Alliance portfolio of programs of between 0.83 and 1.17 cents per kWh, with a mean of 0.99 cents/kWh, when viewed from the Alliance perspective through the Venture period (see chapter 8 for additional detail on levelized costs).[2]

THEME 6: The regional approach of the Alliance is an asset and even greater leverage in program implementation can be gained in the future. The Alliance has developed an infrastructure of programs, relationships, and personnel that represents organizational capital that will be valuable in the future. Interviews with market actors indicated some diverse opinions regarding past efforts of the Alliance and the amount of energy savings that should be attributed to Alliance activities. Even taking those comments into account, there was a general consensus that the Alliance was able to undertake certain programmatic activities more efficiently on a regional basis than was possible through local efforts. The study team's review of programs selected for implementation by the Alliance indicated that most programs were well suited to implementation by a regional organization. In this respect, the Alliance was living up to its goal of focusing on market transformation projects that can best be addressed at a regional level.

[2] It should be noted that the study team analyzed four programs from a retrospective perspective. Other than making an adjustment to the future consumer replacement cost of CFLs, no estimates of *future* costs, or estimated future savings were modified from Alliance estimates. Neither 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 TRC perspective.

E.2 Estimated Impacts of the Alliance – Energy Savings and Levelized Costs

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. The calculation used for this is:

$$\frac{\text{Total \$ spent to date on Alliance activities}}{\text{Levelized Alliance Savings to Date}}$$

Using the Alliance numbers from the 2002 MAR for the costs ($96M) and savings (134 aMW) for *all* Alliance activities produces a levelized cost of 0.7 cents/kWh.

The study team's analysis of the savings associated with the Energy Star Lighting, the Energy Star Windows, Building Operator Certification (BOC), and MagnaDrive programs – when combined with Alliance estimates of savings for other tracked programs - produces an average cumulative savings through 2002 of 98 aMW compared to the Alliance's original estimate of 134 aMW. This analysis is documented in Chapters 3 through 6 of the main report and uses the low CFL attribution scenario from Chapter 3. These adjusted numbers (when summed with Alliance estimates for other programs) produce a study team estimated total levelized cost for all the Alliance's activities of 0.99 cents/kWh, with a 90% probability that the cost is 1.17 cents/kWh 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, it is still well below the avoided cost of power in the region.

E.3 Overall Value of the Alliance

The interviews conducted with stakeholders and market actors contained a set of questions that addressed the overall value of the Alliance. Questions addressed four areas of Alliance activities – Planning, Implementation, Evaluation, and Communication. The individuals interviewed are shown in Appendix A to this report. They include project implementers, project evaluators, utility program managers, retailers/trade allies, and other stakeholders. These questions were not asked of Alliance staff. The interviews with the evaluation personnel that conducted the MPERs was informative in that they were able to provide opinions based on their overall review of the programs and the interviews they had conducted with various market actors. The responses to these questions regarding the perceived value of the Alliance were combined with other information obtained from the review of reports, and interviews with Alliance staff. This process produced insights that the study team believes are useful for this assessment.

Overall Value: Impact of Alliance on Market Transformation. The interviews with stakeholders (excluding Alliance staff) indicated:

- A widely held belief that the Alliance is responsible for higher levels of market transformation than would have occurred had the Alliance not existed.
- That the Alliance had a significant impact on a number of markets for energy efficiency technology and their efforts on the energy efficient residential windows market in the Northwest is exemplary of a successful MT program.
- That the focus of the Alliance's market transformation efforts has been appropriate, i.e., the Alliance has done a good job of identifying and pursuing programs best addressed regionally. Also, the study team's reviews of the selection process and the programs implemented supported this finding. Examples include training programs such as builder operator certification (BOC), and projects targeted at manufacturers (e.g., Energy Star windows) as the types of programs whose implementation spans utility service territories and even state boundaries.

While the comments above represent the study team's findings based upon the interviews, there were other comments made that did not appear to be part of the *majority* view, but the study team believed that they were worth bringing to the attention of the Alliance and its Board for their consideration. Two such comments were:

- There was one dissenting opinion regarding the impacts of the Alliance on market transformation which was based upon the belief that baselines are dramatically understated, i.e., many market changes observed would have happened without the Alliance - due to other factors.
- Another individual expressed the opinion that while venture selection has been good overall, there was concern expressed about the recent selection process.

Overall Value: Alliance Tracking of Impacts. There was a general view among the stakeholders interviewed that impact estimates tended to be modestly high. Comments pertaining to this finding include:

- Several individuals expressed concerns about the Alliance claimed impacts for its efforts in residential lighting and this did show up in the bi-modal estimates of CFL sales influence used in the study team analysis in Chapter 3.
- The individuals interviewed indicated that while they generally believe the Alliance impact estimates were somewhat high, it was believed to be only a modest overstatement on the order of 10 percent or so on average.
- There was a perceived need to update baselines used to estimate program impacts more frequently.
- There is a need to test performance assumptions in the field rather than assume that actual performance matches predicted performance.
- Evaluators did not feel pressured by Alliance study sponsors to produce favorable numbers or results.

In addition to the sets of comments that are viewed as study team findings above, other comments that may be of interest to the Alliance and its Board are:

- Some of the Board members interviewed (and also other stakeholders) indicated that they were "trusting" a few knowledgeable "other" Board members to ensure unbiased impact evaluations since they had expertise in this area.
- Originally the MPERs were designed to look at entire markets, not just at project indicators and effects; but, over time, they have changed to focus on project effects and delivery processes and less on the overall market.

Overall Value: Organizational Effectiveness. A question was asked regarding how well the Alliance operated as a business organization. This was asked in the context of overall operational effectiveness compared to other organizations with which the individual being interviewed was familiar. Findings on this topic included:

- Only one interviewee rated the Alliance as "below average" as a business organization – other respondents rated the alliance as well above average (7 or 8 on a scale of 1 to 10) and, based on other organizational studies, this is a high rating and reflects favorably on how the Alliance operates.
- Planning was viewed as a strength of the Alliance.
- Communication to stakeholders was rated as very good.
- Importantly, Alliance staff was well respected by the majority of stakeholders interviewed.

Some other comments for consideration that were not viewed as findings are:

- Some concerns about recent trends in various areas (venture selection, accountability, and transparent accounting), but this was viewed as recent and not yet of great significance.
- The Alliance has faced recent challenges due to organizational changes in general, staff turnover and staffing patterns in particular.
- The Alliance's reputation among trade allies was raised as a "potential" concern – related to this concern was implementation contractor selection and their ability to relate to the concerns of trade allies and industrial customers in particular, and the implementation of an overall quality control process managed by the Alliance rather than its contractors to ensure that relations with key trade allies remained favorable.

E.4 Alliance Analysis Process and Issues Discussion

A central aspect of this assignment was to consider alternative hypotheses concerning the market effects of Alliance programs. In meetings with the Ad Hoc Retrospective Committee, this was termed the "But For" analysis and was meant to focus on determining the appropriate baseline against which Alliance activities should be measured. In other words, a best practices

determination of what would have happened in these markets if the Alliance programs had not been offered.

To address this question, a specific and targeted approach was developed to address alternative hypotheses and develop range estimates for both the baseline (i.e., what would have happened in the absence of the Alliance) and for "pivot" assumptions which focused on the assumptions or attributes of each program that had the greatest influence on estimates of program impacts. For lighting, pivot assumptions include the assumed operating hours per lamp, the savings per lamp installed, and installation rates. Each of these pivot assumptions was examined by the study team using a range of values that encompasses both a low and high scenario. The scenarios around these pivot assumptions were rolled up using a sampling framework to produce a range of likely impacts for each program and an associated likelihood of occurrence. The framework and approach to this "But For" analysis is documented in Chapter 2 and implemented in the detailed program analyses presented in Chapters 3 through 6. This process was used to produce the study team's estimates of Alliance impacts.

Three Alliance processes were central to the study team's efforts to dimension the impact of the Alliance on the markets for energy-efficiency technologies and services. This included the cost-effectiveness analysis process, the evaluation process as represented by the MPERs, and the annual Market Activity Report (MAR) which presents the Alliance's estimates of annual and cumulative impacts. Select issues are discussed with each of these processes, then a set of recommendations is provided.

The Alliance Cost-Effectiveness Model — The study team conducted a review of the Alliance Cost-Effectiveness (ACE) model as part of the assessment of the Alliance's claims, particularly the models used for the four programs the study team investigated in detail. Difficulties encountered by the study team point to a need to streamline the ACE modeling process.

Market Progress Evaluation Reports (MPERs) — In developing the review of the Alliance's accomplishments, the team reviewed a large number of the available Market Progress Evaluation Reports (MPERs). Since the objective of this assessment was to determine energy savings attributable to the Alliance and whether the Alliance has contributed to market transformation, the study team's review concentrated upon how the MPERs can be used to determine the program progress. As a general statement, most MPERs focused primarily on assisting the Alliance on project implementation feedback, with some verification of market effects and a limited review of the input assumptions to the ACE model. Expected savings per application associated with a project and the related assumptions used in the cost-effectiveness model were not researched or not researched at the same level of detail. Overall, the MPERs are a good process review of program delivery, but did not research project impacts as actively as might have been expected.

The Market Activities Report (MAR) — The need for accuracy in the CE analyses and the role of the MPERs depends in part on what the Alliance and its Board hopes to accomplish with the energy savings estimates that are attributed to the Alliance in its MAR. The MAR is widely viewed as the Alliance's definitive statement on what it believes it has accomplished. The language used in the MAR supports this assumption. For example in the recent 2002 MAR, it

states that *"For the reporting period January 1, 2002 to December 30, 2002, the Alliance has saved 45aMW, as depicted in Chart 1."* In the next paragraph of the MAR Executive Summary it states that *"Total Savings of the Alliance since its inception in 1997 (exclusive of utility direct rebates) is 134aMW."* The Alliance energy savings claims are very direct and unequivocal.

Given this, a question that must be addressed concerns the appropriate underpinning and evidence needed to ensure that these claims are viewed as credible by entities that work with and support the Alliance. The study team believes that it is important that the Alliance provide estimates of energy savings accomplishments, but there may be better approaches to bracketing and bounding the estimates than are currently used in the MAR. Even with that change, the MPERs should refocus a bit more on providing support for energy savings estimates.

E.5 Recommendations

A number of specific recommendations are made by the study team in this section. The recommendations are divided into five categories and are presented below.

Recommendation Area #1 — Cost-Effectiveness Models and Processes:

R1.1 – The Cost-Effectiveness spread-sheet models should be "cleaned-up" and a better documentation process implemented to avoid confusion in the future. The study team believes that several man-weeks devoted to this process could considerably enhance the transparency, and user-friendliness of these important tools and save labor hours down the road that might well make up for the short term costs of upgrading the CE process.[3]

R1.2 - Develop more specific processes to update and track assumptions used with direct links to sources of assumptions and referencing the MPERs that are tasked with reviewing the input assumptions for each project.

R1.3 - Board recognition of the complexity of this work element can help ensure that there is a reasonable review process for model results. The fact that a model is used does not, in itself, ensure that the outputs are appropriate.

Recommendation Area #2 — Use of scenario analysis and identification of pivot factors in reporting of Alliance accomplishments:

R2.1 - Evaluation and planning (e.g., the venture business plan) would benefit from the use of bounding scenario analyses and the identification of pivot factors. The portfolio committee discusses these factors when deciding whether a specific project should be undertaken, but these assumptions need to be documented and tracked over time. This would provide the following benefits:

[3] There is the additional concern of knowledge being concentrated among a few key staff, if for some reason those staff members were not available to the Alliance in the future.

- Large uncertainties on select pivot factors could be targeted in the MPER analyses to reduce these uncertainties.
- As the MPERs address these factors, better information can be incorporated into the CE analyses and they will better reflect the best available information as well as documenting current uncertainties.
- It would help determine the confidence in projected aMW accomplishments.

Recommendation Area #3 – Treatment of Project Baselines (Dynamic versus Static):

R3.1 – The baseline trend line for each Alliance project is determined in the planning process and not typically updated even when there have been substantial changes in the market. Outside factors such as changes in utility programs, prices, and energy shortages influence what would have happened without the Alliance program. As a result, baselines should be dynamic in that they should be re-evaluated every year and updated to reflect major market changes.

R3.2 - The baseline is one of the most influential and uncertain factors in producing any estimate of Alliance project effects. Best efforts are needed on baseline determination, despite the complexities and uncertainties.

Recommendation Area #4 – Trade Ally Relationships Going Forward:

R4.1 - Trade ally relationships are central to the Alliance objectives. Implementation contractors represent the Alliance to these important stakeholders and some contractors have proven to be a key factor in program success. Additional independent quality control processes should be implemented to ensure that good relations are consistently maintained.

Recommendation Area #5 – The Cost-Effectiveness Committee of the Board should revisit the way in which impacts are claimed and reported by the Alliance in public documents:

R5.1 - Guidance is needed on what "claimed aMW impacts" and "levelized cost" means in the context of the MAR:

- Should the MAR only focus on market share indicators?
- Or, are these estimates meant to represent a "best estimate" of aMW attributable to Alliance activities?
- Should estimates be given a degree of confidence and/or expressed as range estimates to reflect the uncertainties in the attribution process?
- Should the MAR estimates be supported by a specific ACE analysis to ensure consistency between savings estimates and levelized costs?

These positions have implications on Alliance credibility and also for resources allocated to evaluation efforts. In addition, this recognizes that all business decisions and venture analysis both within and outside of the area of energy efficiency investments are made with uncertainty,

and that precision in excess of what is used in the private sector to make good business decisions is not needed for the Alliance to successfully meet its objectives.

E.6 Final Comments

This section is designed to emphasize the important context in which these issues are discussed and the recommendations made. The assessment performed by the study team found that the Alliance provides value that exceeds its costs. Interviews with key stakeholders indicated that the Alliance:

- Operates well as a business organization,
- Is strong in planning,
- Communicates well, and
- Has impacted targeted markets.

The benefit-cost analyses conducted with the study team's revised numbers show that the benefits of the Alliance has exceeded its costs. Overall, it is the study team's opinion that the reasons for establishing the Alliance are still valid and provide strong rationale for continuation:

- Energy markets invariably cut across utility and jurisdictional boundaries, it makes most sense to pursue these (MT) efforts regionally; and,
- This regional approach by Alliance is an asset and can gain increased leverage by continuing its relationship building efforts with partners.

1 INTRODUCTION

This report presents the results of the independent evaluation of market transformation accomplishments through the Northwest Energy Efficiency Alliance (Alliance) efforts since 1997. This retrospective evaluation effort was initiated by an ad hoc committee, consisting of Alliance board members and stakeholders representing non-board interests in the region, for the primary purpose of determining whether the Alliance has transformed enough markets over the first six years to justify the costs of the Alliance. This key question was investigated by looking at Alliance activities, and the role the Alliance has played in markets where the Alliance has spent significant resources over the past several years. This assessment of Alliance activities must also take into account the work of other organizations in these markets and their impact on energy efficiency to avoid double counting market impacts and effects. This evaluation was initiated in April 2003, and the work effort spanned approximately four months.

The evaluation team worked directly with the ad hoc committee chairman and the executive director of the Alliance, and met with the committee at key project junctures to ensure that the evaluation was proceeding in a manner consistent with committee objectives. The team used the extensive body of material already 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 activities focused on interviews with staff, evaluators, implementation contractors, market actors, and others to better understand program mechanisms and elicit alternative hypotheses regarding market changes.

The results of the project are timely, considering that the funding cycle for the Alliance stakeholders requires renewal before the end of 2004. The evaluation team also provided observations from the analysis that can assist the Alliance in making improvements in operations.

In this chapter, Section 1.1 contains a brief overview of Alliance history and goals; Section 1.2 presents the objectives of this retrospective evaluation; Section 1.3 provides an overview of the activities conducted by the evaluation team; and Section 1.4 describes the organization of the report.

1.1 Background on Alliance History and Goals

The Northwest region has historically recognized the effects of conservation on the overall cost effectiveness of region's energy system. Substantial efficiency gains were realized during the 1980s and 1990s through utility conservation programs and the adoption of energy codes by state and local authorities in the region. In its 1996 draft power plan, the Northwest Power Planning Council (Council) assessed the remaining achievable potential for conservation and renewable energy in the four state NW regions. At that time, the Council estimated the amount of conservation that would be cost-effective to develop in the region over the next 20 years across a wide range of future electricity use patterns, gas prices, and hydropower availability. This analysis indicated the amount of conservation that would cost less than alternative power sources to be between 800 and 2300 average megawatts (aMW), with an average amount of approximately 1535 aMW.[4] This assessment estimated the levelized costs for acquisition of this conservation resource to be approximately 1.7 cents per kWh.

In the final report submitted that year, recommendations were made to fund a range of specific activities, including conservation, renewables, and low-income energy services.[5] The report assessed a range of cost-effective conservation options, and made recommendations that all electric utilities operating within the region contribute to the development of conservation resources. The Comprehensive Review recognized that many energy efficiency efforts are most appropriately conducted at the local level, but that some conservation and renewable activities would benefit from regional planning and coordination. In addition to establishing a Regional Technical Forum to develop standardized protocols for verifying and evaluating conservation savings, the committee also recommended a coordinated effort to transform regional markets for efficient technologies and practices.

The Comprehensive Review acknowledged that markets invariably cut across utility and jurisdictional boundaries, and thus it makes most sense to pursue market transformation activities regionally. They recommended that a nonprofit organization manage market transformation ventures for the region, and that the governing body should consist of consumer, utility, government, and public interest representatives. The organization should have a planned life of at least 10 years, in recognition of the time required to permanently transform markets and the range of markets or end uses to be targeted. A minimum investment standard for distribution utilities in the region was established, with some flexibility allowed in the collection of these fees. The Alliance, which had recently been formed, was designated as the organization to manage the region's market transformation efforts. The Alliance had been formed specifically to see if more energy efficiency could be secured at a lower cost if the region pooled its resources to influence what was stocked and sold in the marketplace.

In 1998, the Alliance hired Pricewaterhouse Coopers to conduct an operational audit to determine how well the Alliance was operating to achieve its objectives. This review focused on

[4] Chapter 6 – Draft Fourth Northwest Power Plan, 1996.
[5] Comprehensive Review of the Northwest Energy System – Final Report "Toward a Competitive Electric Power Industry for the 21st Century," December 12, 1996.

organizational and administrative aspects of the organization. The assessment indicated that the Alliance's actions and plans were in alignment with the organization's purpose and objectives.[6]

The Alliance began printing annual activity reports and progress reports in 1999, the first set covering activities from inception through 1999, and subsequent activity reports produced annually. A refinement of the organizational goals was articulated in 2000, outlining the following goals for the Alliance[7]:

> Goal 1: The Alliance will manage a strategically prioritized portfolio of cost-effective market transformation (MT) projects.
>
> Goal 2: The Alliance will assist its projects achieve success by supporting related activities including market research, information and education efforts, and partnering with other market actors.
>
> Goal 3: The Alliance will ensure that its ventures are evaluated to document the effects of its efforts and to use that information to improve future efforts.
>
> Goal 4: The Alliance will be an effective and open organization, and will keep its constituents well informed of Alliance activities.

1.2 Objectives of the Assignment

A cost review plan that was adopted by Bonneville Power Administration in 1998 recommended that a review of the Alliance be conducted no later than 2004. In addition, contracts between the Alliance and its utility funders called for an independent review of the organization's market transformation accomplishments before the end of 2003, in anticipation of funding reviews that will take place in 2004. In early 2003, the Alliance requested proposals to conduct this assessment, and outlined objectives for the assignment.[8] During the proposal process, and through a series of conversations with the ad-hoc committee members at the outset of this project, the following key objectives were identified:

- To determine if the Alliance has transformed enough markets over the first six years of its life to justify its costs.
- To provide an objective evaluation of accomplishments that can be given to stakeholders, and assist them in determining whether to continue investing in the Alliance.
- To determine whether Alliance claims for (aMW) savings are backed up, and to bound estimates of savings by dimensioning uncertainty around these estimates.

[6] Northwest Energy Efficiency Alliance Operational Audit, Price Waterhouse Coopers, December 12, 1998.
[7] Strategic Plan, Northwest Energy Efficiency Alliance, April 12, 2000.
[8] Request for Proposals for an Independent Evaluation of Market Transformation Accomplishments through Alliance Efforts Since 1997, January 2003.

- To review project evaluations to determine whether they assessed the right things, and to suggest improvements to the evaluation process.

- To try and distinguish market transformation impacts from electricity price increases and technology advances.

- To identify where (which markets and activities) MT is the right tool, and areas where other approaches may be appropriate.

1.3 Project Activities

The evaluation team organized the assessment into the following major task areas:

Task 1: Kick-off Meeting, Scope Validation, Discuss and Finalize Work Plan

Task 2: Review of Project Strategy and Market Indicators

Task 3: Data and Information Collection

Task 4: Scenario Development for Assessment (organization of data and information)

Task 5: Analysis of Scenarios (Note: A scenario represents a set of Alliance accomplishments and resulting value.)

Task 6: Investment Assessment Framework (best estimates and ranges of Alliance results and value from a risk/reward perspective).

Within each of these project tasks, a number of activities took place. A summary of the activities the team completed in conducting this evaluation is included in the table below:

Activity
Task 1: Kick-off Meeting, Scope Validation, Discuss and Finalize Work Plan
Conduct project kick-off meeting and finalize work plan
Develop project management and communications plan
Submit initial data request
Interview ad-hoc committee members and select board members
Task 2: Review of Project Strategy and Market Indicators
Review Market Progress Evaluation Reports (MPER) and Research Reports [approximately 100 reports]
Conduct literature review on market transformation theory and practice
Review Staff Recommendation Memos and Cost-Effectiveness analyses
Review annual Market Activity Reports for 2001 and 2002
Develop interview guides and conduct initial interviews with key Alliance staff

Activity
Task 3: Data and Information Collection
Initial review of levelized cost calculations
Review of Progress Indicators for each project
Submit additional data request
Review project specific documentation (implementation reports, curriculum, etc.)
Conduct project update meeting with Retrospective ad-hoc committee
Review Alliance cost effective (ACE) models for programs selected for in-depth analysis
Review programmatic actions and savings occurring in other regions
Task 4: Scenario Development for Assessment (organization of data and information)
Determine the pivot assumptions for 4 in-depth programs through sensitivity analysis
Develop potential alternative hypotheses to test pivot assumption ranges and create discussion guides for market actor/stakeholder interviews
Develop draft final report outline
Conduct interviews with key market actors and stakeholders
Consult other studies to assist in establishing ranges for pivot assumptions
Develop scenarios to establish distributions for pivot factors
Task 5: Analysis of Scenarios
Run ACE models for key programs using distributions for each pivot assumption
Analyze interview data for common themes and potential recommendations
Task 6: Investment Assessment Framework
Best estimates and ranges of Alliance results and value from a risk/reward perspective.

1.4 Layout of the Report

Chapter two of this report provides a description of the evaluation approach used for this project. This is followed by four chapters that describe the results of the analyses for each of the four programs selected for in-depth analysis (Energy Star Residential Lighting, Energy Star Residential Windows, Building Operator Certification, and MagnaDrive). Chapter seven provides a summary assessment of other Alliance programs. A summary of the programmatic findings and an assessment of value to the region are contained in Chapter eight. Chapter nine outlines the conclusions and recommendations of the evaluation team, along with the key themes that emerged during the retrospective evaluation.

The appendices of the report contain a) a list of those interviewed during the evaluation, and interview guides, b) distributions for pivot assumptions that were used in the ACE model runs, and c) a list of Alliance documents used during the evaluation.

2 FRAMEWORK AND APPROACH

This chapter outlines the assessment issues addressed in this work effort, the framework used to define the assessment, and the approach taken to produce estimates of Alliance induced market impacts. Section 2.1 outlines the basic assessment problem for energy efficiency projects that use market transformation projects as the approach for encouraging cost-effective investments in energy efficiency technologies and practices by market actors. Section 2.2 discusses the initial interviews that were conducted to better define the assessment objectives. Section 2.3 presents an overview of the approach taken in this assignment. Section 2.4 discusses the processes that were used to develop alternative hypotheses concerning the role of the Alliance in promoting increased energy efficiency in the targeted markets, and Section 2.5 presents an example of the type of scenario analysis that was used as the basis for the in-depth project assessments.

2.1 Assessing Market Transformation (MT) Projects

The Alliance focuses on MT as the "strategic tool … to encourage manufacturers, distributors, and service providers to make affordable energy-efficient products available in the market place" (2001 Annual Report). 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.[9]

Real market changes induced by MT programs rely on a variety of promotion, education, and incentive activities. Successful MT initiatives are by nature multi-faceted 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, or consumer. These mechanisms are discussed in more detail in Chapter 7 of this report.

[9] Recent work done at the New York State Energy Research Development Authority (NYSERDA) utilizes this approach. Recent publications addressing these topics include "Chapter 3: Program Design Logic" in New York Energy $mart Program Evaluation and Status Report, September 2000; and also in "Chapter 5: Causality Approach" in New York Energy $mart Program Evaluation Report, January 2002.

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., commercial architect, builder, buyer interactions).

A focused project theory and 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,[10] 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 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 even if the project had not been offered and which changes 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.[11]

From one perspective, this assessment can be viewed as an analysis of the investment in the Alliance and the return on that investment. There will be some elements that can be more easily quantified than others, but a thorough assessment will need to address the range of benefits produced by the Alliance. The approach taken by the study team develops risk/reward criteria based on scenario analyses of project outcomes, a method that is similar to assessments of investments in research and development portfolios by conducted by private companies.

2.2 Initial Interviews with Alliance Staff

After the evaluation team reviewed Market Evaluation Reports, and Research reports, and other documentation regarding Alliance activities and funding, one of the key steps in gaining a stronger understanding of Alliance activities involved interviews with Alliance staff. These interviews were focused developing a more complete understanding of the assumptions that drive each program. The key themes discussed during the interviews include the following:

[10] Often project planners assume that energy-efficient technologies will be selected for application in those situations in which they will produce the greatest savings. However, this may not be correct. For example, research in the Scandinavian countries initially assumed that horizontal axis washing machines would be installed in households that use such machines heavily and therefore produce higher savings. Instead, field work showed that these machines tended to go to older, wealthier households and early project assumptions made about the usage characteristics of the machines as situated in the field were not borne out by the field work.

[11] Discussions of causality in the context of project evaluation include Susser, M., *Causal Thinking in Health Sciences: Concepts and Strategies*, Oxford University Press, 1973; Huberman, A. and M. Miles, "Data Management and Analysis Methods," in *Collecting and Interpreting Qualitative Materials*, Denzin *et al*. eds., Sage Pubs., Thousand Oaks, CA, 1998; and Oakley, A., "Confronting Causation," *Metascience*, **12** 149-152, 1997.

- Role of project planning assumptions in development of strategy and theory.
  - Understanding 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.
- Role of the Market Assessment studies in providing a feedback loop back to implementation.
- Adaptive Management e.g., how are programs modified to reflect evaluation results and how are key choices made regarding such things as retiring certain programs or morphing existing programs into new offers.
- Begin the thought process regarding the appropriate way to explore alternative hypotheses regarding attribution of program results to ensure an unbiased view as called for by the ad hoc retrospective committee.

These interviews were held at the Alliance offices during early June, 2003. At that time, the evaluation team was considering about a dozen programs for detailed review, and the results of these interviews assisted in narrowing the list of programs that would be 'representative' of Alliance activities. A sampling of the questions that were asked staff members during this phase of the project is located in Appendix A.

2.3 Approach to Program Analyses

As part of the retrospective assessment of the Alliance's activities, a detailed investigation of four representative programs (chosen in discussions with the ad hoc committee) was undertaken. These four programs are 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 the MPERs
- Review of the most recent Alliance Cost-Effectiveness (ACE) model
- Threshold analysis
- Determination of the pivot assumptions
- Dimensioning uncertainty of these assumptions
- Simulating the results under different values for the pivot assumptions.

The study team's review of the MPERs focused primarily on trying to obtain 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 has developed a model (Alliance Cost Effectiveness) that essentially computes unit impacts and unit costs which are then fed into the NW Power Planning Councils ProCost model to develop various levelized cost and cost-effectiveness indexes. 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.

After reviewing the ACE model for each program, the evaluation team developed a list of 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 that assumed by the Alliance.

Once the evaluation team identified these pivot assumptions, it then quantified the uncertainty about these assumptions by reviewing the literature and through stakeholder interviews. The approach for eliciting uncertainty estimates in the interviews is discussed in Section 2.4.

Once the evaluation team had the probability distribution associated with each pivot assumption, the next step in the assessment was to use the appropriate ACE model to determine how the programs accomplishments (savings, cost-effectiveness index, and levelized costs) where affected by the uncertainty in these assumptions. For this process, the evaluation used a simulation tool, @Risk, and ran 5000 simulations of the ACE model which pulled observations randomly from the distributions developed for the pivot assumptions and observed the resulting effects upon the program performance measures as defined by the Alliance.

2.4 Alternative Hypotheses Elicited and Explored

Discussions were held with the ad hoc committee on the selection of a set of representative programs that provide an illustrative view of the Alliance's accomplishments. After determination of the pivot assumptions, the next step in the analysis focused on the elicitation of alternative hypotheses regarding changes in market activity, specifically focused on the four programs selected for detailed review. 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 the Alliance on the specific market being analyzed; and
- general feedback regarding 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 evaluation team provided the ad hoc committee chair and Alliance executive director with a list of individuals 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. In addition, the committee chair provided a 'letter of introduction' to potential interviewees that helped facilitate scheduling of interviews. A list of all individuals interviewed during the project is located in Appendix A.

Interviews were scheduled and conducted in-person with key individuals, based on their availability in early August. Additional interviews were conducted via telephone after the on-site interviews. All interviewees were assured confidentiality in that no particular comment would be attributed to them directly, but their name and affiliation would be provided in this report. While these interviews do not represent a statistical sample, they do represent a cross section of viewpoints on Alliance activities. While some groups may appear under-represented, the study team strived to get balanced input within the time constraints of the project, and availability of interviewees. When the study team determined that the information gathered on a specific pivot assumption was sufficient, when combined with other information resources, to confidently bound the ranges for that assumption, further interviews on that particular assumption were not sought.

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. Interviewees were given free reign to expound on any of the questions, and many insightful comments were elicited in this manner. The interview guides for the pivot assumptions for each of the four programs, and the general questions are located in Appendix A.

The lists below indicate a range of 'starter' alternative hypotheses that were explored for each of the four programs. A number of individuals made qualitative comments relating to these initial or starter hypotheses, and other hypotheses were developed and explored as appropriate in the interview. This information was captured in interview notes and used by the evaluation team to explore specific issues further. *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 and which impacts could reasonably be attributed to the Alliance.*

2.4.1 Potential Alternative Hypotheses Explored during Interviews

Energy Star Residential Lighting

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

Energy Star Residential Windows

1. Baseline assumptions were different (nationally and regionally)
2. Builders changed installation preferences for other reasons than Alliance activities
3. Manufacturers changed processes for other reasons than Alliance activities
4. Distribution of electrically heated home is different than assumptions

Building Operator Certification

1. Building operating practices baseline assumptions are different
2. Changes in habits of graduates do not produce savings assumed (per sq. ft.)
3. Energy crisis of 2001 (and resulting media attention) drove operator awareness and changed operating practices
4. Square footage managed by attendees was different than assumed.

MagnaDrive

1. Baseline assumptions were different than assumed
2. The technology would have penetrated market w/o Alliance assistance
3. Utility acquisition programs may have achieved similar results

2.5 Approach to Scenario Analysis – Illustrated Example

The scenario analysis used in this assessment for the four programs selected for an in-depth examination was designed around the ACE Model that 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 develop by the Northwest Power Planning Council (NWPC) and the inputs to the ACE model follow those developed by the NWPC and as part of the Northwest's regional technical forum. However, for any specific Alliance project, the inputs are unique to that project.

A six-step approach characterized each program scenario analysis:

Step 1: Begin with the cost-effectiveness analyses for the four programs identified for detailed analysis.

Step 2: Select pivot assumptions that influence cost-effectiveness.

Step 3: Trace assumptions to MPERs or other reference documents.

Step 4: Conduct interviews with other organizations to bracket impacts, key assumptions and develop scenarios.

Step 5: Seek ranges for key values.

Step 6: Delineate breakeven scenarios and distributions of economic outcomes.

The traditional 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. An example to illustrate the traditional approach and the distribution approach is presented below using the Alliances Residential Lighting Project as a case study with which to illustrate each approach.

The traditional scenario analysis would pick a best estimate value and then high and low scenarios. Using the assumptions of the Alliance for its residential CFL project, this would translate into:

Estimated Value: Alliance receives credit for all CFL sales that were not utility coupon or giveaway sales minus assumed baseline of 100,000 CFL sales (this baseline comes from the ACE model for the CFLs project)

Low Scenario: The low scenario might assume that the many utilities in the region that developed their own CFL programs actually were the more important driver and that 30% of the CFLs that the Alliance is taking credit for in the "Estimated Value" case are actually spillover from the utility coupon and giveaway programs to other sales of CFLS, i.e., the awareness was created by the utility programs and that CFLs would have been available in adequate supply such that the utility programs were a more significant driver of total CFL sales than is assumed in the estimated value base case.

High Scenario: The high scenario assumes that spillover goes in the other direction and that due to Alliance efforts, utilities are able to sell 30% more CFLs than would otherwise have been the case since the Alliance helped set up coupon programs, the redemption center and encouraged retailers to stock CFLs. The end result is that without the Alliance efforts the utility achieved sales would have been 30% less

Translating these three cases into actual sales figures gives the following:

A numeric example is used to illustrate two different approaches for performing scenario analyses – 1) the standard high, medium and low scenario approach, and 2) a distribution based approach. ***The numbers used here are for illustration only and are not the numbers that comprise the actual analysis of the lighting program presented in Chapter 3.***

For this example, assume that:

8,000,000 = Total CFL sales (Total)

3,900,000 = CFLs were sold with utility coupons or part of giveaways (Utility)

100,000 = Baseline, i.e. CFL sales that would have occurred without either utility or alliance efforts.

The low, best estimate, and high scenarios defined above incorporate different assumptions about the direction of spillover, i.e., it is either zero,+30% or -30%. Thus, the three scenarios to be examined are:

(1) LOW attribution scenario = (Total) - (Utility) - (30% spillover i.e., impact on non-utility sales cause by utility efforts) - (baseline) = 2.8 million

(2) MEDIUM -- Estimated value = (Total) - (Utility) - (baseline) = 4.0 million.

(3) HIGH attribution scenario = (Total) - (Utility) + (30% spillover, i.e., alliance efforts make utility sales 30% higher than would otherwise have been the case) – (baseline) = 5,170 thousand or roughly 5.2 million.

This scenario analysis provides three numbers that are obtained through the interviews with experts and using general reasonableness criteria. In summary, the Low estimate is 2.8 million CFLs attributed to the Alliance, the medium case is 4.0 million CFLs and the high is 5.2 million CFLs.

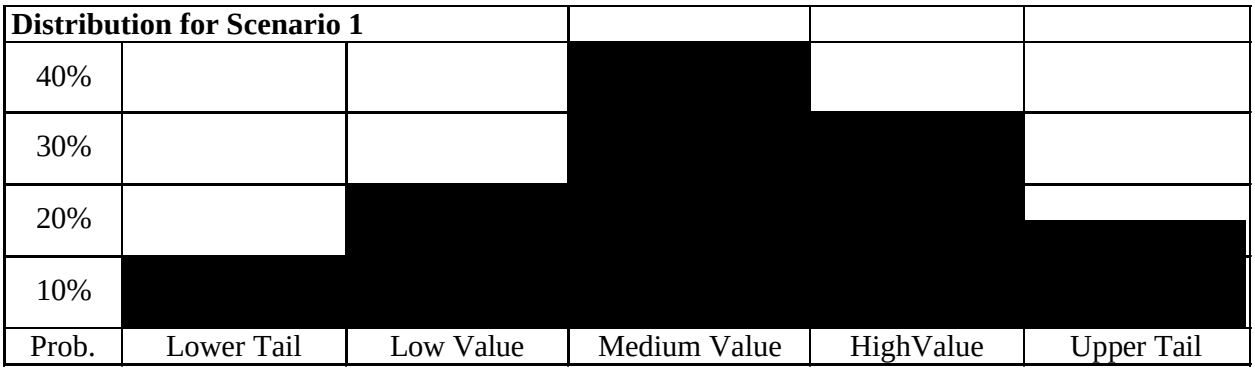
What else would one like to know about these scenarios? Additional information that would be useful might include:

- How likely is each of these scenarios to occur?
- Are scenarios other than these three as likely or more likely to occur?
- What is meant by low, medium and high?
  - Is the low scenario the lowest conceivable value?
  - Is the high the highest conceivable value?

Just knowing these three values – a low scenario, a medium scenario and a high scenario -- may not tell us much and might not capture the expert judgment and ancillary information available very well

The distribution approach used in the scenario analyses to be presented in Chapters 3 through 6 for the four selected programs attempt 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 the low scenario. Asking general questions about the odds of the high and low scenario occurring may produce information such as that shown in Exhibit 2-1 below where 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 (by a ratio of 3:2) and there is also a small possibility that the true outcome is either above the high or below the low scenario. Exhibit 2-1 portrays a distribution the embodies this additional information

Exhibit 2-1
Example of Distribution-Based Scenario Analysis



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 only incorporating rough estimates of the likelihood of occurrence, the end result is a better representation of the scenarios being assessed.

To complete this example, distributions are developed for select pivot factors that drive the final estimates of impacts and attribution to Alliance efforts. In the case of the lighting project, two distributions are developed from judgment, expert opinion and augmented by secondary research (e.g., other lighting evaluations). These two distributions are:

1. *Number of lamps sold due to Alliance activity.*
2. *Savings in Watts for each lamp sold (takes into account installation, retention, wattage, and other factors).*

The final distribution for overall attributed impacts is developed by:

1. Taking 5,000 "random draws" of values are made from each distribution;
2. For each value from each distribution, the final attribution value is calculated for that set of drawn values
3. This gives us 5,000 values which are graphed to give us the final distribution of impacts attributable to the alliance.

The following Chapter 3 illustrates this process used for the Alliance Residential Lighting Project, and subsequent chapters present results for Alliance Windows Project, Builder Operator Certification Training, and for the MagnaDrive project.

2.6 Definitions Used in Program Analysis

The following terms are used throughout the report to describe the quantitative effects of Alliance activities. Several of these are defined in the ACE model.[12]

Venture period:

- Savings are based on the *actions* that occurred from inception through 2003, and they include continued savings each year through 2010 for those actions implemented during the venture period [i.e., the 'demand side power plant' is built and will continue to produce savings].

[12] Source: "Alliance Portfolio Cost Effectiveness (2002 Numbers)" documentation to "2002-Alliance-Project-Benefits-Summary-4-14-2003.xls" spreadsheet

Cumulative Savings through 2002

- The energy savings in average megawatts accomplished from program inception through the end of 2002 (but not including future savings streams)

Alliance Perspective (C-E and B/C Ratio):

- Costs are only Alliance dollars spent
- Benefits are regional aMW achieved with the addition of 7.5% T&D losses.

Total Resource Cost Perspective (C-E and B/C Ratio):

- Costs are regional costs ("Alliance, local utility administration costs, consumer first costs, consumer O&M, etc.")

- Benefits are regional aMW achieved with the addition of 7.5% T&D losses plus the total regional ancillary benefits ("T&D deferral credit, water savings, natural gas savings, etc.")

Levelized cost

- "The present value of a resource's cost (including capital, financing, and operating costs, and quantified non-energy benefits) converted into a stream of equal annual payments and divided by the annual kWh saved."[13]

[13] Source: 2001 Market Activities Report (MAR)

3 ANALYSIS OF ENERGY STAR RESIDENTIAL LIGHTING

This chapter presents the in-depth evaluation of the residential lighting program. Section 3.1 provides a brief background on program goals, mechanisms, and activities. Section 3.2 describes the process used to evaluate and bound the impact estimates for the program, and compares the results with Alliance claims. Section 3.3 presents the findings that emerged from the assessment of the lighting program.

3.1 Introduction to Program

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 Energy Star (ES) platform. While early program efforts had worked with manufacturers to accelerate availability of high quality compact fluorescent lighting (CFL) products for the consumer marketplace, 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.[14] The Alliance CFL 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 NW by coordinating marketing messages and materials for retailers, and through outreach to new partners in the region. The implementation contractor for the Alliance, Ecos Consulting, also

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

managed the coupon program funded directly by BPA and some of the region's utilities during the same time period. While the coupon campaign was not part of the Alliance Lighting Program, it did take advantage of the retailer network already established by Ecos and the Alliance. [15]

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

Specific progress indicators for the program include:

- Increase consumer understanding and awareness of Energy Star products
- Increase availability and variety of Energy Star products at retail
- Increase sales of CFLs to first time buyers
- Increase consumer satisfaction with CFL purchases
- Increase promotional efforts by retailers to sell Energy Star products
- Price of Energy Star products continues to drop.

Total Alliance savings claimed through 2002 for the program are 70.4 aMW.[16]

3.2 Assessing Program Accomplishments

This section assesses the accomplishments of the Alliance's Energy Star Lighting program in terms of measurable performance metrics. Based on the market activities report (MAR), the evaluation team defines these metrics to be the program's electricity savings (in aMW), its cost-effectiveness from the Alliance's perspective, as well as the total resource perspective, and the levelized cost (from both perspectives). As discussed in Section 2.3, the assessment involves determining the key assumptions underlying the program's assumed accomplishments, developing alternative hypotheses based on these assumptions, and running these scenarios within the Alliance Cost-Effectiveness model to determine their impact. The sections below present a detailed discussion of these steps. This is followed in Section 3.3 by the results of this assessment.

3.2.1 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. While there are many assumptions involved in assessing a program, the evaluation team restricted its attention to those inputs that

[15] Northwest Energy Efficiency Alliance Residential Energy Star Lighting Program, Annual Report 2001-2002, by Ecos Consulting.

[16] This number represents the Alliance estimate of savings as reported in the 2002 Market Activities Report. Note that direct utility /BPA rebates were removed from the total lamp savings for the region (the amount backed out for rebates was 32 aMW in 2001, and 2.7 aMW in 2002).

are 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 associated with each CFL sold.
2. The number of CFLs sold due to 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 key 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 (which differs between interior and exterior bulbs).
- 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 impact 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 due to the efforts of the Alliance. The first pivot assumption involves determining how many of the over 8 million CFLs sold in 2001 was due to the efforts of the Alliance versus how many were due to the California energy crises, the BPA coupon program, and utilities' giveaway programs. The other pivot assumption is to what degree this explosion in CFLs sales affected the baseline (i.e., non-Alliance influenced sales) going into the future.

Once determined these pivot assumptions, the next step in the analysis was to develop and quantify alternative hypotheses for these assumptions. This task is discussed in the next section.

3.2.2 Alternative Hypotheses

After identifying the pivot assumptions associated with the ES Lighting program's accomplishments, the next step is to identify both meaningful alternatives to these assumptions and their likely occurrence (i.e., their probability distribution). In this section the evaluation team presents the values for its alternative hypotheses and the source of this information. It is important to note that in general the pivot assumptions associated with the kWh savings per bulb are generally measurable, and there is a fair amount of research on these assumptions. However, the pivot assumptions associated with the numbers of bulbs sold due to Alliance influence is based on the judgment of the experts interviewed and information contained in the evaluation reports designed to address the attribution of effects to the Alliance activities. It is possible in an evaluation activity to ask market participants whether actions of the Alliance influenced a market action and to what degree. Overall, the goal was to gather and use the best available information on the identified pivot assumptions.

Displaced Wattage

The Alliance, in their ES Lighting Cost-Effectiveness model, assumes that the displaced wattage associated with each CFL is 74 watts. This was based on a survey conducted as part of the Lightsaver program. This survey showed that approximately 23% of the bulbs in this program were 30 watt CFLs replacing 150 watt incandescent, and an additional 33% where 27 watt CFLs replacing 100 watt incandescent. Based on information obtained from several sources,[17] the evaluation team determined that an alternative assumption would have, on average, a displacement of 58 watts. The evaluation team further assumed a distribution of possible displaced wattages where 80% of the observations would lie between 47 and 70 watts.

Hours of use

The Alliance assumed that the new CFL would be used for 3 hours in an interior location or 5 hours in an exterior placement. Based on several of the same resources cited for displaced wattage,[18] the study team assumed that the hours of use would average 2.75 hours interior and 4 hours exterior. The team further assumed that while there remained some uncertainty about these numbers, 80% of the possibilities would occur between 2.1 and 3.3 hours per day for interior lamps and between 2.4 and 5.5 hours per day for exterior lights. These numbers reflect some amount of takeback that often occurs when customers install more efficient lighting.

Lifetime

Based on the review of manufacturer's literature, the evaluation team found that advancements in production techniques have resulted in an increase in the expected life of CFLs. A wide range of lamp quality and claims are made within the industry. As an alternative hypothesis, the evaluation team assumed that the average lifetime has increased from the Alliance's 7,000 hours to an average of 7,500 hours, with 80% of the probability going from 6,000 hours to 9,000 hours.

---

[17] A number of studies were consulted during this analysis, including the following:
"U.S. Lighting Market Characterization – Volume 1: National Lighting Inventory and Energy Consumption Estimate – Final Report" Navigant Consulting for U.S. DOE EERE, September 2002; indicates installed lamps average 67 watts for incandescent, and 18 watts for CFLs.
A recent utility program evaluation in the NW "Conservation Kit Program Evaluation" Seattle City Light – May 2003 presents information that appears to indicate an avg. displaced watts ~ 57 watts.
An older utility report completed in the region, "Impact Evaluation of MPCs Residential Lighting Program, Hagler Bailly, December 1995; used the following values to estimate displaced watts = 62 (1993 program) and 59 (1992 program).
One major retailer indicated the majority of the bulbs sold were 60 watt replacements — typically a 13 watt CFL — resulting in a 47 watt displaced wattage estimate. While it is acknowledged that the estimates used by the Alliance were developed by the NW Power Planning Council, and generated at a time when the program had a significant mixture of fixtures and bulbs – with a focus on bulbs in high-use areas, since the majority of the claimed program savings occurred in 2001-02, the evaluation team based its distribution of displaced wattage on these and other studies, interviews conducted, and professional judgment.

[18] The recent DOE study uses 2.1 h/day for exterior lighting, and 3 h/day as the highest interior level for one room. (2.2 used as CFL avg.). The MPC study from 1995 used 4 h/day (based on ELCAP 3.75 h/day data from 1992 – and primary survey data of 4 h/day). Based on these data, and the input from those interviewed, the team selected the mid-point numbers of 2.75 and 4.0 hours for interior and exterior lighting, respectively.

Installation/Removal Rate

The original Alliance Cost-Effectiveness model assumed that 1) all purchased CFLs would be installed, and 2) 12% of the installed lamps would be removed by the customer within the first year and not replaced. This figure was based on survey responses reported in a recent MPER. A more recent presentation by the Alliance's evaluation contractor indicates that, based on survey data, one year after purchase about 85% of the lamps sold in wave 1 were still installed, and 76% of those sold in wave two were still in place.[19] Additional research and interviews suggest that that not all purchased CFLs would be installed, particularly given that many of the bulbs sold in 2001 and 2002 were in multi-lamp packs.[20] Therefore, the evaluation team assumed a combined average installation and removal rate of 28% (meaning 72% of purchased lamps were still installed one year after purchase), with the range of 16% to 40% that brackets 80% of the observations for removal of lamps.

Price per Bulb

With the increase in CFLs from foreign manufacturers and the increased stocking of these bulbs in large discount retailers such as Costco, the evaluation team determined that the cost of a bulb assumed by the Alliance ($8.00 in 2003 and $6.00 in 2007) may be high, and a more realistic range of prices may be $4.40 to $5.60, with an average of $5 in 2003, and a range from $2.40 to $3.60, with an average in $3.00 in 2007.

Savings per Lamp

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 down to an average of 39 kWh per bulb. [21] Exhibit 3-1 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.

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

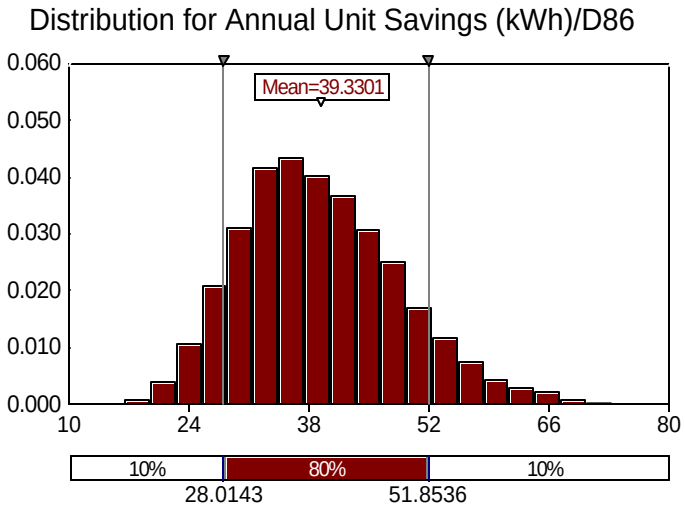
[19] "Residential Lighting Program Market Progress Evaluation Report," Stephen Grover, EcoNorthwest, presented to Alliance June 16, 2003.

[20] "Conservation Kit Program Evaluation: Transforming the Residential Use of Compact Fluorescent Lighting." Tachibana, D.L.O., Seattle City Light, May 2003. In this giveaway program, 92% of participants installed at least one bulb from the kit, and 67% installed two, immediately after receiving the kit. Including later installation, and net of free riders, 1.7 bulbs per kit were installed. Among kit participants, 66% tried a CF bulb in their home for the first time.
"Impact Evaluation of MPCs Residential Lighting Program", HBI, December 1995 used a 79% installation rate after 1 year.

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

area utilities. The 2001 MAR states "In 2001, the region captured 31 aMW of savings through market effects including Alliance programs, utility marketing campaigns, price elasticity's and

Exhibit 3-1



retailer and manufacturer marketing efforts." 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 cannot 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.[22] In addition to input from those in the region on this attribution question, the evaluation team can compare changes in sales volume in the NW 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

[22] One major retailer even suggested that the Alliance had little to no effect on their sales of CFLs, and another interviewee felt that utilities that ran coupon programs in the region should be credited with spillover for bring people into stores.

2002. While the NW may have seen sales number increase tenfold from 2000 to 2001, sales increased four-fold in California during the same period.[23]

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 only responsible for half of the non-coupon sales, or approximately 2 million bulbs. The assumed distribution for each alternative is presented in Appendix B.

2002 Baseline

Given the huge increase in CFL sales in 2001, the next 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 around 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.

Exhibit 3-2 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.

Exhibit 3-2: 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

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

3.3 Assessment Findings

This section reviews the results of the simulation of the Alliance Cost-Effectiveness model using the above alternative hypotheses on the pivot assumptions. Following the structure of the MAR, the evaluation team focuses on the impact of these alternative hypotheses on three main areas:

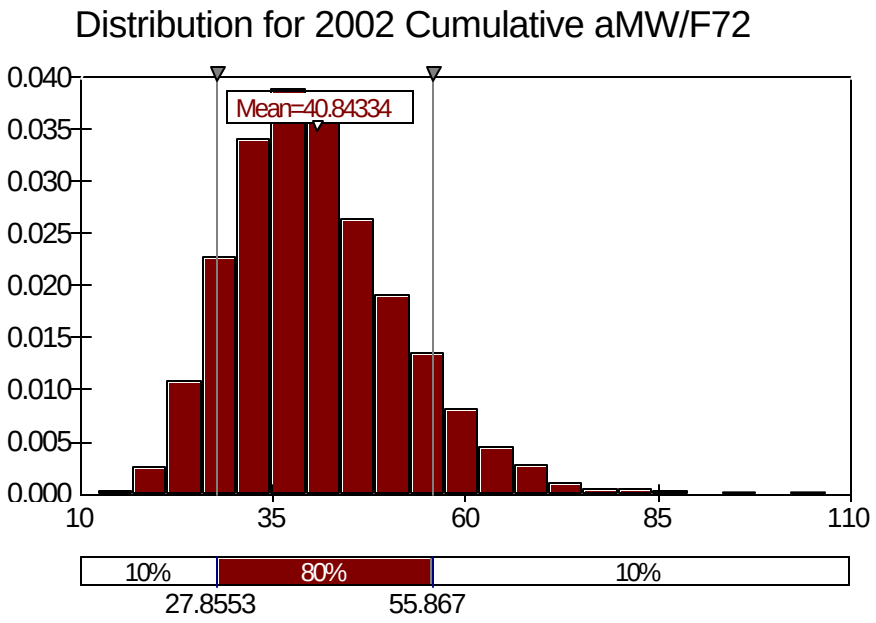
- The cumulative savings (aMW) associated with the program,
- The levelized cost (cents/kWH) from the Alliance and total resource perspectives, and
- The cost-effectiveness ratio, also from the Alliance and total resource perspectives.

To determine these impacts, the evaluation team used the ACE model[24] appropriate for this program, and altered the input assumptions as discussed above. Using a Monte Carlo simulation tool, @Risk, the evaluation team ran 5000 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 through the venture period, as defined by the Alliance.

3.3.1 Cumulative Savings

The impact of these alternative scenarios on the cumulative aMW savings through 2002 due to the ES Lighting program is presented in Exhibit 3-3. for the high influence scenario and Exhibit 3-4 for the low impact scenario.

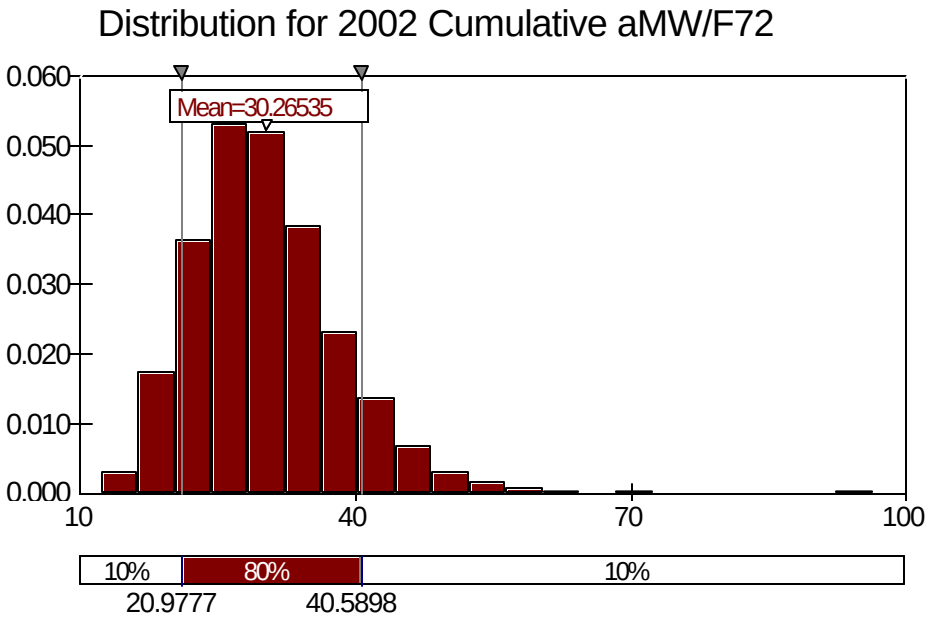
Exhibit 3-3



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

For the high influence scenario, the cumulative savings through 2002 drop from the Alliances estimate of 70.4 aMW to a mean value of 40.8 aMW. This drop is due primarily to the decrease in the annual kWh savings per bulb. The savings at risk[25] at the 80% quantile is approximately 13 aMW. 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 CFL program.

Exhibit 3-4



3.3.2 Levelized Cost

Exhibit 3-5 presents the resulting average levelized costs from the Alliance and Total Resource perspective for ES Lighting program under the high and low scenarios. While the alternative hypotheses in both cases has increased the levelized cost relative to the Alliance's original results, the levelized cost for both the high and low influence cases are well below the avoided electricity cost for the region.

3.3.3 Cost-Effectiveness

Exhibit 3-6 presents the resulting average cost-effectiveness from the Alliance and total resource perspective for ES Lighting program under the high and low scenarios. As expected, given the levelized cost results, the program is still cost effective, though in the low influence scenario the CE ratio is slightly below 1.0 from the Total Resource perspective during the venture period.

[25] The savings at risk is the lowest expected savings under these assumptions at a given level of probability.

Overall, regardless of the assumptions used (displaced watts, attribution of savings, etc), the program is still cost effective and has a levelized cost well below the cost of power in the region.

Exhibit 3-5: Average Levelized Cost, ES Lighting

LEVELIZED COST (cents/kWh)	Alliance[26]	Team	
		High	Low
Alliance Perspective			
Venture + Post Period	-0.15	-0.02	0.03
Venture Period Only	-0.09	0.13	0.24
TR Perspective			
Venture + Post Period	1.04	1.2	1.8
Venture Period Only	0.44	1.9	3.0

Exhibit 3-6: Average Cost-Effectiveness, ES Lighting

Cost-Effectiveness Index	Alliance[27]	Team	
		High	Low
Alliance Perspective			
Venture + Post Period	27.3	12.7	10.6
Venture Period Only	17.5	7.7	5.9
TR Perspective			
Venture + Post Period	2.2	1.5	1.2
Venture Period Only	2.1	1.2	1.0

[26] Source: 2002 Market Activities Report, Northwest Energy Efficiency Alliance for TR perspective venture + post venture period numbers, and cumulative savings numbers (70.4 aMW) reported as Alliance claims. All venture period numbers were pulled from the ACE model provided to the team. The ACE model was updated by the Alliance after 2001 to reflect actual CFL sales in the region, and re-run to produce adjusted levelized cost numbers. For 2002 savings reported in the MAR, the ACE model was not updated by the Alliance, thus the savings numbers used in the ACE model are based on predicted 2002 sales, not actual, and the levelized cost numbers reported in the MAR do not reflect the updated aMW savings as reported in the MAR. As described in chapter 2, the evaluation team used the ACE model for all program comparisons. In the case of the lighting program, this results in team estimates of program savings and levelized costs that are consistent with the ACE model, but not necessarily consistent with MAR-reported savings numbers.

[27] Ibid.

3.3.4 Qualitative Assessment

The evaluation team's review of Alliance documents and interviews conducted for the evaluation provided numerous insights on the CFL program, and also helped the team 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 2001-02. 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.[28]

- Ongoing, innovative, co-marketing 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.

- 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 must be better educated on proper selection and use of CFLs.

- At this stage, the Alliance does not have a clearly defined exit strategy for residential lighting. The Alliance should strive to define when the market has been adequately transformed. This could be defined as reaching a market share of all lighting sales, or another related metric.

[28] 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.

4 ANALYSIS OF ENERGY STAR RESIDENTIAL WINDOWS

This chapter presents the in-depth evaluation of the Energy Star Residential Windows program. Section 4.1 provides a brief background on program goals, mechanisms, and activities. Section 4.2 describes the process used to evaluate and bound the impact estimates for the program, and compares the results with Alliance claims. Section 4.3 presents the findings that emerged from the assessment of the Windows program.

4.1 Introduction to Program

The Alliance Windows program began in 1998 amidst a focus by the Alliance on building a positive image among market actors in the residential sector for the Energy Star brand in the Northwest. In the spring of 1998, the Alliance rolled out the Windows project and began meeting with builders and window manufacturers and attending trade shows in the region. The implementation contractor for the project had worked with the National Fenestration Rating Council on national standards for windows. This background allowed for the development of a strong working relationship with manufacturers in the region.

Because a high percentage of windows sold in the region are also manufactured in the region, the project focused on working closely with six of the largest manufacturers in developing less costly methods of building high-efficiency windows. Using alternative technologies, the project was able to demonstrate that low-e coatings, stainless steel spacers, and better frame design would allow manufacturers to meet new U-value targets without significantly increasing costs.

The Alliance Windows project initially set a target U value of 0.30. When the national Energy Star program set its standard of 0.35, the Alliance recognized the value of maintaining consistency with the national marketplace, and adopted 0.35 as their target as well. This would allow the Alliance to leverage national marketing materials in their partnerships with Northwest organizations. Project partnerships were expanded to include co-marketing activities with utilities, retailers, and manufacturers. The Alliance was able to leverage Energy Star dollars through matching funds provided by manufacturers and other partners. Throughout the project, the Alliance conducted retailer training, and worked with state and local governments to establish prescriptive requirements in building codes for window U values.[29]

[29] More detailed program history and a review of recent activities can be found in *Energy Star Windows, No.5,* Quantec, January 2002.

Market penetration for Energy Star Windows continued to climb rapidly, and project targets were exceeded by the end of 2000. In June 2001, the program ended.

In summary, the program strategy was to build product image and brand association to increase the sales of high efficiency windows so that they would become the norm in the Northwest market. Program delivery mechanisms are described briefly above, and can be summarized as:

- Conduct promotional initiatives through co-marketing arrangements to leverage national marketing messages.
- Work with manufacturers to develop more cost-effective methods of building energy efficient windows.
- Provide training materials and technical assistance to retailers, builders, and code officials in the region.
- Educate consumers on the benefits of high efficiency windows.

Progress indicators for the program include:

- Cooperation from a majority of the window manufacturers in the region in terms of significant cost sharing of marketing.
- Increased awareness of Energy Star fenestration products and their benefits.
- Increased market share (up to at least 54%) of Energy Star fenestration products in all four states.

Total Alliance savings claimed through 2002 for the program are 13.8 aMW. Energy Star windows achieved a 70% market share in the Northwest by the end of 2002. [30]

4.2 Assessing Program Accomplishments

In this section, the evaluation team assesses the accomplishments of the Alliance's Energy Star Windows program in terms of measurable performance metrics. Based on the MAR, the evaluation team defines these metrics to be the program's electricity savings (in aMW), its cost-effectiveness from the Alliance's perspective as well as the total resource perspective, and the levelized cost (from both perspectives). As discussed in Section 2.3, the assessment involves determining the key assumptions underlying the program's assumed accomplishments, developing alternative hypotheses based on these assumptions, and running these scenarios within the Alliance Cost-Effectiveness model to determine their impact. The sections below present a detailed discussion of these steps. This is followed in section 4.3 by the results of this assessment.

[30] 2002 Market Activities Report.

4.2.1 Pivot Assumptions

Following the approach outlined for ES Lighting, the first step in assessing the accomplishments of the ES Windows program is determining the key assumptions required for quantifying the chosen metrics. While there are many assumptions involved in assessing a program, the evaluation team restricted its attention to those inputs that are subject to a relatively high degree of uncertainty or had a significant impact on the outcome. These key assumptions are denoted as "pivot" assumptions.

One of the pivot assumptions for this program is the savings associated with the installation of ES windows. Determining these savings is a complicated process, and is dependent on characteristics of the buildings where the windows are installed, the difference in efficiency between the Energy Star product and the product being replaced, and weather conditions. It was beyond the scope of this project to conduct an analysis of the energy savings model being used to estimate savings associated with the windows, so the evaluation team assumed that the values used by the Alliance in their ACE model are correct.[31]

The number of ES windows installed each year is also another pivot assumption for this program. Estimates of market penetration were based on data provided by manufacturers to the program implementer, and on through triangulation of surveys of retailers, wholesalers, and builders conducted by the evaluation contractor. The evaluation team did not perform an uncertainty assessment on these data. The ACE model itself is driven off 1997 information on window sales. The remaining variables that affect the outcome of the assessment are electric heat saturation and incremental cost.

Therefore, for this analysis, the pivot assumption the evaluation team investigated are:

- The proportion of electrically heated homes in the Pacific Northwest.
- The incremental cost of installing ES windows.

Once the evaluation team determined these pivot assumptions, the next step in the analysis was to develop and quantify alternative hypotheses for these assumptions. This task is discussed in the next section.

4.2.2 Alternative Hypotheses

After identifying the pivot assumptions associated with the ES Windows program's accomplishments, the next step is to identify both meaningful alternatives to these assumptions and their likely occurrence (i.e., their probability distribution). This section presents the values for the evaluation team's alternative hypotheses as well as the source of this information.

[31] In the ACE model used for this analysis (CE-C97-028-ES-Windows-MPER5-AAA2001-SH-LC.xls, run date April 11, 2002), these key savings numbers have a note saying "Origin Unknown." The source for these numbers should be made explicit and their accuracy verified.

Electric Heat Saturation

The ACE model for this program assumes that 51% of all houses in the Pacific Northwest (both new and existing) use electricity for space heating. The evaluation team reviewed information supplied to us by the NW Power Planning Council (NWPPC).[32] This spreadsheet shows the saturation of electric space heating to be 42%. Therefore, for this pivot assumption, the evaluation team used the 42% as the mean value, and had a distribution that included the 51% value at the 80% probability level. It is important to note that the NW Power Planning Council has this saturation number declining over time, as the proportion of new homes with electric space heating is lower than existing homes. [Note: the ACE model does not capture this difference between new and existing electric space heating saturation.] The evaluation team also changed the distribution of house type within the electric space heat population to reflect the NWPPC numbers, but did not develop distributions for these proportions.

Incremental Costs

The Alliance assumes that the incremental cost of ES windows is $0.47/square foot of windows. While costs did change over time as manufacturers applied new technologies more effectively, based on interviews conducted with regional experts and information provided in the MPERs, the team judged the average cost to be slightly higher at $0.50/square foot. Because differences in manufacturing costs are not consistent across all manufacturers in the region, the range of values considered was $0.25 to $0.75 per square foot cost differential.

Exhibit 4-1 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. The distributions for these assumptions can be found in Appendix B.

Exhibit 4-1: Pivot Assumptions for ES Windows

Assumption	Alliance	Team
Electric Space Heat Saturation	51%	42%
Incremental Cost	$0.47/SF	$0.50/SF

4.3 Assessment Findings

This section reviews the results of the simulation of the Alliance Cost-Effectiveness model using the above alternative hypotheses on the pivot assumptions. Following the structure of the MAR, the evaluation team focuses on the impact of these alternative hypotheses on three main areas:

- The cumulative savings (aMW) associated with the program.
- The levelized cost (cents/kWH) from the Alliance and total resource perspectives
- The cost-effectiveness ratio, also from the Alliance and total resource perspectives.

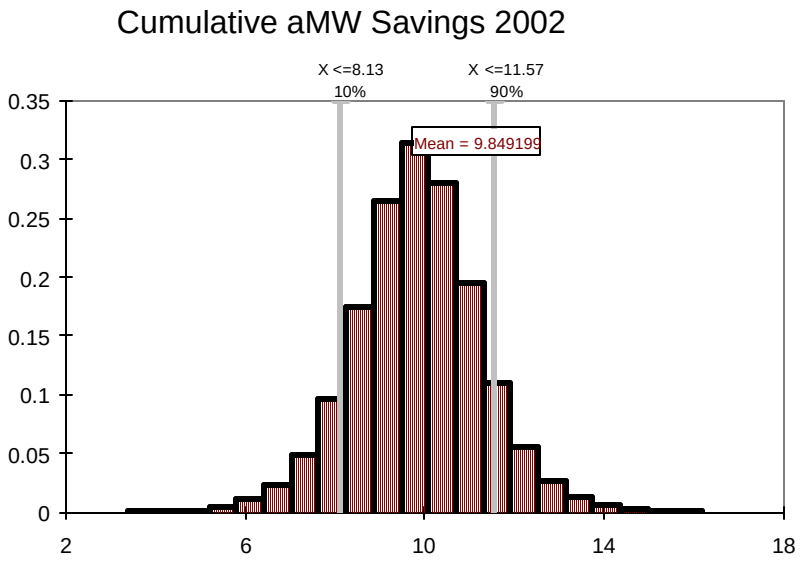
[32] The information currently used by NWPPC on electric heat saturation was supplied to the evaluation team as a spreadsheet, PNWResSectorSupplyCurveUnits.xls.

To determine these impacts, the evaluation team used the ACE model[33] appropriate for this program, and altered the input assumptions as discussed above. Using a Monte Carlo simulation tool, @Risk, the evaluation team ran 5000 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 discusses only the implication of these alternative hypotheses up to through the venture period, as defined by the Alliance.

4.3.1 Cumulative Savings

The impact of these alternative scenarios on the cumulative aMW savings through 2002 due to the ES Windows program is presented in Exhibit 4-2. The change in the electric space heat saturation resulted in a decline in cumulative savings to 2002 from the Alliance estimate of 13.8 aMW reported in the MAR to an average of 9.8 aMW.

Exhibit 4-2



4.3.2 Levelized Cost

Exhibit 4-3 presents the resulting average levelized costs from the Alliance and total resource perspectives for the ES Windows program. The alternative hypotheses increased the levelized cost relative to the Alliance's original results, but the levelized cost in all cases are well below the avoided electricity cost.

[33] CE-C97-028-ES-Windows-MPER5-AAA2001-SH-LC.xls, run date April 11, 2002.

Exhibit 4-3: Average Levelized Cost, ES Windows

LEVELIZED COST (cents/kWh)	Alliance	Team
Alliance Perspective		
Venture + Post Period	-0.47	-0.46
Venture Period Only	-0.38	-0.33
TR Perspective		
Venture + Post Period	0.55	0.64
Venture Period Only	0.64	0.77

4.3.3 Cost-Effectiveness

Exhibit 4-4 presents the resulting average cost-effectiveness from the Alliance and Total Resource perspectives for ES Windows program. As expected, given the levelized cost results, the program is still cost effective from all perspectives during all periods.

Exhibit 4-4: Average Cost-Effectiveness, ES Windows

COST EFFECTIVENESS INDEX	Alliance	Team
Alliance Perspective		
Venture + Post Period	119.7	83.5
Venture Period Only	27.0	19.0
TR Perspective		
Venture + Post Period	2.8	2.7
Venture Period Only	2.6	2.3

4.3.4 Qualitative Findings

The Windows program proved to be a highly successful venture for the Alliance. It was based on the market transformation principles of; elimination of financial disincentives sometimes associated with energy efficient technology, raising the bar on codes and standards for a specific technology, and increasing awarenes ss of the benefits of the technology. The Alliance accomplished this by primarily working upstream from the energy end user. Project targets were exceeded ahead of schedule, and the program ended in 2001.

Key success factors include; development of cost saving manufacturing processes that did not require retooling; credibility of the implementation contractor among trade allies in the windows market; tailored marketing strategies for individual manufacturers; and retailer incentives.

The ACE model associated with the Windows program has seen many modifications over the years, resulting in a model that is not transparent or well-documented. A number of key calculations are performed outside of the model – and those results hard-wired into the current model. While the program is clearly cost-effective, and it is understandable that the Alliance focused on 'getting the program implemented', recommendations were made by the evaluation contractor in March 2000 to update data included in the model. Even so, the evaluation team analysis indicates the levelized costs claimed for the program are within reasonable bounds.

5 ANALYSIS OF BUILDING OPERATOR CERTIFICATION

This chapter presents the in-depth evaluation of the Building Operator Certification (BOC) program. Section 5.1 provides a brief background on program goals, mechanisms, and activities. Section 5.2 describes the process used to evaluate and bound the impact estimates for the program, and compares the results with Alliance claims. Section 5.3 presents the findings that emerged from the assessment of the BOC program.

5.1 Introduction to Program

Training of building operators in the Northwest began in the 1980s, and the region's first Building Operator Training Certificate program was created in 1993. A number of regional organizations have contributed to the curricula and delivery of BOC program over the years. Beginning in 1996, the Alliance recognized the importance of this work and began funding the endeavor as operated by the NW Energy Efficiency Council (NEEC) and the Northwest Building Operators Association (NWBOA). The Alliance chose to provide major funding for the BOC program from 1997 through 2001. Beginning in 2002, the Alliance chose to provide limited funding for marketing and the development of continuing education curricula.[34] This fits well with the market transformation strategy of creating self-sufficient programs

The BOC program is designed to train commercial building operators and facility managers in effective operation and maintenance (O&M) techniques, including optimizing building systems to minimize energy use and increase occupant comfort. While O&M activities have been identified by numerous studies as critical elements of well-run commercial and industrial buildings, building maintenance staff have often historically been ill-informed regarding energy issues.

Currently, two BOC curricula are offered in the region. The NEEC program discussed above has a curriculum it began teaching in Washington in 1996. NEEC licenses its curriculum to partnering entities who deliver the BOC training in 12 other states. In Oregon, the partnering entity is the Northwest Energy Education Institute, which has been delivering the BOC since 1998. NEEC provides certification for students who complete BOC training using its curriculum, regardless of which entity implemented the curriculum. NWBOA has a curriculum that it teaches in Idaho and Montana. NWBOA provides certification for the building operators it trains.

[34] A more detailed history of the program is available in "Regional Building Operator Certification Venture – MPER #7", Research Into Action, September 2001.

The program strategy is to establish a sustainable O&M training environment for Northwest building operators. Program delivery mechanisms are described briefly above, and can be summarized as:

- Develop curriculum and secure accreditation for training designed to provide the skills required to optimize building performance.
- Work through several regional organizations to deliver qualified training.
- Create a model where participants cover the costs of training.

Specific progress indicators for the program include:

- Established and sustained an industry led, voluntary competency based certification process that is recognized and valued by building operators and employees.
- Secured accreditation and recognition from institutions, employers and facility oriented associations.
- Increased non-Alliance income; solicited sponsorships and co-marketing opportunities with facility associations, utilities, and large employers.
- Conducted ongoing market research to identify additional opportunities for certification.
- Developed and offered two or more levels of training.

Total Alliance savings claimed through 2002 for the program are 15.3 aMW, and over 1200 building operators were certified between 1997 and 2001.

5.2 Assessing Program Accomplishments

This section assesses the accomplishments of the BOC program in terms of measurable performance metrics. Based on the MAR, the evaluation team defines these metrics to be the program's electricity savings (in aMW), its cost-effectiveness from the Alliance's perspective and the total resource perspective, and the levelized cost (from both perspectives). As discussed in Section 2.3, the assessment involves determining the key assumptions underlying the program's assumed accomplishments, developing alternative hypotheses based on these assumptions, and running these scenarios within the Alliance Cost-Effectiveness (ACE) model[35] to determine their impact. The sections below present a detailed discussion of these steps. This is followed in Section 5.3 by the results of this assessment.

[35] CE-BOC-C97-0250MPER7-MAR-2002-5yr.xls, run date April 2, 2003.

5.2.1Pivot Assumptions

As was the case for the other programs the evaluation team investigated, the first step in assessing the quantitative impacts of the BOC program is determining the key assumptions required for quantifying the chosen metrics. While there are many assumptions involved in assessing a program, the evaluation team restricted its attention to those inputs that are subject to a relatively high degree of uncertainty or had a significant impact on the outcome of impact estimates. For BOC, the pivot assumptions are:

- The square footage of facility controlled by each participant.
- The savings per square foot associated with this training.
- The lifetime (persistence) of measures installed or actions taken.

Once the evaluation team had determined these pivot assumptions, the next step in the analysis was to develop and quantify alternative hypotheses for these assumptions. This task is discussed in the next section.

5.2.2Alternative Hypotheses

After identifying the pivot assumptions associated with the BOC program's accomplishments, the next step is to identify both meaningful alternatives to these assumptions, as well as their likely occurrence (i.e., their probability distribution). This section presents the values for the alternative hypotheses and the source of this information. Overall, the goal was to gather and use the best available information on the identified pivot assumptions.

Square Footage

Initial program planning data used a value of 50,000 square feet per facility to estimate potential program impacts. Subsequent surveys with building operators and supervisors in the NW put the average facility size an order of magnitude higher. Program evaluators used survey data, combined with a 'uniqueness factor' that took into account facilities sending more than one operator for training. This resulted in the ACE model for this program assuming that each participant is responsible for maintaining 234,850 square feet. Additional information gathered during the retrospective evaluation work indicates that this number may be too large, and that the current participant population can reasonably be expected to affect estimated savings for about 50,000 square feet.[36] Some interview subjects indicated they believed the higher number used for previous estimates was reasonable. Therefore, the evaluation team developed an alternative assumption that has a mean value halfway between these two values (i.e., 142,424 square feet). The probability distribution was chosen so that a majority of the values would lie between the two estimates.

Savings per Square Foot

The Alliance assumed that certification results in a savings of 2.5% of a building's electricity use. This implies a savings per square footage number of 0.5 kWh/SF. The study team's research

[36] "Education that Changes Behavior: The Impacts of the BOC Program", Marjorie McRae, Jane Peters, Elizabeth Titus, and Tom Rooney, International Energy Program Evaluation Conference Proceedings, August 2003.

suggests that certification can be expected to produce a higher level of savings, in the 5-10% range, implying savings as high as 2.0 kWh/SF.[37] Therefore, the distribution for this pivot assumption has a mean value of 1.2 kWh/SF, and spans the range from 0.5 kWh/SF to 2.0 kWh/SF.

Measure Lifetime

The ACE model for the BOC program assumes that the average lifetime for energy efficiency actions and measures undertaken because of operator certification is 5 years. The evaluation team's review of other certification programs and interviews with instructors suggest that this is probably a good average estimate, but the measure lifetime may be slightly higher for a number of actions taken by participants. Therefore, the evaluation team used an average of 5.7 years.

Exhibit 5-1 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.

Exhibit 5-1: Pivot Assumptions, BOC

Assumption	Alliance	Team
Square Footage per Participant	234,850	142,424
Savings per Square Foot	0.5 kWh/SF	1.2 kWh/SF
Measure Lifetime	5 years	5.7 years

5.3 Assessment Findings

This section reviews the results of the simulation of the Alliance Cost-Effectiveness model using the above alternative hypotheses on the pivot assumptions. Following the structure of the MAR, the evaluation team focuses on the impact of these alternative hypotheses on three main areas:

- The cumulative savings (aMW) associated with the program.
- The levelized cost (cents/kWH) from the Alliance and total resource perspective.
- The cost-effectiveness ratio, also from the Alliance and total resource perspective.

To determine these impacts, the evaluation team used the ACE model appropriate for this program, and altered the input assumptions as discussed above.[38] Using a Monte Carlo simulation tool, @Risk, the evaluation team ran 5000 simulations of the ACE model which pulled observations randomly from the distributions developed for the pivot assumptions. Since

[37] A number of sources were considered, including "Rebuild America" website data that indicate estimated energy savings of 10-20% can be achieved through efficient O&M practices. The Alliance's own *Building Performance Systems* project overview states 'studies indicate existing commercial building operating performance could be improved from 5-15% through enhanced O&M practices alone'. One case study presented at an ASHRAE conference in 1997 demonstrated O&M savings of 22.5%. While these numbers reflect significantly larger savings than the BOC program estimated, interviews did not support using that larger number. The evaluation team chose numbers between the conservative estimate of 2.5% used by the Alliance and some of the cited studies.

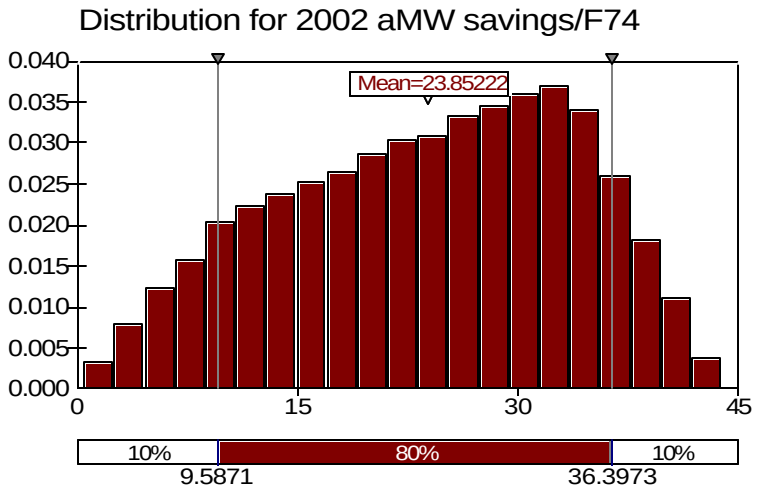
[38] CE-BOC-C97-025-MPER7-MAR-2002-5yr-Summary.xls with a run date of April 2, 2003

this is a retrospective review of the Alliance's performance, the evaluation team discusses only the implication of these alternative hypotheses up to the venture period, as defined by the Alliance.

5.3.1 Cumulative Savings

The impact of these alternative scenarios on the cumulative to 2002 aMW savings due to the BOC program is presented in Exhibit 5-2. These alternative hypotheses result in a cumulative savings of 24 aMW, which is significantly larger than the Alliance's estimate of 15.3 aMW. The Savings at Risk at the 80% quantile is approximately 14 aMW.

Exhibit 5-2



5.3.2 Levelized Cost

Exhibit 5-3 presents the resulting average levelized costs from the Alliance and Total Resource perspective for the BOC program under alternative scenarios. As was the case in for cumulative savings, the scenarios produce, on average, a significantly lower levelized cost.

EXHIBIT 5-3: AVERAGE LEVELIZED COST, BOC

LEVELIZED COST (cents/kWh)	Alliance[39]	Team
Alliance Perspective		
Venture + Post Period	-0.22	-0.23
Venture Period Only	0.11	-0.06
TR Perspective		
Venture + Post Period	0.12	0.07
Venture Period Only	0.48	0.40

[39] Source: 2002 Market Activities Report, Northwest Energy Efficiency Alliance.

5.3.3Cost-Effectiveness

Finally, Exhibit 5-4 presents the resulting average cost-effectiveness from the Alliance and total resource perspective for BOC program. As before, the alternative hypotheses result in a higher cost-effectiveness index for this program than the one developed by the Alliance.

Exhibit 5-4: Average Cost-Effectiveness, BOC

COST-EFFECTIVENESS INDEX	Alliance[40]	Team
Alliance Perspective		
Venture + Post Period	15.1	25.5
Venture Period Only	5.0	8.5
TR Perspective		
Venture + Post Period	4.9	8.3
Venture Period Only	2.9	4.8

5.3.4Qualitative Findings

Overall, the BOC program is indicative of a program that makes good use of regional resources. The development of curricula and accreditation that is recognized regionally (and to some degree nationally) has value that an independently developed local program would not. Building operators move from one facility to another, and the growing acceptance of BOC certification as a qualification for building staff is a good metric for determining transformation in this marketplace. Targets based on acceptance of certification as a basis for hiring could be used to define an exit strategy for the Alliance.

The program leverages its dollars well, and participants now cover most program costs through registration fees.

Further market penetration of the training could be achieved through additional co-marketing of training with utilities, professional organizations, and organizations that operate public facilities.

While there is a relatively high degree of uncertainty around the energy efficiency actions taken by participants *as a result of* the training, the cost associated with measuring actual before and after energy intensities at participant and nonparticipant facilities is likely not warranted.

[40] Source: Ibid.

6 ANALYSIS OF MAGNADRIVE

This chapter presents the MagnaDrive program. MagnaDrive is an entrepreneurial public/private partnership that seeks to accelerate the market acceptance of a new electric motor speed control device. Section 6.1 provides a brief background on program goals, mechanisms, and activities. Section 6.2 describes the process used to evaluate and bound the impact estimates for the program, and compares the results with Alliance claims. Section 6.3 discusses the findings that emerged from this assessment.

6.1 Introduction to Program

MagnaDrive is a startup company, located in Seattle. They have an R&D facility in Port Angeles, Washington. In 1999, the Alliance commissioned a market research study on the speed control market to determine whether there was a viable market niche for the MagnaDrive technology that might expand the current adjustable speed drive (ASD) market. The ASD coupling works by transmitting torque from an electric motor to a load across an air gap. There is no mechanical connection between the shaft and the load, but torque is transmitted via a copper conductor to a magnet rotor assembly and adjusted by varying the gap space between the two.

The program strategy is to expand the speed control market, rather than replace variable frequency (VFD) drives. Key applications where MagnaDrive technology may have advantages over VFD are in harsh environments, in vibration sensitive equipment, and in equipment in which motor speeds are generally above 90%. Industries currently targeted by the Alliance/MagnaDrive project are wastewater, HVAC, irrigation, and pulp and paper.[41]

The Alliance has invested in MagnaDrive since 1999. Early activities focused on testing and comparing the MagnaDrive technology with other ASD devices. Case studies of early pilot sites were developed and information was provided in various formats to utility industrial reps, distributors, and targeted end-use customers. MagnaDrive completed a third round of private equity funding in late 2002. The company also recently had a change in top management. Sales in terms of horsepower installed in the region, while still modest, have grown consistently since 1999. Out-of-region installations now outnumber those in the Northwest. In 2001, MagnaDrive

[41] More detailed program background and review of recent activities can be found in *MagnaDrive, Market Progress Evaluation Report, MPER #3*, Quantec, July 2003.

installed about 2 HP out of region for every HP in region, and in 2002 about 4 times as much out of region.[42]

The program mechanisms can be summarized as:

- Test and compare MagnaDrive to VFD and other technologies.
- Demonstrate in-field performance and communicate the benefits to the marketplace.

Progress indicators for the program currently include:

- Determined that the market potential exists beyond the current and projected VFD sales in the NW.
- Independently verified that the MagnaDrive coupling technology saves at least 60% of the energy saved by typical VFDs across a range of speed control applications.
- Installed the MagnaDrive coupling in at least three field sites where VFDs have been unsuccessful in penetrating the market.
- Commercialized the MagnaDrive coupling and streamline the manufacturing process.
- Increased overall awareness of and interest in the MagnaDrive Coupling.

Total Alliance savings claimed through 2002 for the program are 1.1 aMW.

6.2 Assessing Program Accomplishments

This section assesses the accomplishments of the MagnaDrive program in terms of measurable performance metrics. Based on the MAR, the evaluation team defines these metrics to be the program's electricity savings (in aMW), its cost-effectiveness from the Alliance's perspective as well as the total resource perspective, and the levelized cost (from both perspectives). As discussed in Section 2.3, the assessment involves determining the key assumptions underlying the programs stated accomplishments, developing alternative hypotheses based on these assumptions, and running scenarios within the Alliance Cost-Effectiveness (ACE) model[43] to determine their impact. The sections below present a detailed discussion of these steps.

6.2.1 Pivot Assumptions

The MagnaDrive program involves a range of activities associated with developing a start up company based on a manufactured technology, including promoting a specific product to the marketplace. Therefore, there is not a wealth of information available that can be used to develop alternative scenarios. Unit energy savings estimates available were developed by the Alliance,[44] and resources were not available to develop an independent estimate. Sales data are assumed to

[42] Sales data provided by Jim Cich, MagnaDrive and Jeff Harris of the Alliance. Out of region sales totaled 6160 HP in 2001 and 21,071 in 2002.
[43] CE-C99-051-MagnaDrive-MPER1-AAA2001-LC.xls run date Feb. 24, 2002
[44] The savings per HP used for impact calculations are based on performance tests conducted at OSU laboratories and analysis of 6 field site case studies.

be reasonably accurate. The variables the evaluation team thus investigated as pivot assumptions are:

- The horsepower of the installed MagnaDrive units in the Pacific Northwest.
- The expected market growth of the demand for VSDs in the Pacific Northwest.

Once the evaluation team determined these pivot assumptions, the next step in the analysis was to develop and quantify alternative hypotheses for these assumptions. This task is discussed in the next section.

6.2.2 Alternative Hypotheses

After identifying the pivot assumptions associated with the MagnaDrive program's accomplishments, the next step is to identify both meaningful alternatives to these assumptions their likely occurrence (i.e., their probability distribution). This section presents the values for the alternative hypotheses as well as the source of this information. The discussion focuses on the average value of these alternatives. Appendix B provides information on the distribution about these average values.

Installed Horsepower

The ACE model for this program does not contain information on actual installations of MagnaDrive units.[45] Therefore, the evaluation team determined that this is an important pivot assumption. The evaluation team obtained the actual installation rates for 1999 to 2002 and placed these into the model. The team then assumed that there was no uncertainty associated with these figures, and so did not develop a probability distribution for these inputs. In general, the total sales of MagnaDrive units during this period were approximately half the amount forecasted in the ACE model.

VSD Demand Growth

The other pivot assumption in assessing the performance of the MagnaDrive program is the demand growth for variable speed drives (which is directly proportional to the demand growth of MagnaDrive within the ACE model). The ACE model assumes a 5% growth in demand for VSDs. Given that the actual MagnaDrive sales are significantly below the initial forecast, the evaluation team believed that this growth rate was probably toward the high end of the distribution. For the alternative hypothesis, the evaluation team assumed that the average growth rate was closer to 2.5%.

Exhibit 6-1 summarizes the above pivot assumptions for the MagnaDrive program.

[45] The Alliance does receive the actual installed MagnaDrive units (measured in HP), and reports these results in the MAR. However, the ACE model is not updated with these actual installations, and so the levelized costs and cost effectiveness numbers presented in the MAR do not reflect actual historical performance of the program.

Exhibit 6-1: Pivot Assumptions, MagnaDrive

Assumption	Alliance (ACE)	Team (and 2002 MAR)
Historical Installed HP[46]		
1999	1,108	553
2000	6,951	3,469
2001	6,651	3,332
2002	8,462	4,223
VSD Market Growth	5.0%	2.5%

6.3 Assessment Findings

This section reviews the results of the simulation of the Alliance Cost-Effectiveness model using the alternative hypotheses on the pivot assumptions. Following the structure of the MAR, the evaluation team focuses on the impact of these alternative hypotheses on three main areas:

- The cumulative savings (aMW) associated with the program.
- The levelized cost (cents/kWh) from the Alliance and total resource perspectives.
- The cost-effectiveness ratio from the Alliance and total resource perspectives.

To determine these impacts, the evaluation team used the ACE model appropriate for this program, and altered the input assumptions as discussed above. Using @Risk, the evaluation team ran a Monte Carlo simulation to give a spectrum of possible outcomes. Since this is a retrospective review of the Alliance's performance, only the implication of these alternative hypotheses up to the venture period, as defined by the Alliance will be discussed.

6.3.1 Cumulative Savings

Since the information on installed MagnaDrive units was assumed to be accurate, and the evaluation team did not have the resources to develop meaningful alternative assumptions about the savings associated with each unit, the cumulative savings to 2002 associated with the MagnaDrive program are assumed to be nonstochastic. Thus, the cumulative savings through 2002 are 1.12 aMW, which matches the cumulative savings reported in the 2002 MAR.

6.3.2 Levelized Cost

Exhibit 6-2 presents the resulting average levelized costs from the Alliance and total resource perspectives for the MagnaDrive program under the alternative scenarios. The decrease in the

[46] The table presents the *Alliance* predicted installed HP at the time of project adoption, as used in the ACE model to calculate Alliance levelized costs presented in the MAR. These HP values were updated by Alliance staff to reflect actual installations in the Northwest, and the updated aMW are presented in the MAR. The *Team* installed HP corresponds to these updated values used in the 2002 MAR.

Exhibit 6-2: Average Levelized Cost, MagnaDrive

LEVELIZED COST (cents/kWh)	Alliance	Team
Perspective		
Venture + Post Period	-0.12	-0.09
Venture Period Only	2.18	5.31
TR Perspective		
Venture + Post Period	1.28	1.34
Venture Period Only	3.83	7.41

growth rate significantly increased the levelized cost of the program, and during the venture period, the levelized cost is above the 4 cents/kWh avoided cost.

6.3.3 Cost-Effectiveness

Finally, Exhibit 6-3 presents the resulting average cost-effectiveness from the Alliance and total resource perspectives for MagnaDrive program. Given the relatively high levelized cost during the venture period, the cost-effectiveness index from both the Alliance and the total resource perspectives are below 1 during the venture period.

Exhibit 6-3: Average Cost-Effectiveness Index, MagnaDrive

COST EFFECTIVENESS INDEX	Alliance	Team
Alliance Perspective		
Venture + Post Period	28.6	22.1
Venture Period Only	1.2	0.5
TR Perspective		
Venture + Post Period	2.0	1.9
Venture Period Only	0.7	0.4

6.3.4 Qualitative Findings

The MagnaDrive program is an *entrepreneurial* program that focuses on commercializing a specific technology. Some regional sources expressed concern that this does not promote the development of a robust market for a product or service. Others felt that these types of programs are an excellent use of regional resources, because individual utilities and organizations would not have the resources to independently test and promote new technologies. Other findings:

- The MagnaDrive program has successfully demonstrated the technology at a number of sites, and communicated the benefits through case studies.

- MagnaDrive (the company) would benefit from increased interaction with Alliance staff, and the development of more joint marketing activities.

- The technology is not appropriate for many industrial applications, where VFDs are still the technology of choice, because of their operating cost benefits at lower speeds.

Levelized cost numbers reported in the MAR are based on projected values, and were not adjusted to reflect actual aMW savings estimates to date, while the actual aMW savings are reported. While there may be justification for assuming that the projected long-term savings will be achieved, consistency should be maintained for all numbers reported in the MAR. Any time actual savings numbers rather than projected numbers are reported, the ACE model should be re-run to assure internal consistency of the numbers.

Interactions with Industrial Customers

Some industrial customers feel that Alliance activities to promote technologies such as MagnaDrive overlap with national efforts conducted by DOE, EPRI, and others. Concern was expressed that the program focuses on a specific technology and then looks for appropriate applications rather than focusing on understanding the process needs of a specific industrial sector, and then assisting with the selection of the appropriate technology.

Corporate energy managers in the Northwest are relatively sophisticated, so assisting them with a specific technology may not be the most appropriate approach. For smaller industrial companies, educating them about the benefits of a new technology may help solve their specific problems. In either case, demonstrating an understanding of the issues facing the customers being approached is critical to their consideration of the technology or service being proposed.

The concern discussed above regarding credibility with industrial customers is one that utility industrial representatives constantly face. They sometimes spend years developing credibility with key customers, and get justifiably protective of the relationships they have built. While it may be advantageous for the Alliance to work directly with industrial customers in some cases, utility reps would like to always be contacted before calling their key accounts.

While the Alliance made concerted efforts to promote the technology to utility industrial program managers, additional coordination with utilities would benefit the MagnaDrive program. Currently, some utility ASD programs will not provide incentives for MagnaDrive, but will for VFD technology.

7 SUMMARY ANALYSIS OF OTHER ALLIANCE PROGRAMS

As part of the review of Alliance activities, the evaluation team conducted an initial overview of all programs. After the four programs discussed in the preceding chapters were selected for detailed review, the team continued to consider the market transformation accomplishments of other programs in the Alliance portfolio. A set of programs was selected for summary analysis that would be representative of the remainder of the portfolio, cutting across sectors and implementation mechanisms. The assessment presented in this chapter focuses on describing the lessons learned as they relate to the primary program mechanisms involved — which include the following program types — entrepreneurial, consumer, training, and upstream.

7.1 Program Selection

In the early years of the Alliance, each new project was presented to the board of directors for evaluation and approval. The board later delegated the detailed evaluation of prospective ventures to a committee, as recommended in the operational audit conducted in 1998[47]. Currently, this Portfolio Committee meets monthly to review both internal and external proposals for new or modified project activities. The criteria used by the committee for selection of new ventures include:

- financial return
- electricity savings
- geographic balance
- long term market impacts
- customer class reach.

Alliance staff prepares *Staff Recommendation Memos* and *Cost Effectiveness Analyses* for proposals brought before the portfolio committee. These processes have evolved over time to provide greater detail on costs, potential benefits to the region, timelines, and approach mechanisms. The portfolio committee then makes a recommendation to the board regarding moving forward with a specific proposal at a designated funding level.

In this retrospective evaluation, it was decided to perform a detailed review of four programs and an overview assessment of a few additional programs in order to provide a cross sectional review

[47] Northwest Energy Efficiency Alliance Operational Audit, PriceWaterhouse Coopers, December 1998.

of the Alliance portfolio Through a series of discussions with the ad-hoc committee and Alliance staff, the following programs were selected for summary assessment:

Program	Sector	Mechanism
Commercial Buildings Initiative	COM	Multiple Mechanisms
BacGen	IND	Entrepreneurial
Evaporator Fan VFD	IND	Consumer
Scientific Irrigation Scheduling	AG	Training & Consumer
Energy Ideas Clearinghouse	INFO	Upstream educational
Energy Star Washers	RES	Upstream
Lighting Design Lab	COM	Training – upstream
Compressed Air Challenge	IND	Training – consumer
Codes & Standards	INFO	Upstream

7.2 Overview of Successes and Lessons

This section presents some lessons learned for each of the four program categories — upstream, training, entrepreneurial, and consumer (end-use).

7.2.1Upstream Programs

Upstream program approaches can be applied to any customer segment. Of the programs singled out for detailed analysis in this evaluation, the Windows program is a classic example of an effective upstream program. While these programs employ a variety of mechanisms, the most common actions applied to upstream programs at the Alliance include:

- Identification of market barriers, regulatory hurdles, and marketing needs through surveys and other data collection activities.
- Market intervention through standards development, manufacturer process improvements, trade ally interactions, and retailer support.
- Assistance in promoting and marketing products to create consumer awareness and *'pull'*
- Support of local utility acquisition programs.

For example, since its inception in June 2001, the *Commerical Buildings Initiative* (CBI) program employs a variety of mechanisms that had been used by the six formerly stand-alone programs now under its umbrella. CBI is based on a strategy of targeting specific market segments (schools, hospitals, grocery stores, etc.) based on a set of well defined selection criteria. These criteria include market size, geographic spread, market readiness, and spillover potential. [48] The key to this strategy is to connect the efficiency message to the values of the respective market segment and to understand the market potential for specific products. The

[48] More detail on CBI strategy can be found in *Market Research Report, Commercial Building Initiative – Target Market Priorities*, by Schick Consulting and Pacific Energy Associates, September, 2002.

approach taken to serve these sectors is based on a foundation of education, training, and technical assistance, as well as working with code officials. Marketing messages are based more on relationship building than on advertising. This approach is a long-term one, and it is early to tell whether this ambitious program will achieve its goals. A range of views was expressed by interviewees on this approach. Some commented that they had concerns about a such a broad, segment based approach – that the Alliance might do better to stick to more focused, individual actions. Others indicated they believed a 'unifying' approach to both Residential and Commercial markets would strengthen the acceptance of Alliance activities. As a result, it will be important to track key market indicators and assess what actions are taken that can be attributed to this initiative in the MPERs.

The *Energy Star Washers* program is another example of upstream approach at the Alliance. The strategy here was to increase market share of ES washers in the northwest through an increase in national energy efficiency standards. The program evolved from the original Washwise program in the late 90s to include greater support for retailers in the region as well. In 2001, the washer program was placed under the Energy Star Home Products umbrella.

The Alliance played an active role in the development of the new federal washing machine standards through participation in specifications development activities with the Consortium for Energy Efficiency (CEE) and the Department of Energy (DOE). Both organizations give the Alliance high marks for their input into the process, indicating that the Alliance was 'very proactive' and 'a good friend to the Energy Star managed programs'. The increases in market penetration for ES appliances in general, and washing machines in particular, were more dramatic in the NW than most regions of the country. As the 2002 data indicate in Exhibit 7-1, the Northwest has easily exceeded the target set for the program of *sustaining a 15% market share for energy-efficient clothes washers in the northwest*. This data is based on sales through national retailers only. The Alliance has worked closely with independents and regional chains in the northwest to consistently increase the number of participating retailers, and achieve comparable market penetrations for most appliances.

Some concern was expressed during the evaluation that there was some overlap between the Alliance program and state appliance rebate programs in the region, and it was suggested that better coordination could occur to avoid duplication of effort. The evaluation team also notes that a review of baseline data used for the cost effectiveness calculations be considered, and that attribution for all savings associated with the 2004 standards could be overstating the Alliance's role in the development of national standards.

The Alliance plays an active, though background role in the development of *codes and standards* in the region. Interviewees gave the Alliance high marks for partnering with local, state, and national bodies to improve energy codes across a wide range of products and sectors.

In summary, a review of progress indicators for Upstream Programs shows that:

- The Alliance has done a good job supporting energy code work in the region.

Exhibit 7-1
Regional Market Penetration of Energy Star Products

Market Penetration, by Region

	Region										
Appliance Type	Alaska/ Hawaii	California	Lower Midwest	Mid-Atlantic	New England	New York	Northwest	South/ Southeast	Southwest/ Rockies	Upper Midwest	Average of all appliances
Air Conditioners	35.6%	36.9%	25.5%	37.0%	47.9%	51.0%	40.7%	23.6%	34.8%	38.1%	37.1%
Clothes Washers	23.4%	22.8%	11.0%	15.6%	25.8%	17.9%	31.9%	10.7%	22.3%	16.5%	19.8%
Dish Washers	30.1%	39.3%	37.9%	36.2%	31.9%	33.5%	34.7%	40.4%	33.9%	32.6%	35.0%
Refrigerators	23.8%	25.7%	16.9%	19.6%	25.4%	22.9%	22.4%	17.8%	21.6%	18.5%	21.5%
Average of all appliances	28.2%	31.1%	22.8%	27.1%	32.8%	31.3%	32.4%	23.1%	28.2%	26.4%	28.4%

http://estar7.energystar.gov/index.cfm?c=pt_reps_res_retail.pt_reps_res_retail
This is sales data from national chains, which account for roughly 40% of all U.S. retail sales (source: above website).

- The CBI 'segment' approach has improved access to architects and trade associations, but the jury is still out on the overall effectiveness of the new market segment program umbrella approach.

- Market share of various Energy Star products, including washers, is higher in NW than the country as a whole.[49]

- Consumer awareness related to energy efficient products has increased significantly in the region over the past several years.

- Participating Energy Star retailers increased, and range of products available has increased in many instances.

- Upstream programs pose difficult evaluation problems, but the study team believes that it is important to verify the in-field performance of any technology promoted through and Alliance project. This can be done by working with retailers to track a small sample of customers, and then survey these customers to help ensure that the operating assumptions contained in the CE analyses are, in fact, representative of what is taking place in the field.

7.2.2Training Programs

Education and training programs can take many forms to serve market transformation needs. The BOC program reviewed in Chapter 5 of this report provides a clear example of the advantages of regional coordination for a certification process that serves market actors in the commercial sector. The Alliance has engaged in a number of other training-based ventures, including the Lighting Design Lab (LDL), Compressed Air Challenge (CAC), and Scientific Irrigation Scheduling (SIS).

Typical implementation mechanisms for training programs include:

- Identify market actors and end-users who affect energy use.

- Develop curriculum and tools to educate these market actors on the benefits of energy efficient practices and products.

- Increase awareness of the offerings through outreach within respective sectors.

- Conduct training and measure effects.

The *Lighting Design Lab* (LDL) project began in 1998, when the Alliance and Seattle City Light (SCL), who has operated the lab in Seattle since 1989, initiated a collaborative effort to broaden the reach of those that used the facility. Currently, the University of Washington operates a daylighting lab housed at the LDL. Recently, daylighting labs at the University of Oregon were opened and made available for consultations as well. The strategy of this program is to change design practices in the NW to include state-of-the-art daylighting design, and to include high

[49] Earlier this year, the Alliance was named one of the Energy Star Award winners by EPA for Leadership in Energy Efficiency.

efficiency lighting products in buildings. The labs provide an *infrastructure* resource for the region's architects, lighting designer, electrical engineers, building operators, and facility managers. The lab provides individual consultations with these building professionals to develop lighting strategies suited to a particular project. In addition to training activities and modeling of lighting designs, a mock-up of a design or equipment option can be physically tested before expenditures are made for an entire building. To date, over 100 daylighting model studies have been completed, and over 2000 individuals received training through the lab's efforts.

Savings associated with this program are not tracked, nor were data readily available on the number of facilities actually constructed based on consultations with lab personnel. The program appears to be achieving improved outreach by conducting training at sites throughout the region. Use of the lab resources by architects in the region still has room for improvement, though. Interviewees indicated the lab provides a valuable service, and adds to the regional efficiency infrastructure. The collaborative nature of the activity (Alliance, utility, and university) should prove to induce long-term change in lighting design practices in the northwest. Some analysis of actual energy savings achieved through implementation of LDL consultations or training would be valuable. While these savings can be difficult to measure, a process similar to that used to estimate BOC savings could be used.

The *Compressed Air Challenge* program is based on a similar strategy to that employed by BOC — to develop an independent training and certification program — except that CAC also seeks to build a national collaborative. The program conducts compressed air management courses, and has coordinated those courses with state energy offices and utilities in the region. While the total number of individuals trained through the program is not large, Alliance costs have been limited, and industrial participants indicated there was value to the training, particularly associated with the best practices information provided. Savings for the program are not tracked. A separate, but related program that sought to increase the efficiency of pneumatic conveying systems, *Just Enough Air*, ended in 2002. It incorporates a service program, along with the training elements, and best practices guide. A number of industrial pilot sites saw significant reductions in costs associated with operating their pneumatic systems, but overall program savings did not outweigh program costs during the venture period.

Scientific Irrigation Scheduling seeks to educate irrigators in the region to measure crop moisture needs, and use this information to provide the right amount of water at the right time. A key component of irrigation scheduling is access to and use of accurate weather data. The *Agrimet Weather Station Network* has assisted in achieving this. The *Soil Moisture Data Logger* provides another tool for irrigators to help determine optimum irrigation schedules. This project ended in 2000. At that time, evaluation interviews with outreach coordinators suggested that SIS will become common practice for 50% of growers who irrigate within 10 year, but that Alliance efforts may be too short-lived to have the effect initially targeted. The evaluation team did not interview agricultural market actors in the northwest.

In summary, the status of Progress Indicators for training programs indicate:

- Case study development was successful in many instances
- Market awareness increases evident through adoption of new practices in both C&I sectors

- There has been some progress on creating self-sustaining entities to deliver training
- Regional energy-efficiency educational infrastructure has improved based on Alliance activities. One interviewee commented "these education programs have a high value to the region"
- It would be useful to track participants in educational programs and conduct short surveys to determine what actions are actually taking place in the field and whether the individuals attribute some aspect of these actions to the training received.

7.2.3Entrepreneurial Programs

The Alliance's entrepreneurial ventures seek to help new, specific efficiency technologies and services find market acceptance by supporting the efforts of start-up enterprises. The mechanisms chosen to achieve this strategy include:

- Identify fledgling tools or processes that will improve energy efficiency within a given sector or end use, and examine whether market potential exists.
- Independently test the technology to assure it works as claimed.
- Identify regulatory or other hurdles that may limit product success.
- Assist in developing realistic business plans to bring the tool to market.
- Provide ongoing assistance to assist entrepreneur in reaching market.

The MagnaDrive program was discussed in some detail in Chapter 6 of this report. *BacGen* is another example of an entrepreneurial program that the Alliance has supported. BacGen Technologies approached the Alliance in 1997 with a proposal to save energy by working with wastewater treatment facilities in the region to increase the efficiency of their operations. The approach focuses on a reduction of mechanical aeration at wastewater facilities, and the company provides a range of diagnostic and implementation services to the wastewater industry. The Alliance has assisted with business plan development, pilot site implementation & funding, case studies and funding coordination. BPA has provided additional funding for BacGen installations through its efficiency resource acquisition program. Currently, BacGen has about 20 sites in the northwest, and about 100 in California.

There are remaining market barriers, including lack of understanding of the technology and approach among state health regulators, and a lack of capital for BacGen activities among targeted customers. The Alliance's local government reps help to arrange meetings to address the regulatory barriers, and some facilities are entering into ESCO agreements with BacGen to address the lack of capital concern. The Alliance has recently reduced its financial role to essentially providing only marketing dollars.

Some interviewees expressed concern with the entrepreneurial approach, indicating their belief that by supporting one company and a specific technology, the Alliance does not necessarily help

create a robust, competitive market for a set of products or services. The approach is quite different than those employed for upstream and training programs, and the Alliance will need to address these concerns going forward. Alternatively, others interviewed indicated that for utilities, having the Alliance do the vetting of potential new energy efficiency technologies was an excellent use of a regional resource – as it reduces duplication of effort by regional utilities, and allows for investigation of technologies that an individual utility would not have the resources to test. While this is certainly true, industrial customers are sometimes best served in this regard through national efforts underway for specific targeted industries, and care should be taken to involve a wide range of stakeholders before launching new industrial focused entrepreneurial efforts.

In terms of implementation, care in conducting thorough due diligence before making an investment in any start-up company must be assured. Picking a promising energy efficiency technology is only the start. Assessing the target market niche, analyzing competitive technologies and companies, and determining whether regulatory or other barriers can be overcome in a timely manner through cooperation between the Alliance and the start-up management team all come into play in the process. The views expressed by stakeholders and market actors indicate that while the Alliance has been thorough in some of these activities, the due diligence has not always been consistent. While a private venture capital firm may choose to apply different levels of analysis to potential investments, the investments made by the Alliance involve the use of stakeholder funds, and will continue to be scrutinized closely.

In summary, the status of Progress Indicators for entrepreneurial programs indicate that:

- Technologies have been successfully tested and demonstrated.
- To date, there has been limited market acceptance of program technologies and processes. Evaluators commented on the BacGen program that "evidence for widespread market transformation has not significantly surfaced."
- The Alliance must continue to assess the market potential of new technologies, develop case studies, and promote benefits to the right market actors.

7.2.4Consumer (End-use) Programs

Consumer programs are characterized by activities that are targeted directly to energy end users, and can be focused on any customer class. Key mechanisms for these programs include:

- Raise awareness regarding benefits of an efficiency product or process.
- Demonstrate the benefits to the respective end-user group.
- Establish local support for education and technical assistance.

While some of the training programs discussed above are targeted directly to end-users, the primary mechanism to induce market change in those is through education of the end-user or trade ally, not the implementation of a specific technology. Consumer programs have historically been the focus of utility resource conservation efforts, and some parties interviewed

indicated a belief that is where these programs should reside. Others expressed the need for the Alliance to target specific regional industries with technology programs that may be more difficult to develop at individual utilities. This is the case with the *Evaporator Fan VFD Initiative*, which began in 1998. This project's strategy is to make VFDs a standard technology for evaporator fans in NW food storage facilities. They employ an implementation contractor in the region that has significant experience with industrial refrigeration systems.

The program has focused on demonstrating to owners and operators of refrigerated warehouses that the technology has financial benefits, and is reliable. It has proven to be critical to demonstrate that the technology has at least a neutral impact on fruit quality, and to disseminate this information to the broader marketplace. Demonstration at approximately 20 facilities showed fan energy savings of 24-78%, and mass loss of stored fruit improved slightly as well. The acceptance of the technology within the target market sector is on the upswing, and the most recent evaluation suggested that "VFDs will become ubiquitous over the next 10 years, with or without utility programs". The program has met its goals of conducting field trials, and developing a database of storage facilities. It has long term (2007) targets of increasing market penetration of VFDs to at least 31% of warehouses and 47% of fruit storage facilities. Evaluators also recommended developing an Evap Fan VFD consultant base, in order to develop a more robust market for services than now exists, and to provide an array of information resources – including expanded case study distribution to market actors, a VFD application guide, and web resources.

The status of Progress Indicators for consumer programs can be summarized as follows:

- Savings are not tracked for a number of these programs, but the study team believes that it would be possible for some of these programs to perform case studies and review field performance to see if the technologies that are being supported by Alliance efforts are having the anticipated impacts.

- Achievements are mixed, solid progress has been achieved on a number of fronts while financial successes are less clear.

- Coordination with local utility programs and QC procedures for implementation contractors who interact with utility key account customers is critical to future success.

8 OVERALL VALUE ASSESSMENT

This chapter provides a summary of the findings from the scenario analysis conducted for the four programs assessed in detail, and the effects on the overall cost effectiveness of the Alliance. It also presents qualitative findings regarding Alliance activities that are not program specific. Section 8.1 presents the distributions and overall energy savings associated with Alliance activities, and summarizes the program impacts. Section 8.2 summarizes the overall value of the Alliance based on the team's interviews with stakeholders and market actors in the region.

8.1 Estimated Impacts of the Alliance – Energy Savings and Levelized Costs

Chapters 3 through 6 addressed the impacts of four selected programs based on a detailed analysis by the study team and a tracing of the numbers through the cost-effectiveness models with the addition of new information (when appropriate) from other studies and interviews conducted. In addition, this process used ranges instead of point estimates for impacts to dimension the uncertainty in some of these estimates. This section takes the results from these individual program analysis efforts and examines their impact on the overall energy savings claimed by the alliance.

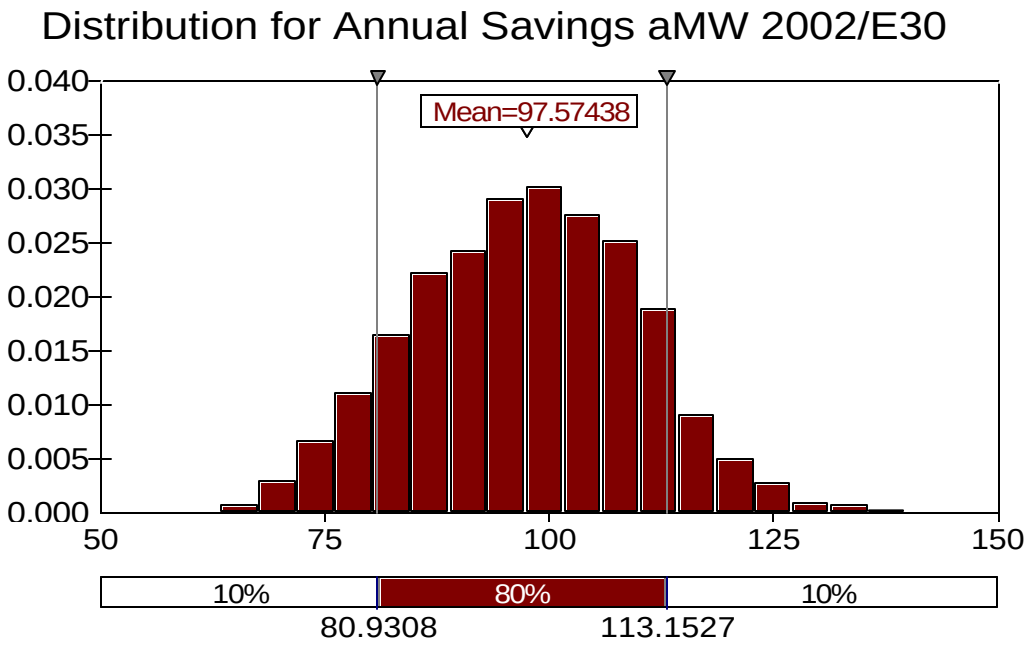
A key question associated with the analysis is how the results of the investigation into alternative scenarios for the four programs affect the overall Alliance investment perspective. To address this issue, the levelized cost from the Alliance perspective through 2002 was used. The calculation used for this is:

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

Using the Alliance numbers from the 2002 MAR for the costs and savings from *all* programs produces a levelized cost of 0.7 cents/kWh.

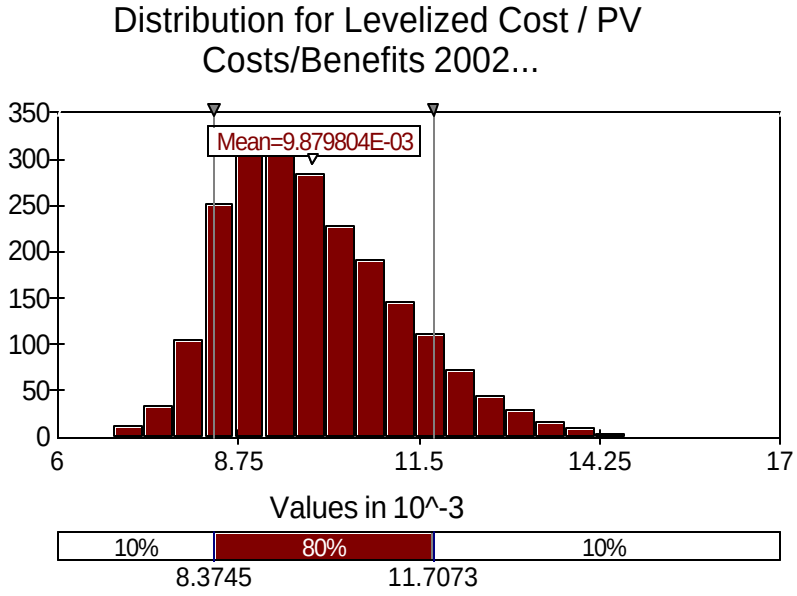
The study team's analysis of the savings associated with the ES Lighting, the ES Windows, BOC, and MagnaDrive programs, when combined with the Alliance claimed savings for other programs, produces an average cumulative savings to date of 98 aMW for *all* programs – using the low influence scenario for the CFL program (compared to the Alliance's original estimate of 134 aMW). The distribution for the total savings to date is presented in Exhibit 8-1.

Exhibit 8-1
Distribution for Overall Cumulative Savings Through 2002



Note: Savings shown use team estimates for 4 programs reviewed in detail, including the low influence scenario for the CFL program. Using this distribution for total savings through 2002, in the above levelized cost equation, the probability distribution for this levelized cost shown in Exhibit 8-2 is obtained.

Exhibit 8-2
Distribution for Levelized Cost, Alliance Venture Period Perspective



The revised analyses documented in Chapters 3 through 6, when combined with Alliance estimates for other programs, result in a study team total levelized cost 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, it is still well below the avoided cost of power in the region. When levelized costs are considered from the TRC 2010 perspective, the team's estimate of levelized cost for the entire portfolio is between 1.13 cents/kWh and 1.29 cents/kWh, with a mean value of 1.21 cents/kWh.[50]

The composite changes across the four programs analyzed produce the new venture period levelized cost estimates shown in Exhibit 8-3 below. These estimates represent the best available information that was available to the study team. 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 in estimates of the savings per unit or application (e.g., savings per lamp or savings attributable to each person participating in the BOC training).

Exhibit 8-3: Average TRC Venture Period Levelized Cost

TRC LEVELIZED COST (cents/kWh)	Alliance	Team
Energy Star Lighting – High Scenario	.44	1.89
Energy Star Lighting – Low Scenario	.44	3.04
Energy Star Windows	.64	.77
BOC	.48	.40
MagnaDrive	3.83	7.41

Exhibit 8-4 shows a summary of the venture period benefit-cost ratios (from the Alliance perspective) as determined by the study team analysis, compared to the same ratios developed by the Alliance in the ACE models for each program. Other than the MagnaDrive program, all programs analyzed by the team were cost-effective.

8.2 Overall Value of the Alliance

The interviews conducted with trade allies and market actors contained a set of questions that addressed the overall value of the Alliance. Questions addressed four areas of Alliance activities – Planning, Implementation, Evaluation, and Communication. These questions were not asked

[50] 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. Neither 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 TRC perspective, and should be reviewed periodically.

Exhibit 8-4: Average Alliance Venture Period Cost-Effectiveness (Benefits/Costs)

ALLIANCE COST EFFECTIVENESS INDEX	Alliance	Team
Energy Star Lighting – High Scenario	17.5	7.7
Energy Star Lighting – Low Scenario	17.5	3.0
Energy Star Windows	27.0	19.0
BOC	5.0	8.5
MagnaDrive	0.7	0.4

of Alliance staff. The individuals interviewed are shown in Appendix A to this report. They include project implementers, project evaluators, utility program managers, retailers/trade allies, and other stakeholders. The responses to these questions regarding the perceived value of the Alliance were combined with other information obtained from the review of reports, and interviews with Alliance staff. This process produced insights that the study team believes are useful for this assessment.

Not all individuals interviewed were able to address each of the topic areas; however, when putting these responses and comments in context, there were three areas that were generally addressed by the interviews.

***Overall Value: Impact of Alliance on Market Transformation*.** The interviews with stakeholders (excluding Alliance staff) indicated:

- A widely held belief that the Alliance is responsible for higher levels of market transformation than would have occurred had the Alliance not existed.
- That the Alliance has had a significant impact on a number of markets for energy efficiency technology and their efforts on the energy efficient windows market in the Northwest is exemplary of a successful MT program.
    - That the focus of the Alliance's market transformation efforts has been appropriate, i.e., the Alliance has done a good job of identifying and pursuing programs best addressed regionally. Also, the study team's reviews of the selection process and the program implemented supported this finding. Examples include training programs such as BOC, and projects targeted at manufacturers (e.g., Energy Star windows) are the types of programs whose implementation spans utility service territories and even state boundaries.
    - The Alliance has developed an infrastructure of programs, facilities, relationships, and personnel that represents an asset to the region. Physical examples of this infrastructure include the Lighting Design Lab and web-based information resources. The relationships developed by the Alliance staff and contractors with local governments, manufacturers, and retailers represent another type of capital that provides opportunities for future efficiency activities that would not otherwise exist.

While the comments above represent the study team's findings based upon the interviews, there were other comments made that did not appear to be part of the *majority* view, but the study team believed that they were worth bringing to the attention of the Alliance and its Board for their consideration. Two such comments were:

- There was one dissenting opinion regarding the impacts of the Alliance on market transformation which was based upon the belief that baselines are dramatically understated, i.e., many market changes observed would have happened without the Alliance - due to other factors.

- Another individual expressed the opinion that while venture selection has been good overall, there was concern expressed about the recent selection process.

Overall Value: Alliance Tracking of Impacts. There was a general view among the stakeholders interviewed that impact estimates tended to be modestly high. Comments pertaining to this finding include:

- Several individuals expressed concerns about the Alliance claimed impacts for its efforts in residential lighting and this did show up in the bi-modal estimates of CFL sales influence used in the study team analysis in Chapter 3.

- The individuals interviewed indicated that while they generally believe the Alliance impact estimates were somewhat high, it was believed to be only a modest overstatement on the order of 10 percent or so on average.

- There was a perceived need to update baselines used to estimate program impacts more frequently.

- There is a need to test performance assumptions in the field rather than assume that actual performance matches predicted performance.

In addition to the sets of comments that are viewed as study team findings above, other comments that may be of interest to the Alliance and its Board are:

- Evaluators did not feel pressured by Alliance study sponsors to produce favorable numbers or results.

- Some of the Board members interviewed (and also other stakeholders) indicated that they were "trusting" a few knowledgeable "other" Board members to ensure unbiased impact evaluations since they had expertise in this area.

- Originally the MPERs were designed to look at entire markets, not just at project indicators and effects; but, over time, they have changed to focus on project effects and delivery processes and less on the overall market.

Overall Value: Organizational Effectiveness. A question was asked regarding how well the Alliance operated as a business organization. This was asked in the context of overall

operational effectiveness compared to other organizations with which the individual being interviewed was familiar. Comments on this topic included:

- Only one interviewee rated the Alliance as "below average" as a business organization – other respondents rated the alliance as well above average (a 7 or 8 on a scale of 1 to 10) and, based on other organizational studies, this is a high rating and reflects favorably on how the Alliance operates.
- Planning was viewed as a strength of the Alliance.
- Communication to stakeholders was rated as very good.
- Importantly, alliance staff was well respected by all stakeholders interviewed.

Some other comments for consideration that were not viewed as findings are:

- Some concerns about recent trends in various areas (venture selection, accountability, and transparent accounting), but this was viewed as quite recent and not yet of great significance.

- The Alliance has faced recent challenges due to organizational changes in general, staff turn over and staffing patterns in particular.

- The Alliance's reputation among trade allies was raised as a "potential" concern – related to this concern was implementation contractor selection and their ability to relate to the concerns of trade allies and industrial customers in particular, and the implementation of an overall quality control process managed by the Alliance rather than its contractors to ensure that relations with key trade allies remained favorable.

9 ISSUES, FINDINGS AND RECOMMENDATIONS

This chapter discusses the findings and recommendations of the retrospective assessment. It is divided into several sections with the first presenting general findings that the study team has classified as "over-arching themes" resulting from the assessment. Section 9.2 discusses aspects of three key processes that are linked; the Cost-Effectiveness (CE) Analyses, the Market Progress and Evaluation Reports (MPERs), and the production of the annual Market Activity Report (MAR). The final section presents the study team's recommendations for consideration by the Alliance and its Board.

9.1 Over-Arching Themes from this Assessment

This work effort was comprised of numerous tasks ranging from review of numerous alliance reports and documents, interviews with regional experts and market actors, and quantitative assessment of program accomplishments. It is important in a project of this type to examine how this information might be organized in a manner that can provide a relevant overview of the Alliance. In preparation for the final presentation to the Ad Hoc Retrospective Assessment Committee, the study team reviewed the information from the assessment and developed seven over-arching themes that represent the high level findings. This are discussed below and in greater detail in the subsequent sections of this chapter.

THEME 1: The Alliance business culture is characterized by open communications, a focus on the planning and delivery of programs, and no discernable bias. The Alliance has developed a culture of adaptive management and continuous learning that has been communicated throughout the organization. Alliance personnel were open and direct in its communications with the study team. The project interviews with evaluators and implementers indicated that the Alliance worked with them to reach appropriate answers. There were no pressures to produce any specific result or finding, and the general attitude was one of working with the study team to reach appropriate answers and conclusions, and to continue to make the Alliance a "learning" organization. As a relatively new organization that had the challenge of initiating market transformation programs, the focus of the Alliance to date has been on the planning and efficient delivery of appropriate programs.

THEME 2: The Alliance has been successful at transforming, or contributing to the transformation of markets. The study team reviewed Alliance program evaluations, and interviewed the researchers who conducted program specific evaluations, as well as other

regional stakeholders and market actors involved in energy efficient markets in the northwest. Based on the information gathered, the study team determined that the Alliance made substantive contributions to transforming regional markets for energy efficiency equipment and practices. Specifically, the MPERs addressing the Energy Star Windows program were compelling in their documentation of Alliance influence on the market share of efficient windows installed and the increase in the number of active manufacturers of high efficiency windows in the region. Both the MPERs and national data indicate market penetration of Energy Star windows in the Northwest are more than twice the national average. Interviews with industry experts also supported the contention that Alliance activities have permanently impacted the windows market.

Other markets where there was considerable evidence of market transformation included clothes washers and CFLs. For clothes washers, the market penetration of Energy Star washers in the NW are significantly higher than the national average (see chapter 7). The market for CFLs changed more dramatically in the NW than other regions of the country, even when the West Coast energy crisis is considered (see chapter 3). The specific magnitude of the impact of the Alliance on these markets was a subject that not all market actors in the region agreed upon, but there was a more general agreement that permanent changes had taken place in these markets and these changes were at least partially the result of Alliance activities.

THEME 3: Market Progress Evaluation Reports tended to focus on the program delivery process and on providing feedback for program design and implementation improvements. This met an immediate need for Alliance personnel responsible for program implementation, and these reports improved the delivery and implementation process. This trend towards process analyses and providing feedback for program improvement fits well with the Alliance's goal of adaptive management, but the estimates of impacts and the ability to substantiate claims of Alliance-induced market effects would have been enhanced by having the MPERs more directly address savings per unit and the issue of attribution within each study. In general, the MPERs were not structured to provide information on attribution or savings per unit for energy efficiency equipment (or applications) influenced by Alliance activities.

THEME 4: Cost-effectiveness analyses were difficult to replicate and the current processes used are cumbersome. Cost-effectiveness models and analysis efforts form the basis for projecting market impacts from programs under development by the Alliance and they are used as the basis for the Alliance claims of cost effectiveness as presented to the public in the MAR. The initial pressures on the Alliance have been to develop and implement programs in the field. The study team commends this past focus, but is emphasizing the need for improvement in this area going forward. The magnitude of claims made by the Alliance as its portfolio of programs has grown will result in new challenges related to accountability that may not have been present (or needed) during the start-up phase. As a result, a more streamlined and transparent process for estimating and modeling program cost-effectiveness is needed.

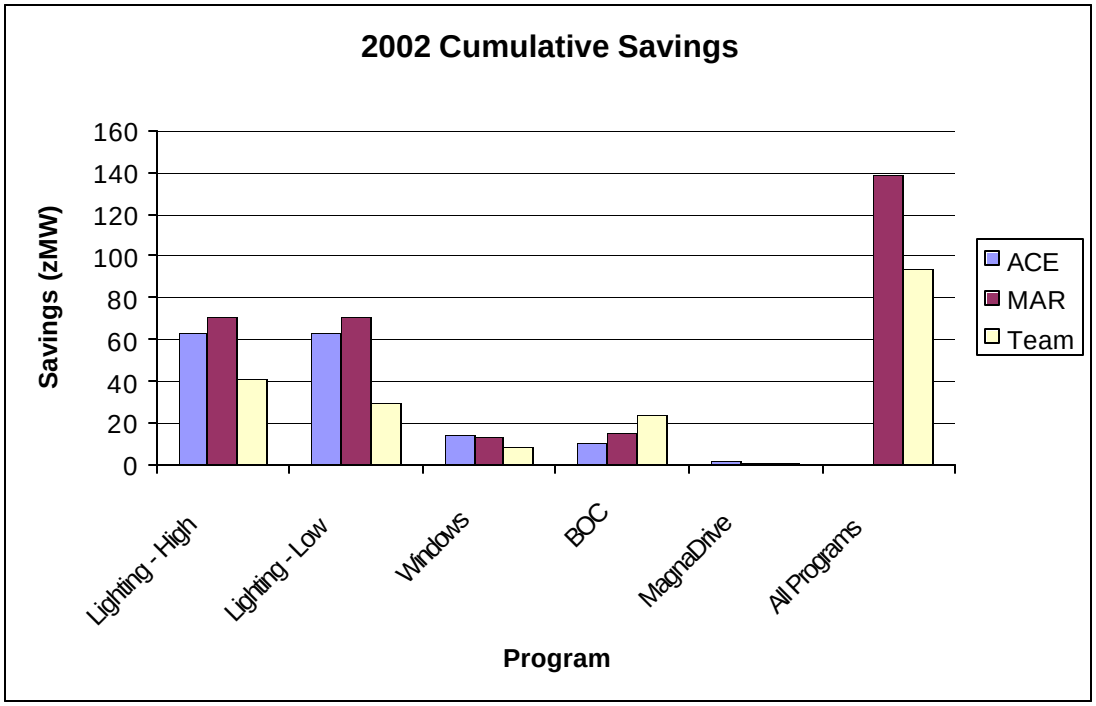
In general, it is can be easy for those not directly working with a model-based system to underestimate the complexities involved in the modeling effort. There is often a question of how to allocate resources within an organization and some tradeoffs are generally made regarding the activities performed. The initial pressures on the Alliance have been to develop and implement

programs in the field. The study team commends this past focus, but is emphasizing the need for improvement in this area going forward. The magnitude of claims made by the Alliance as its portfolio of programs has grown will result in new challenges related to accountability that may not have been present (or needed) during the start-up phase. As a result, a more streamlined and transparent process for estimating and modeling program cost-effectiveness is needed.

The study team traced Alliance claims of energy savings as presented in the MAR and developed alternative scenarios, which were subsequently run through the CE models. These analyses resulted in lower estimates of Alliance impact claims as compared to the numbers reported in the 2002 MAR (from 134aMW to 98aMW).[51] Most of this adjustment came in one program – the ENERGY STAR® Residential Lighting program – with adjustments in other programs examined being much less significant. The numbers used in this adjustment are from the "low influence scenario" for the CFL program (see Chapter 3).

A comparison of this analysis is shown in Exhibit 9-1. Note that ACE calculated savings were not available for all programs not reviewed, so there is no ACE value shown for 'all programs'.

Exhibit 9-1
Comparison of Energy Savings Through 2002



[51] See footnote #26.

THEME 5: Benefits of the Alliance have exceeded costs. Even with the study team's adjustment to estimated Alliance energy savings estimates, the analysis of program impacts shows the benefits from Alliance activities have exceeded its costs. In fact, the team analysis indicates a levelized cost for the Alliance portfolio of programs of between 0.83 and 1.17 cents per kWh, with a mean of 0.99 cents/kWh, when they are considered from the Alliance venture period perspective (see chapter 8).

THEME 6: The regional approach of the Alliance is an asset and even greater leverage in program implementation can be gained in the future. The Alliance has developed an infrastructure of programs, relationships, and personnel that represents organizational capital that will be valuable in the future. Interviews with market actors indicated some diverse opinions regarding past efforts of the Alliance and the amount of energy savings that should be attributed to alliance activities. Even taking those comments into account, there was a general consensus that the Alliance was able to undertake certain programmatic activities more efficiently on a regional basis than was possible through local efforts. The study team's review of programs selected for implementation by the Alliance indicated that most programs were well suited to implementation by a regional organization. In this respect, the Alliance was living up to its goal of focusing on market transformation projects that can best be addressed at a regional level.

In summary, the six themes that came out of the study team's assessment work effort show that the Alliance has been an effective organization that has focused on the selection, design and delivery of programs. As a new entity, this was an appropriate focus. With programs that have grown, the Alliance infrastructure in terms of analysis capabilities needs to grow as well.

9.2 Issues Related to Cost-Effectiveness and Evaluation Processes

One of the key charges that was given to the study team was to examine Alliance claims and work to validate the fact the energy savings attributable to the Alliance justify the costs of the Alliance. To accomplish this objective, the study team began with the 2002 Market Activities Report (MAR) which documents the Alliance's estimates of impacts. As discussed earlier in this report, four programs were selected for detailed analysis by the study team. This involved a review of underlying assumptions and hands-on work with the Alliance cost-effectiveness models used to produce estimated savings, benefit-cost ratios, and estimates of levelized costs. This section discusses three processes that work together to produce the Alliance estimates of energy savings and benefit-cost analyses. These three processes are – 1) the cost-effectiveness model(s) used by the Alliance, 2) the MPERs that evaluate projects, and 3) the MAR which consolidates information from these two sources in an annual report.

9.2.1 The Alliance Cost Effectiveness Model

The study team conducted a review of the Alliance Cost Effectiveness (ACE) model as part of the assessment of the Alliance's claims, particularly for the models used for the four programs investigated in detail.

The ACE model was originally developed to standardize the analysis across all programs. As a result each ACE spreadsheet contains the same structure including worksheets, location of cells, and formatting, with program specific calculations are contained on either the "Non-standard Calcs" sheet or the "Input Assumptions" sheet. This makes the consistency across program model analysis somewhat superficial in that many of the meaningful calculations are performed in these non-standard calculation sheets. Given the need to develop different project scenarios, some project modeling efforts have developed numerous calculation sections within the "Non-standard Calc" sheet which results in complicated models. One of the reasons for this may simply be time constraints. As in all work environments, Alliance staff have deadlines and time pressures and it is easy to understand why a quick fix might be taken to meet a near term deadline. At some point, it becomes appropriate to "clean-up " and streamline the modeling process even though each individual decision that has been taken in the past may have been reasonable and served the need for practicality and expediency. The difficulty encountered by the study team in tracing CE analysis efforts and identifying which assumptions were used points to a need to streamline the CE modeling process.

In addition, the current ACE models include the past assumptions used in the model even though these may be outdated and not used in the current calculations. While there are clearly benefits to this approach, it does make it difficult to easily determine which assumptions are used in the model. It might be better to store these past assumptions in a separate document. And finally, to help clarify the model, the team recommends that the necessary input assumptions for the model should be clearly stated on the "Input Assumption" sheet, and no inputs should have to be entered on any other worksheet.[52]

A final issue is the application of the ACE model and its relationship to the numbers reported in the MAR, is to strive for consistency across all programs. As an example, ACE modeling of the lighting program was updated to incorporate actual sales of bulbs through 2001, but not through 2002. Alliance cost-effectiveness and levelized cost calculations are thus based on partially updated numbers. Conversely, for MagnaDrive, the numbers in the ACE model are the original planning numbers, even though the Alliance had data on actual MagnaDrive installations available. This may have been a resource allocation decision, i.e., when is it appropriate to update the analysis if the program is still in its early stages. Judgment is always required in making resource decisions regarding when to update impact estimates particularly for programs that are showing relatively small impacts. In general, however, as the Alliance continues to track and report attained impacts, the ACE model should represent the best currently available numbers rather than default back to initial planning values. This issue is made somewhat more complex by the fact that the Market Activities Report uses the actual accomplishments (in terms of aMW) to date for each program, while standard practice it to not change these assumptions in the ACE model. This can result in subtle differences between the cumulative savings reported in the MAR and those used to calculate the levelized costs and cost effectiveness indices also reported in the MAR. Updating the ACE model to use the actual accomplishments would eliminate this inconsistency.

[52] For example, in the ACE model for windows (CE-C97-028-ES-Windows-MPER5-AAA2001-SH-LC.xls, run date April 11, 2002) some inputs are found on the "Input Assumption " worksheet while other inputs are found on the "Non-standard Calcs" worksheet.

The study team does not believe that the issues raised above in the application of the ACE models and the incorporation of the results in the MAR has led to substantive miss-reporting of results. However, as programs grow and attribution of impacts to Alliance activities continues, these issues could become important in the future and should be addressed on a going-forward basis (see recommendations). It is the study team's opinion that, at this point in the development of the Alliance, some additional effort to organize, document modeling efforts, and streamline the ACE process will produce benefits for the Alliance.

9.2.2Market Progress Evaluation Reports

In developing the review of the Alliance's accomplishments, the team reviewed a large number of the available MPERs. Since the retrospective objective as to determine impacts, i.e., to what extent has the Alliance contributed to energy savings and moved markets, the study team's review concentrated upon how the MPERs can be used to determine the program progress. As a general statement, the study team's review of the MPERs indicated that most MPERs reviewed market indicators and provided some input into important indicators such as market share calculations. Expected savings per application associated with the project and related assumptions used in the cost-effectiveness model were not researched or not researched at the same level of detail. Essentially, the MPERs focused primarily on assisting the Alliance on project implementation feedback, with some verification of market effects and a limited review of the input assumptions to the ACE model. The study team believes that a modest incremental effort would be required to more explicitly explore project impacts (through a more careful assessment of input assumptions) and attribution of impacts to Alliance activities. In many instances, this could be accomplished by adding a few questions to surveys that were fielded by the evaluation contractors. Overall, the MPERs are a good process review of program delivery, but did not research project savings as actively as might have been expected.

Balancing research objectives and allocation of resources is generally an issue and interviews with individuals performing the project evaluations indicated that they believed the focus of the work was on analysis of the program design and delivery as part of the Alliance's adaptive management process. This may be appropriate, but the study team believes that the overall objectives of the Alliance can be better met by providing greater direction to the project evaluators regarding the need to estimate attribution, in-field performance of technologies, and assumptions used in the cost-effectiveness models. Ensuring that expected energy savings from Alliance projects are indeed taking place in the field is also an important objective as the Alliance portfolio of programs grow and become more diverse.[53]

[53] There were some instances where the MPERs did provide guidance on input assumptions and these often were incorporated into the cost-effectiveness analyses. But, this did not always occur. In one of the four programs investigated – energy-efficient windows -- the project MPER made recommendations regarding the cost-effectiveness calculations. MPER #3, Quantec, March 2000 states that "Some of the issues raised in this report are due to 'age' of data utilized by the Alliance." In particular, estimates of housing starts, fuel mix, and energy savings had not been updated since 1995 (or earlier in the case of fuel mix), when they were used to develop the Fourth Northwest Conservation and Electric Power Plan. More recent studies (e.g., a study by Ecotope) showed different electric heat saturations than those assumed in the ACE model. While the current ACE model for this program does contain a detailed section containing the Ecotype numbers, this section of the model was not used to compute the final results. At the time of this report, the cumulative savings, levelized costs, and cost-effectiveness index computed by this ACE model is still based only upon the overall electric space heat saturation from the Fourth

9.2.3The Market Activities Report

The need for accuracy in the CE analyses and the role of the MPERs depends in part on what the Alliance and its Board hopes to accomplish with the energy savings estimates that are attributed to the Alliance in its MAR. The MAR is widely viewed as the Alliance's definitive statement on what it believes it has accomplished. The language used in the MAR supports this assumption. For example in the recent 2002 MAR, it states that *"For the reporting period January 1, 2002 to December 30, 2002, the Alliance has saved 45aMW, as depicted in Chart 1."* In the next paragraph of the MAR Executive Summary it states that *"Total Savings of the Alliance since its inception in 1997 (exclusive of utility direct rebates) is 134aMW."*

It was not uncommon in interviews for the respondent to directly quote these numbers and wonder what support they had, i.e., were they conservative and savings might be even higher or were they optimistic. In one case, the respondent referenced the MAR and said "I know that the Alliance didn't save 134aMW, I just don't know whether the real number is above or below that value." The implication of this statement, in the opinion of the study team, is that these relatively absolute statements regarding Alliance accomplishments may be over-reaching and, for at least some stakeholders, it has the unintended effect of raising some concerns about the balance and credibility of the Alliance. While most stakeholders interviewed indicated they felt the Alliance staff takes great care to make these numbers accurate, it is important to note the dissenting view.

The MAR has high quality graphics and is authoritative in appearance. The Alliance energy savings claims are very direct and unequivocal. Given this, what is the appropriate underpinning and evidence needed to ensure that these claims are viewed as credible by entities that work with and support the Alliance? One option would be for these estimates to be given in terms of ranges and scenarios could be presented that represent "conservative" estimates.

This also translates into a question concerning what should the MPERs be reporting in terms of program impacts and pivot assumptions? The annual MAR addresses market activities, but it also measures program progress in terms of cumulative savings achieved, levelized costs, and cost-effectiveness indexes. The MPERs could, with little additional cost, provide better foundations for estimates of energy savings by making sure that the evaluator is aware that they have to verify current project assumptions used in the CE analysis, and they have to develop estimates of attribution to Alliance activities based on the best available information, even if this is comprised of expert judgment developed during the course of the evaluation.

The study team believes that it is important that the Alliance provide estimates of energy savings accomplishments, but there may be better approaches to bracketing and bounding the estimates

---

Northwest Conservation and Electric Power Plan. This reflects on the current complexity of the documentation and CE models in current use, and the fact that it is sometimes difficult to determine which assumptions were actually being used in the calculations the produced the model outputs. Finally, if a program is believed to be clearly cost-effective, as the windows program was, is it worth the effort to update assumptions and re-run the model.

than are currently used in the MAR. Even with that change, the MPERs should refocus and provide additional support for energy savings estimates.

9.3 Recommendations

A number of specific recommendations are made by the study team in this section. These recommendations reflect the issues discussed in the preceding sections. The recommendations are divided into five categories and are presented below.

Recommendation Area #1 — Cost-Effectiveness Models and Processes:

R1.1 – The Cost-Effectiveness spread-sheet models should be "cleaned-up" and a better documentation process implemented to avoid confusion in the future. The study team believes that several man-weeks devoted to this process could considerably enhance the transparency, and user-friendliness of these important tools and save labor hours down the road that might well make up for the short term costs of upgrading the CE process.[54]

R1.2 - Develop more specific processes to update and track assumptions used with direct links to sources of assumptions and referencing the MPERs that are tasked with reviewing the input assumptions for each project.

R1.3 - The Board needs to recognize the complexity of this work element and help ensure that there is a reasonable review process for model results. The fact that a model is used does not, in itself, ensure that the outputs are appropriate.

Recommendation Area #2 — Use of scenario analysis and identification of pivot factors in reporting of Alliance accomplishments:

R2.1 - Evaluation and planning (e.g., the venture business plan) would benefit from the use of bounding scenario analyses and the identification of pivot factors. The portfolio committee discusses these factors when deciding whether a specific project should be undertaken, but these assumptions need to be documented and tracked over time. This would provide the following benefits:

- Large uncertainties on select pivot factors could be targeted in the MPER analyses to reduce these uncertainties.
- As the MPERs address these factors, better information can be incorporated into the CE analyses and reflect the best available information along with current uncertainties.
- It would help determine the confidence in projected aMW accomplishments.

[54] There is the additional concern of knowledge being concentrated among a few key staff, if for some reason those staff members were not available to the Alliance in the future.

Recommendation #3 — Treatment of Project Baselines (Dynamic versus Static):

R3.1 – The baseline trend line is determined in the planning process and not typically updated even when there have been substantial changes in the market (e.g., changes in the price of electricity) that would seem to have a clear impact on the number of energy efficient products that would be sold if the Alliance had not intervened in that market.

R3.2 - Outside factors such as utility programs, prices, energy shortages do influence what would have happened without the Alliance program and it seems unreasonable to maintain that the baseline that was developed during program planning would remain the same going forward, even under changed circumstances. As a result, baselines should be dynamic in that they should be reconsidered every year and updated to reflect major market changes (e.g., higher electricity prices and constrained supplies that might lead customers to act) and the Alliances best judgment regarding how the baselines should be adapted over time.

R3.3 - The baseline is one of the most influential and uncertain factors in producing any estimate of Alliance project effects. Best efforts are needed on baseline determination, despite the complexities and uncertainties, and changes need to be made on an ongoing basis if Alliance claims are to be viewed as credible.

Recommendation #4 — Trade Ally Relationships Going Forward:

R4.1 - Trade ally relationships are central to the Alliance objectives. Implementation contractors represent the Alliance to these important stakeholders and some contractors have proven to be a key factor in program success. Additional independent quality control processes should be implemented to ensure that good relations are consistently maintained. This can be as simple as having an Alliance staff member call an industry trade ally once a year just to make sure that contacts and coordination have been appropriate. Other potential activities might include a survey of retail partners, manufacturers, and utility key account reps regarding coordination of efforts, or development of guidelines for interactions with specific customer types or trade groups. While this relationship is covered in the process evaluation aspect of the MPERs work, these relationships are so central to Alliance objectives that an additional level of quality control and communication with trade ally organizations seems appropriate (Note: This was suggested by several parties as part of the stakeholder interview process).

Recommendation #5 — Guidance from the Board:

R5.1 - Guidance is needed on what "claimed aMW impacts" means in the context of the MAR:

- Should the MAR only focus on market share indicators?
- Or, are these estimates meant to represent a "best estimate" of aMW attributable to Alliance activities?

- Should estimates be given a degree of confidence and/or expressed as range estimates to reflect the uncertainties in the attribution process.

- Should estimates in the MAR be supported by a specific ACE analysis to ensure consistency between savings estimates and levelized costs?

These positions have implications on Alliance credibility and also for resources allocated to evaluation efforts. In addition, this recognizes that all business decisions and venture analysis both within and outside of the area of energy efficiency investments are made with uncertainty, and that precision in excess of what is used in the private sector to make good business decisions is not needed for the Alliance to successfully meet its objectives.

9.4 Final Comments

This section is designed to again present the important context in which these issues are discussed and the recommendations made. The assessment performed by the study team found that the Alliance provides value that exceeds its costs. Interviews with key stakeholders indicated that the Alliance:

- Operates well as a business organization
- Is strong in planning
- Communicates well
- Has impacted targeted markets.

The benefit-cost analyses with the Team's revised numbers still show that the benefits of the Alliance have exceeded their costs. Overall, it is the study team's opinion that the reasons for establishing the Alliance are still valid and provide strong rationale for continuation:

- Energy markets invariably cut across utility and jurisdictional boundaries, it makes most sense to pursue these (MT) efforts regionally; and,

- This regional approach by Alliance is an asset and can gain increased leverage by continuing its relationship building efforts with partners.

Table of Contents
Appendices

A

1. Individuals Interviewed during Retrospective Evaluation

2. Interview Guide – Organizational Effectiveness

3. Interview Guide for Staff Interviews – Task 2

4. Alternative Hypotheses Data Collection Instruments

- **CFL**
- **Windows**
- **BOC**
- **MagnaDrive**

Task 2

Ad-hoc committee members

Stan Price, NW Energy Efficiency Council
Ken Canon,
Darlene Nimnich, Idaho Power
John Savage, Oregon PUC

Alliance staff

Margie Gardner, executive director
Dave Hewitt, Manager of CBI
Jeff Harris, Manager, Development
Andy Ekman, Project Coordinator
Michael Ponder, Project Coordinator
Susan Hermenet, Director, Planning and Implementation
Marci Sanders, Manager, Residential

Board members/others

Norm Beckert, Consumer Representative, (retired – Boise Cascade)
Tom Eckman, Conservation Manager, NWPPC

Task 4

Staff and Committee Members

Andy Eckman, Building Operator Certification program
Jeff Harris, Cost Effectiveness models
Ken Anderson, Cost Effectiveness models
Marci Sanders, Energy Star Residential Lighting program
Michael Ponder, Magnadrive program
John Jennings, Energy Star Windows program
Phil Degan, Energy Star Windows program
Ken Keating, BPA

Program implementers

My Ton, Sr. Research Analyst, Ecos Consulting
Brian Simmons, Program Manager, Ecos Consulting
Gary Curtis, West Wall Group
Stan Price, NW Energy Efficiency Council
Cynthia Putnam, NW Energy Efficiency Council
Jim Cich, President, MagnaDrive

Program evaluators

Jane Peters, President, Research Into Action, BOC program
Marjorie McCrae, Research Into Action, BOC program
Ken Seiden, Vice President, Quantec, MagnaDrive program
Scott Dimontrosky, Quantec, Energy Star Windows program
Stephen Grover, Sr. Economist, EcoNorthwest, Energy Star Residential Lighting

Utility program managers

Jeff Bumgarner, Director – Energy Services, Pacificorp (Board Member)
Bob Stolarski, Puget Sound Energy (Board Member)

Other Stakeholders & Market Actors

Bill Nesmith, Oregon Energy Trust (Board Member)
Tom Eckman, Conservation Manager, NWPPC
Nathan Carpenter, Corporate Energy Manager, Boise Cascade
Collin Cremo, Retailer, Costco
Shana Cockerman, Retailer, Lowe's
Marc Orenschall, Reporter, News Data Corp.

National organizations

Rebecca Foster, Commercial Program Manager, Consortium for Energy Efficiency
Richard Karney, Department of Energy
Marsha Penhaker, Department of Energy

NEEA Retrospective Evaluation Interviews General Closing Questions

_____ Date_____

This next section covers your views of the NW Alliance as a comprehensive business enterprise. We understand that our work effort is *focused on examining the impacts of the Alliance on various markets* and considerable work is being performed on this issue.

In these questions, we want to *quicky obtain general opinions* about the effectiveness of the Alliance. We believe Specific reference is given to the issues being covered in this review, i.e., market effects of the Alliance:

-------- focus the following on specifics/ interviewee can skip questions if N/A----------

Q1: In your judgement, would the same effort have been placed on Market Transformation if the NW Alliance had not been formed? [i.e – would the markets for energy efficiency products have been transformed anyway?]

1----------10

YES NO

Q2: What is your opinion on how accurately the Alliance tracks overall aMWs for all of its program activities. For example, would you be surprised to find out that the true value of Alliance attained aMWs was [than reported in Market Activities Report]:

50%less 25%less 10%less 10%more 25%more 50%more

Q3. How well has the Alliance chosen the ventures they have decided to participate in?

1----------10

POOR EXCELLENT

Q4. How have they done with implementation/execution once a venture is chosen?

1. consumer programs?

1----------10

POOR EXCELLENT

2. entrepreneurial?

1----------10

POOR EXCELLENT

3. upstream?

1----------10

POOR EXCELLENT

4. training ?

1----------10

POOR EXCELLENT

Q5. Has the focus of the Alliance evaluation efforts been appropriate?

1----------10

NO YES

Q6. Overall, how well have they done on evaluation & attribution?

1----------10

POOR EXCELLENT

Q7. How well have they communicated to stakeholders on above program accomplishments?

1----------10

POOR EXCELLENT

Q8. Have the right progress indicators been selected?

1----------10

NO YES

Q9. How does the Alliance do as a business organization? [in terms of the business activities they are engaged in..]

1----------10

POOR EXCELLENT

NEEA Retrospective Evaluation Staff Interviews ***General Questions***

These questions serve as a discussion guide for task 2 interviews with Alliance staff. In some cases, the questions were directed at specific programs

I. Role of project planning assumptions in development of strategy and theory

b. Are Staff recommendation memos done b4 a program is launched?

c. What is the role of the Cost Effectiveness Committee?

d. What is the role of the Portfolio Committee?

e. Do new projects go to the board for approval, or by committee?

f. Are there sectors where MT may not be the best tool?

g. What other tools have been considered by the Alliance to achieve the objectives? [The Alliance is by charter only interested in MT. If a utility wants a non-MT program, they don't run the money through the Alliance.]

- A specific emphasis will be placed on understanding baselines
- Assumptions regarding field performance of measures will also be reviewed

h. Does the BOD receive hard numbers on cost effectiveness?

II. Selection of market progress indicators

a. When in the process are the progress indicators selected?

b. What impact targets are used? Is there a reason ALL programs with tracked savings don't have defined targets?

c. How are NWPPC measure savings estimates used in planning and estimating program impacts? Is feedback given to them?

d. CE Analysis –is payback, or NPV considered? How are the priorities for indicators picked?

e. When a progress indicator is checked in the MAR, how has the staff determined that the indicator has been met?

III. Role of the Market Assessment studies in providing a feedback loop for implementation

a. When is a market considered to be transformed? Is there a specific market penetration percentage, or change – that would indicate the work has been successful, and sustainable?

b. How does the Alliance coordinate programs with national partners? CEE, Energy Star, etc.

c. In the MAR, when it is indicated that the Alliance ranks ____ compared to other regions – how are those regions defined?

IV. Adaptive Management - how were programs modified to reflect evaluation results?

a. How did the Alliance assess the value of other programs (utilities, BPA)?

b. What do you ask Evaluation contractors to accomplish? Deliverables, scope?

c. How is information gathered regarding the utility programs in the area? 2002 MAR indicates that 5MW was saved outside the Alliance for the entire region – how was this number arrived at?

d. How is in-field performance of savings verified? Time of use, persistence, actually installed?

e. How are the estimates of future savings (used on CE levelized cost numbers) calculated – what changes in baselines are assumed and how are they picked?

V. How choices were made to retire certain programs, or morph them into new ones

a. Are CE analyses done on a regular schedule?

b. Does the portfolio committee make these decisions?

VI. Beginning the thought process that will look at alternative hypotheses regarding attribution of program results

a. What has the Alliance done to try to 'bound' the savings estimates?

b. What other factors do you think may have contributed to market changes for program X?

Alternative Baseline Hypothesis (BOC)

Energy Efficiency Period	Unit Savings				# of Units					Venture Influence				Non-venture Influence				Savings			
	Venture Est. (kWh/SF/y)	Low	Med	High		w/ Venture	w/o Venture			Venture Est.	Low	Med	High	Venture Est.	Low	Med	High	Venture est.	Low	Med	High
							Low	Med.	High												
2002	0.5 (.14, see MPER #7)									100 %				0%				3.8MW 15.3MW(cum) 16.8MW(2010)			

Key variables – test H/M/L range:

- Square feet managed, avg = 234,000 H M L
- Baseline energy = 20 kwh/Sf/yr H M L
- Persistence = 5 yrs H M L
- See ‘assumptions’

Alternative Baseline Hypothesis (CFL)

Energy Efficiency Action Period	Unit Savings				# of Units	Adoption Rates				Venture Influence				Non-venture Influence				Savings			
	Venture Est. (kWh/y)	Low	Med	High		w/ Venture	w/o Venture			Venture Est.	Low	Med	High	Venture Est.	Low	Med	High	Venture est.	Low	Med	High
							Low	Med.	High												
2001	66					8.6 M – coupon – give away = 4.6M				100 %				0%				31.1 MW			

Key variables – test H/M/L range:

- Installation rate = 100% H M L
- Displaced watts = 74 H M L
- Hours per day = 3 interior H M L 5 exterior (see: national study) H M L
- Spillover = 36% (from Alliance to coupon program) H M L
- See ‘assumptions’

Alternative Baseline Hypothesis (MagnaDrive)

Energy Efficiency Action Period	Unit Savings				# of Units					Venture Influence				Non-venture Influence				Savings			
	Venture Est. (kWh/HP)	Low	Med	High		w/ Venture	w/o Venture			Venture Est.	Low	Med	High	Venture Est.	Low	Med	High	Venture est.	Low	Med	High
							Low	Med.	High												
2001	853									100 %				0%				1.43 aMW			

Key variables – test H/M/L range:

- Horsepower installed = 14,716 (through 2001) H M L
- VSD market growth = 5% H M L
- Savings per HP = 853 kWh H M L
- Persistence H M L
- See ‘assumptions’

Alternative Baseline Hypothesis (Windows)

Energy Efficiency Action Period	Unit Savings				# of Units	Market Penetration				Venture Influence				Non-venture Influence				Savings			
	Venture Est. (kWh/SF/y)	Low	Med	High		w/ Venture	w/o Venture			Venture Est.	Low	Med	High	Venture Est.	Low	Med	High	Venture est.	Low	Med	High
							Low	Med.	High												
2002	2.25 (avg.-based on model?)					66% or 70% (2002) or 80% (2010)		14%, or 40%		100 %				0%				13.8MW (cum '02) 45.7MW (2010)			

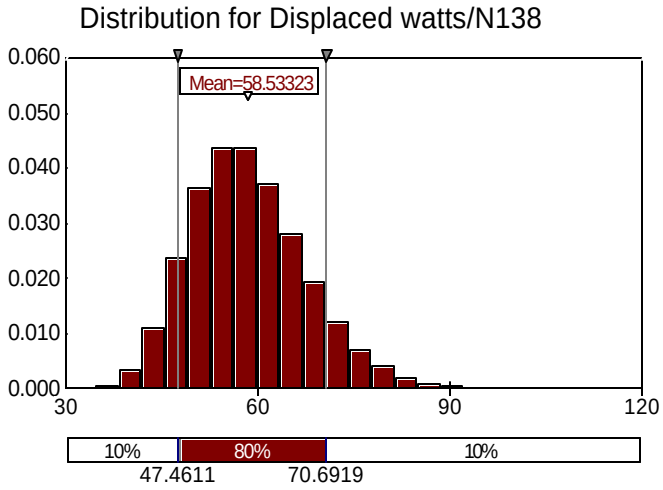
Key variables – test H/M/L range:

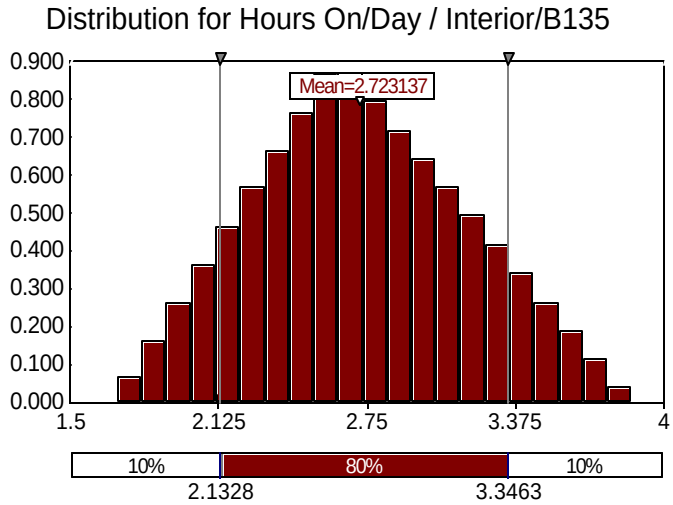
- Housing Stock (elec heated, single family = 40% H M L
  - Multi- fam = 82% H M L
  - Manufactured= 94% H M L
- Incremental Cost of windows = $.48/SF H M L
- Life of Window = 60 years H M L
- See 'assumptions'

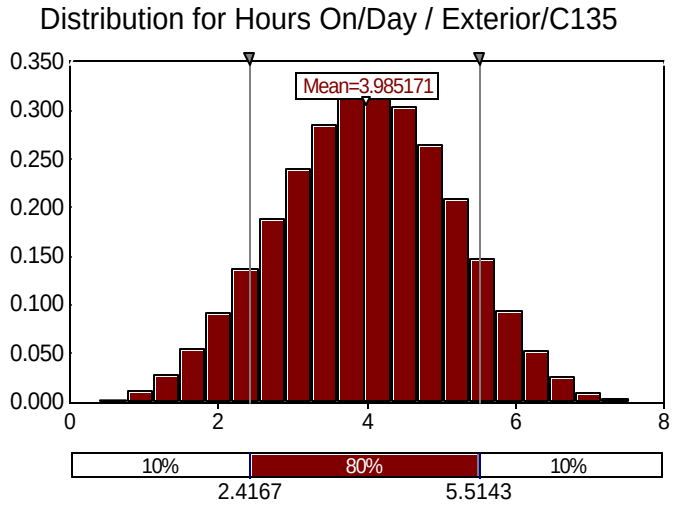
B PIVOT ASSUMPTION AND OUTPUT DISTRIBUTIONS FOR SCENARIO ANALYSIS

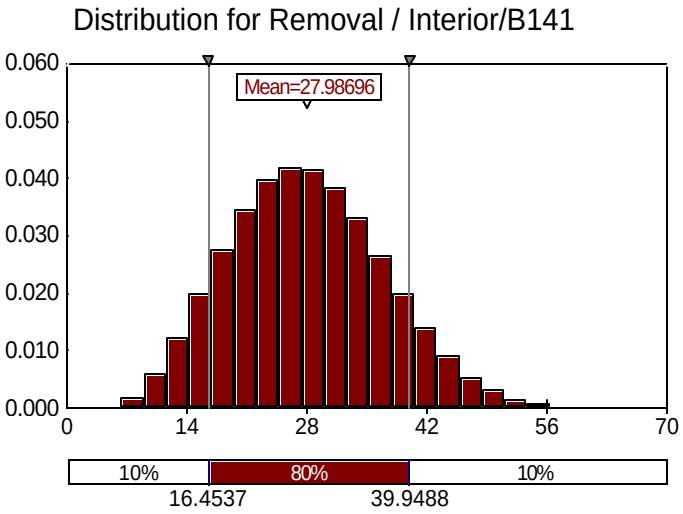
Energy Star Lighting

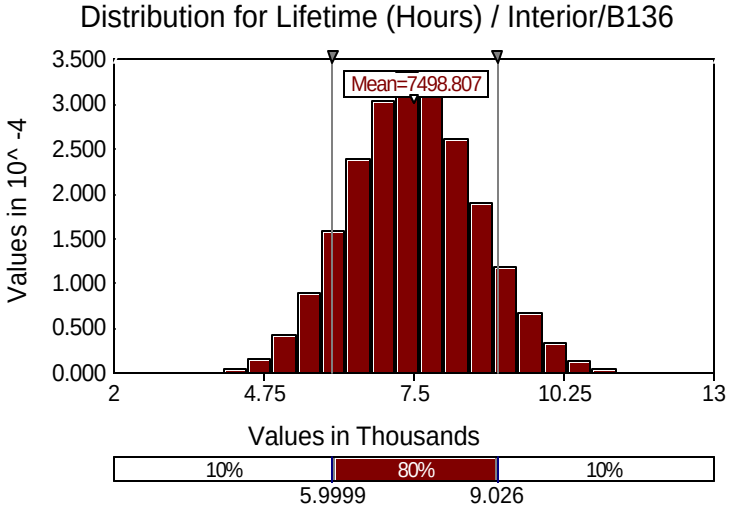
Input Distributions

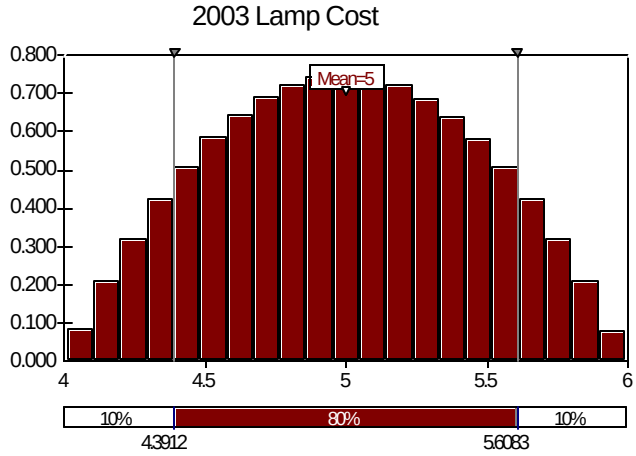


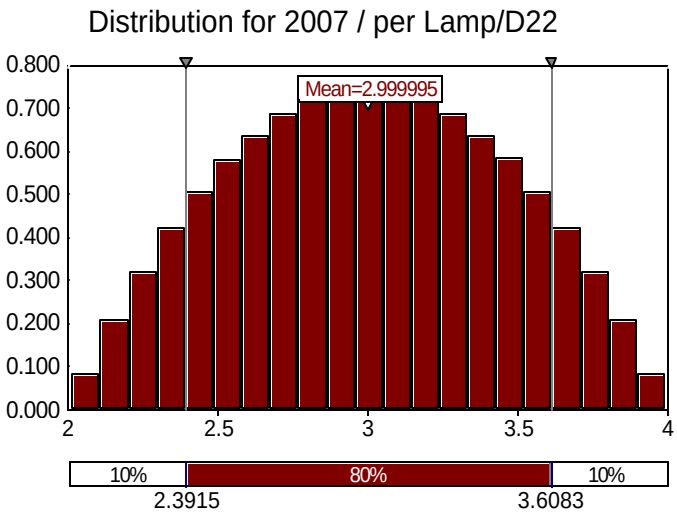




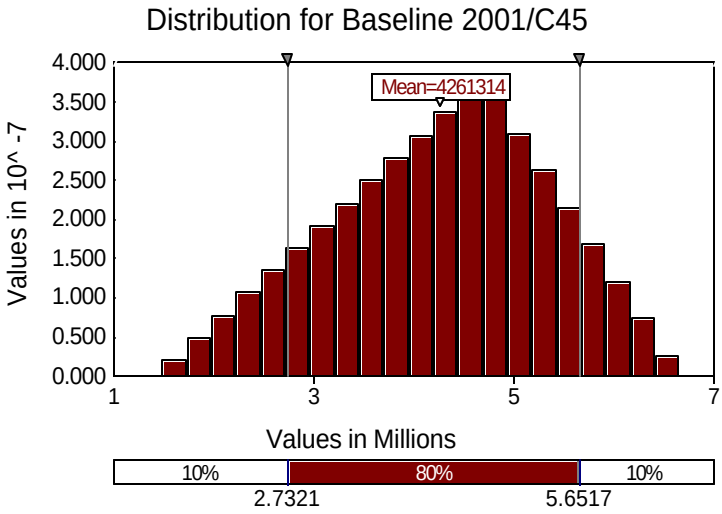

Distribution for Removal / Interior/B141
Mean=27.98696
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0
14
28
42
56
70
10%
80%
10%
16.4537
39.9488

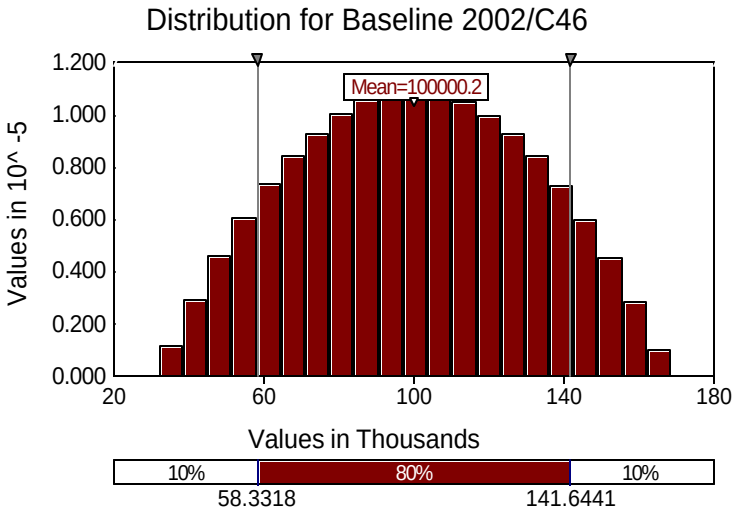

Distribution for Lifetime (Hours) / Interior/B136
Mean=7498.807
Values in 10^ -4
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
2
4.75
7.5
10.25
13
Values in Thousands
10%
80%
10%
5.9999
9.026

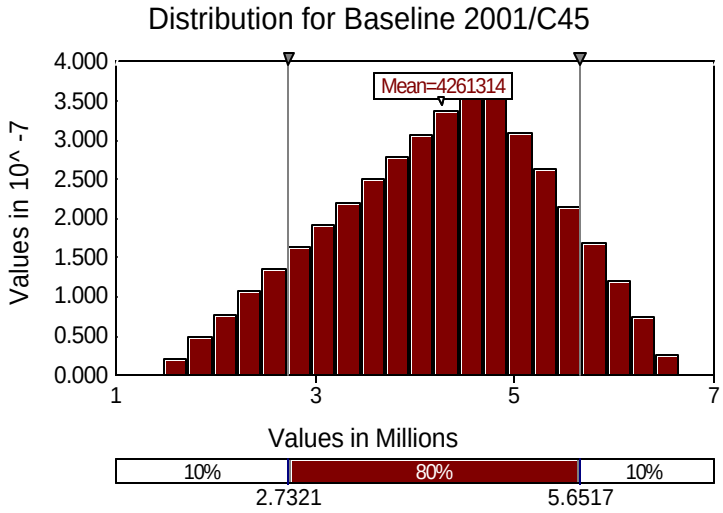

2003 Lamp Cost
Mean=5
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
4
4.5
5
5.5
6
10%
80%
10%
4.3912
5.6083



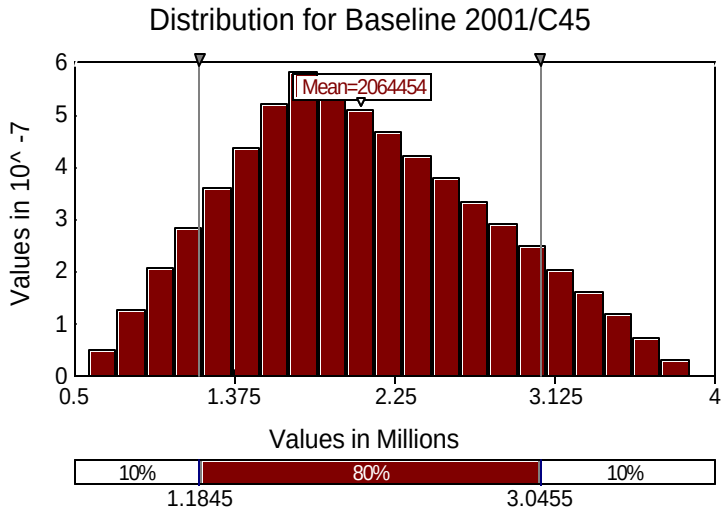
High Influence Assumptions

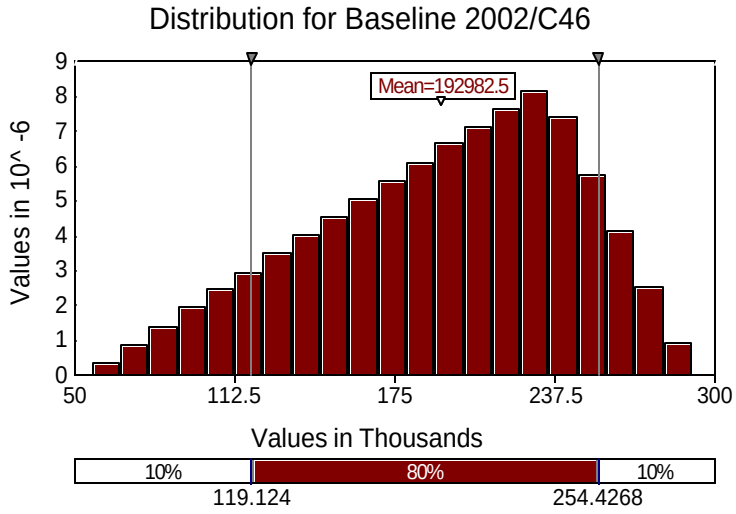




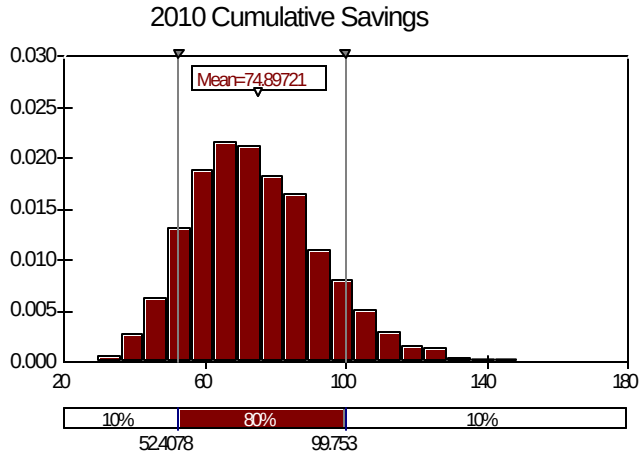


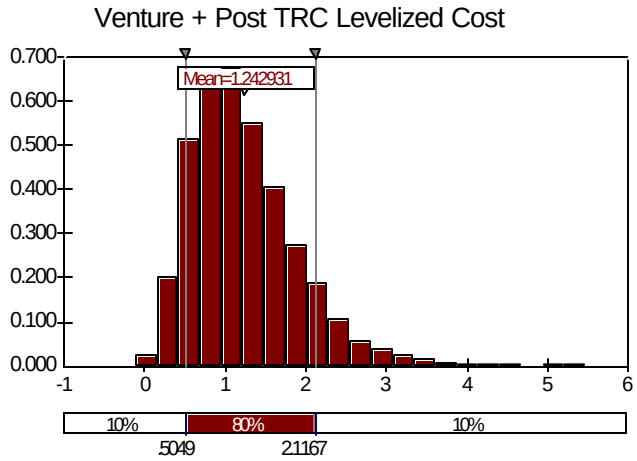
Low Influence Assumptions

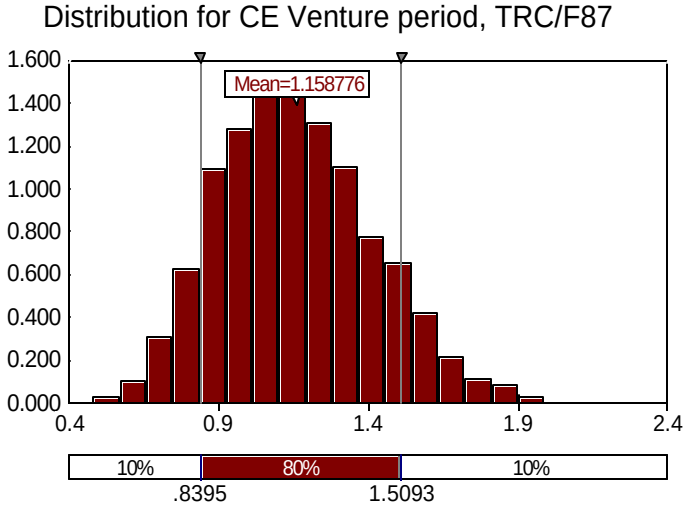


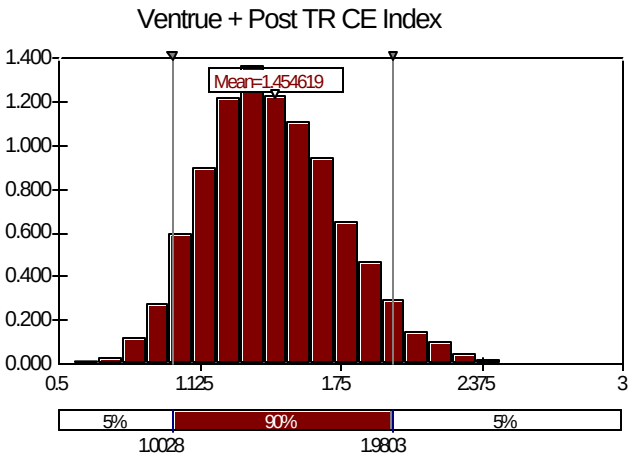


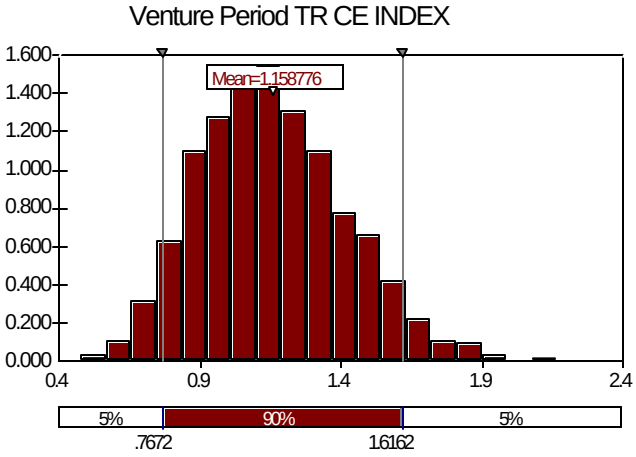
High Influence Results

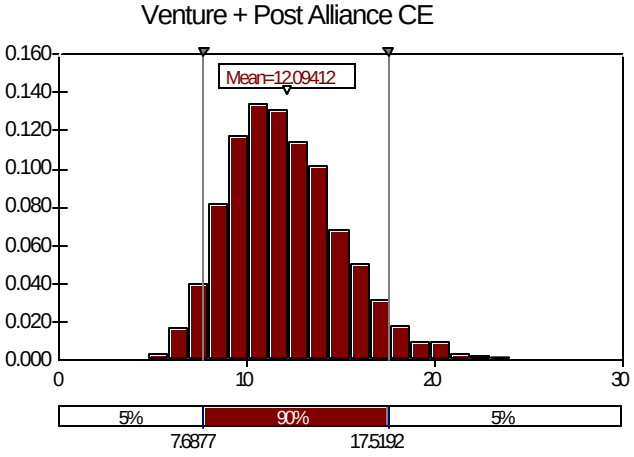




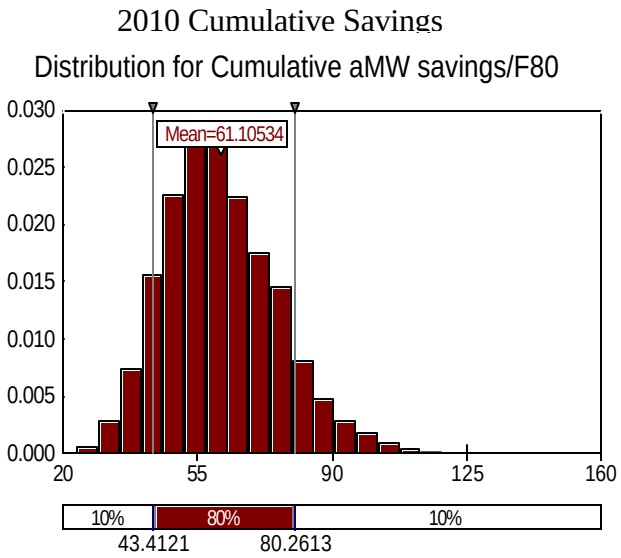


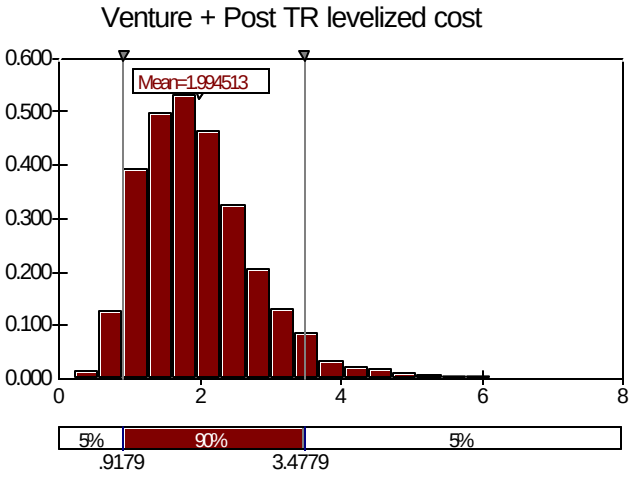

Ventrue + Post TR CE Index
Mean=1.454619
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
0.5
1.125
1.75
2.375
3
5%
90%
5%
1.0028
1.9803

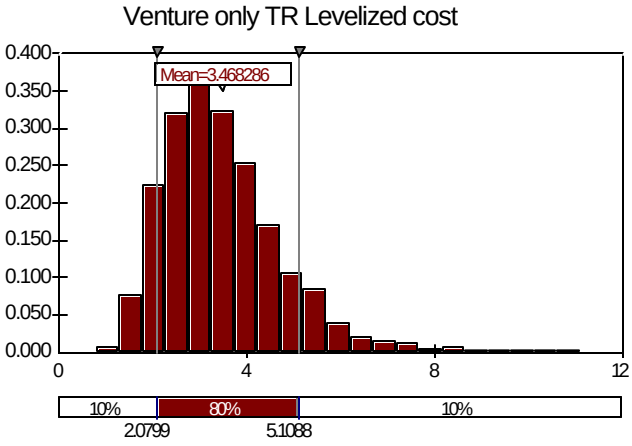

Venture Period TR CE INDEX
Mean=1.158776
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
0.4
0.9
1.4
1.9
2.4
5%
90%
5%
.7672
1.6162


Venture + Post Alliance CE
Mean=12.09412
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
0
10
20
30
5%
90%
5%
7.6877
17.5192

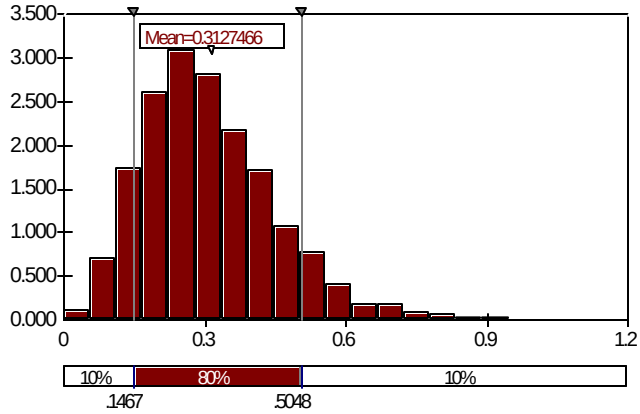
Low Influence Results



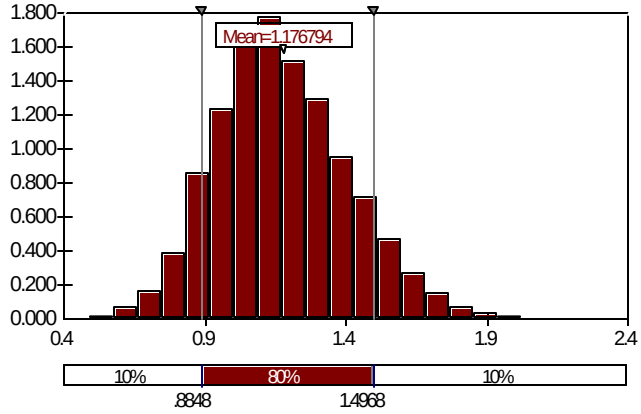




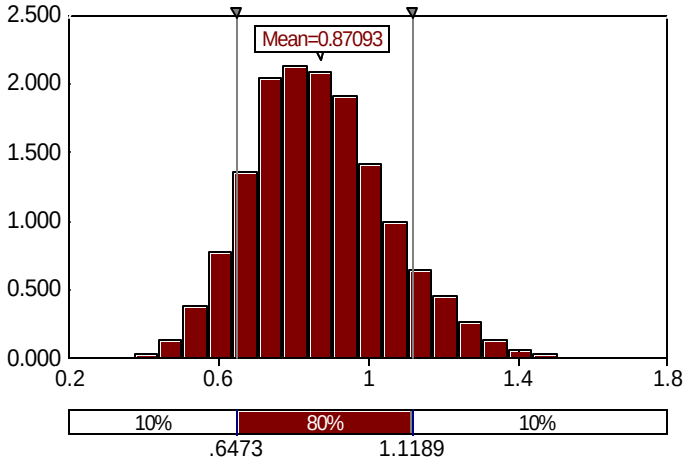
Venture only Alliance levelized cost



Venture + Post TR CE

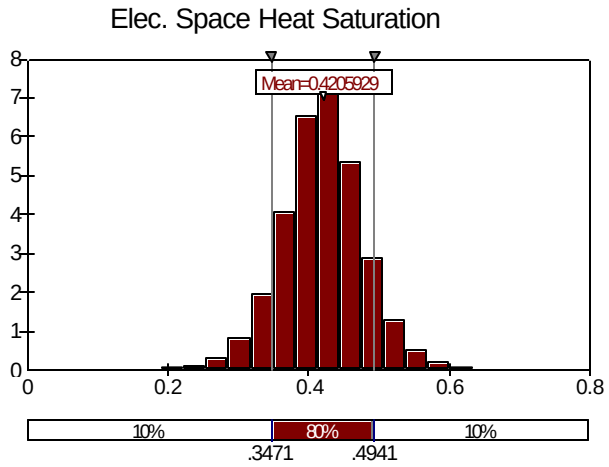


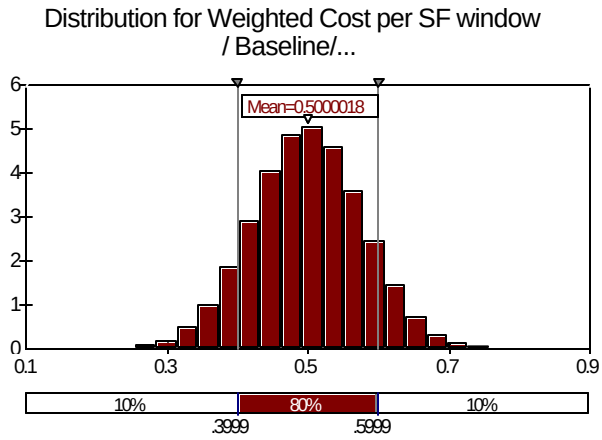
Distribution for CE Venture period, TRC/F87



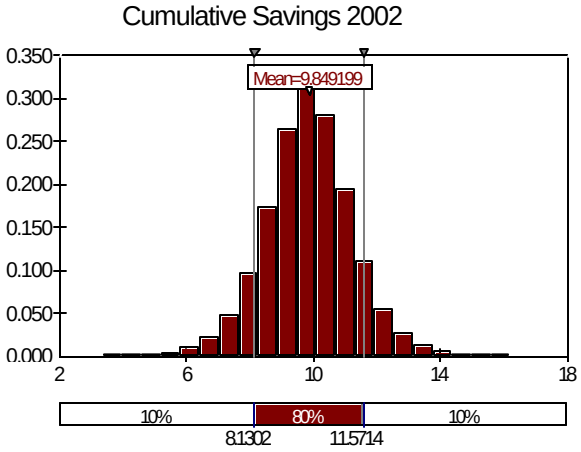
Windows

Input Distributions

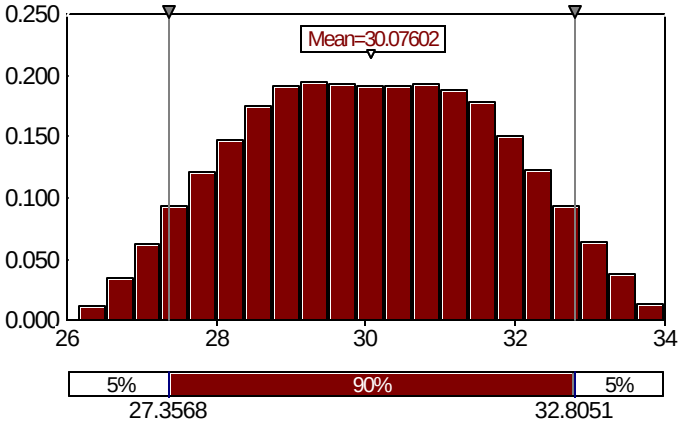




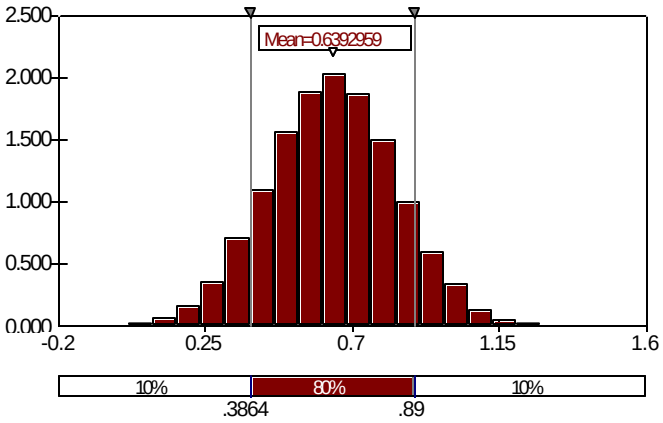
Output Distributions



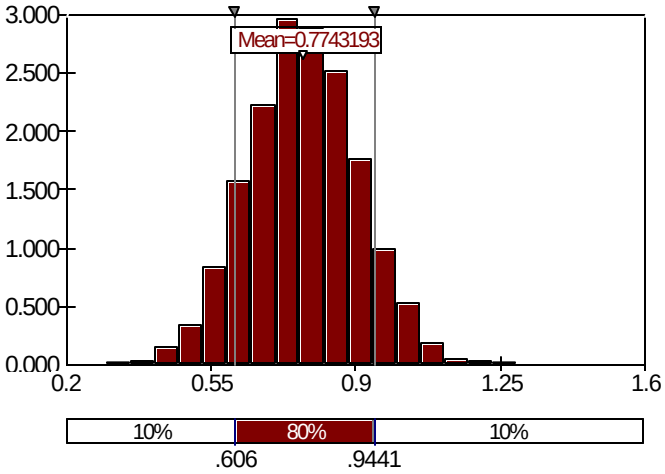
Distribution for 2010 Cumulative aMW Savings/D86



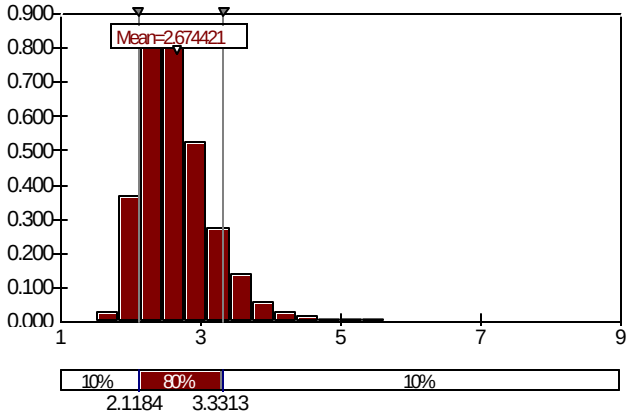
Venture + Post Levelized Cost TR



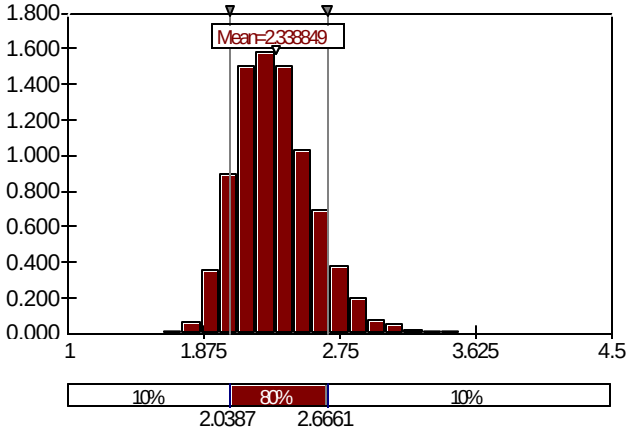
Venture onl TR Levelized Cost



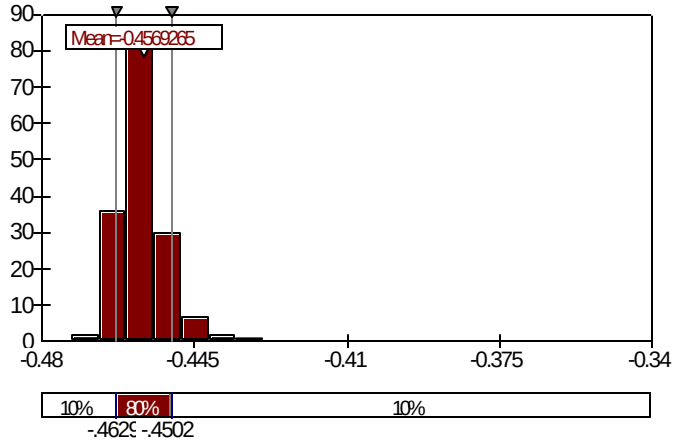
Distribution for Venture + Post TR CE/F88



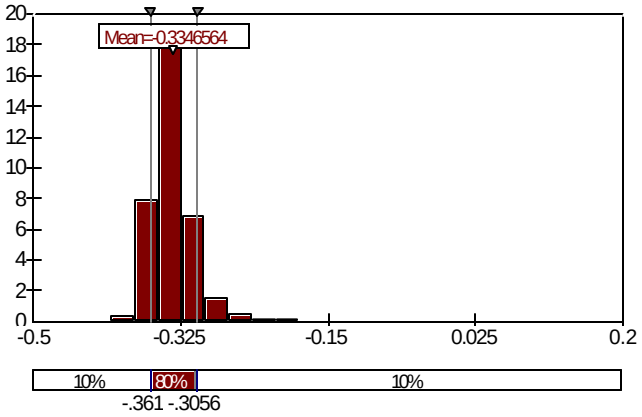
Distribution for Venture only TR CE/F89



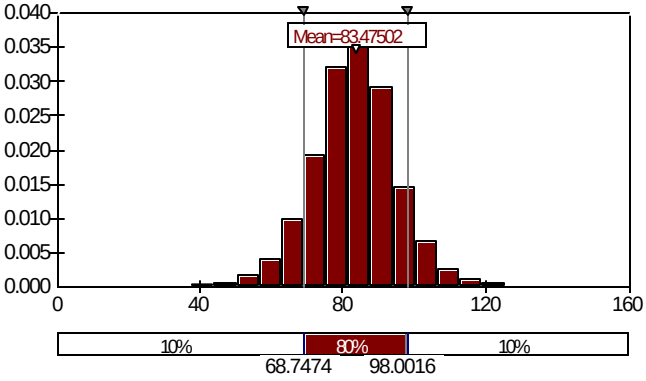
Venture + Post Alliance Levelized Cost



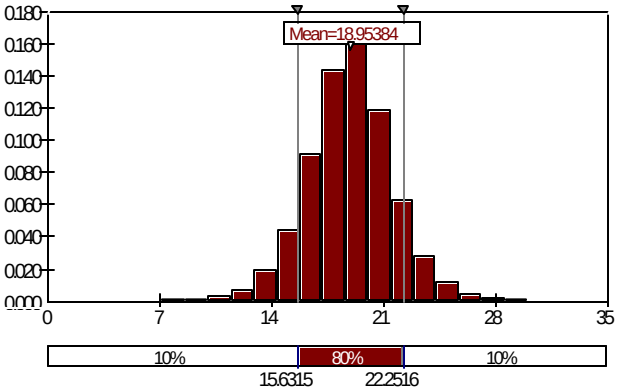
Venture only Alliance Levelized Cost



Distribution for Venture + Post Alliance CE/F91

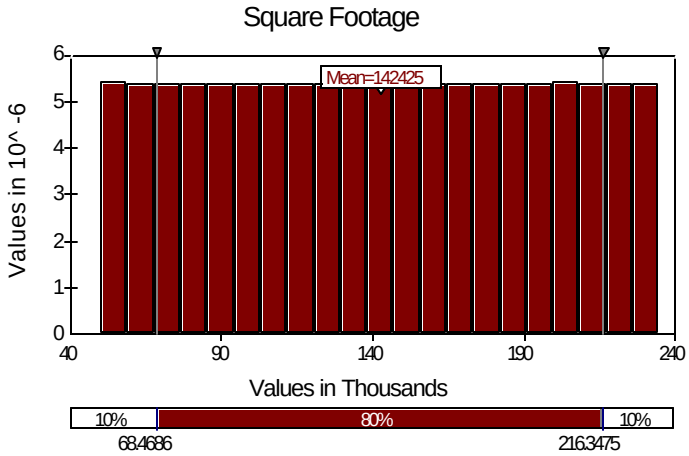


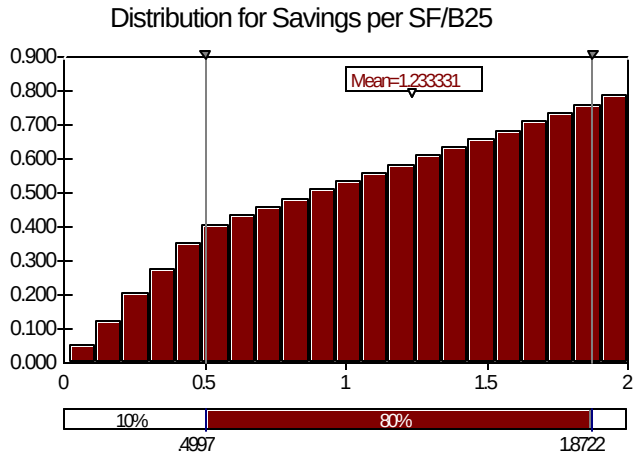
Distribution for Venture only Alliance CE/F92

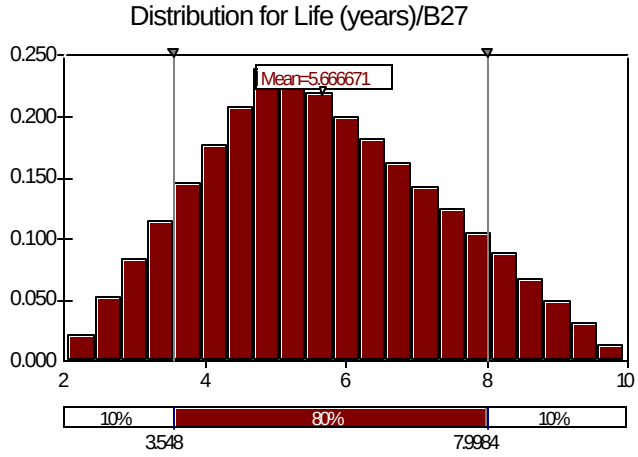


BOC

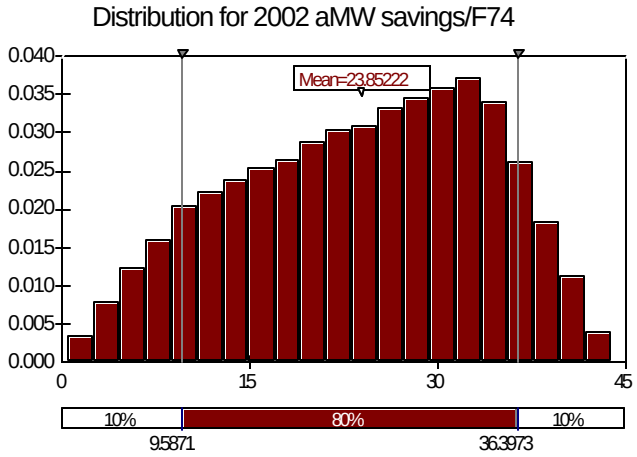
Input Distributions

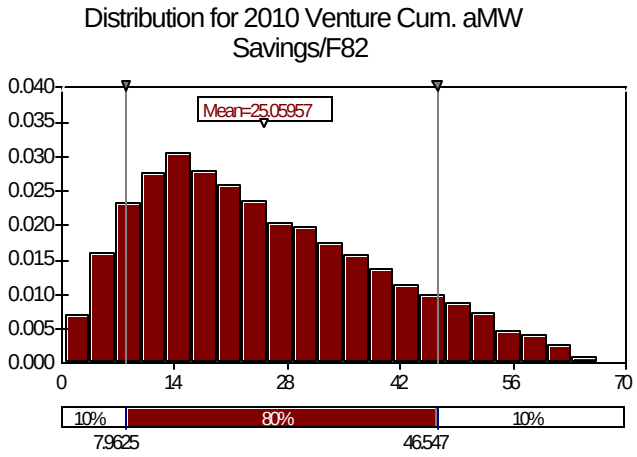


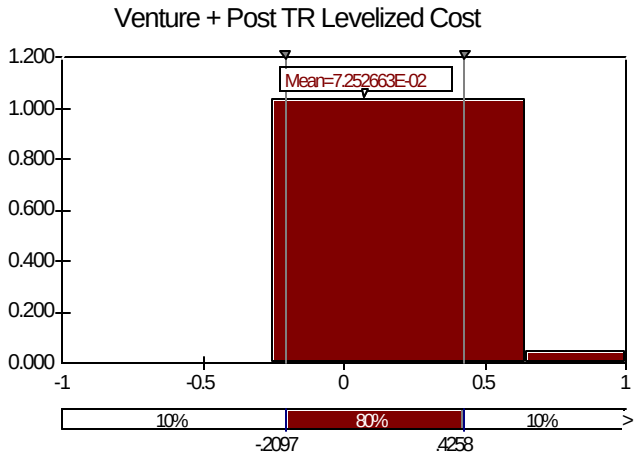




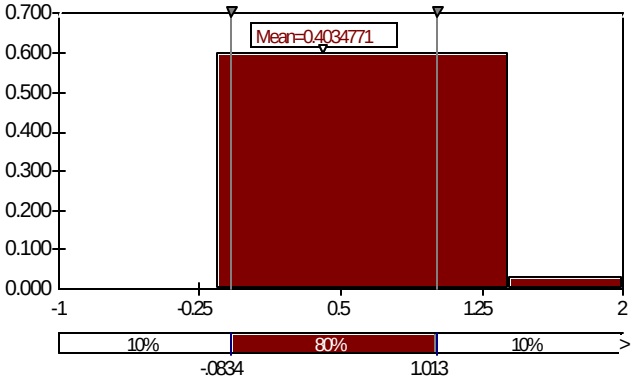
Output Distributions



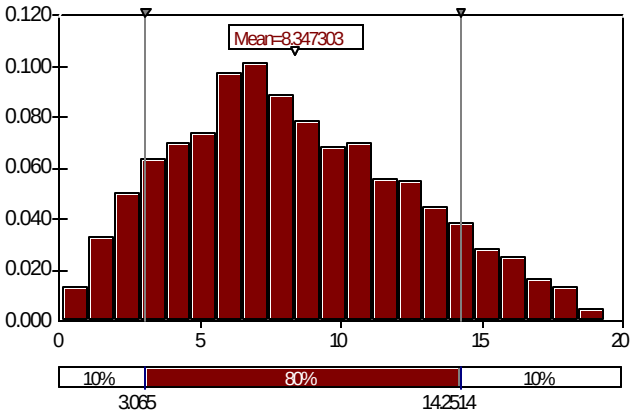




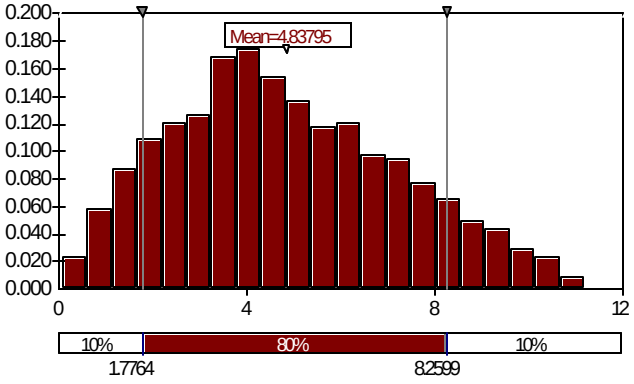
Distribution for Venture Period Only Levelized cost TRC/E89



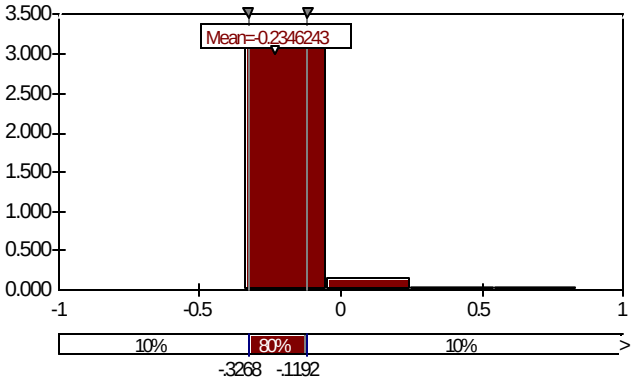
Venture + Post TR CE Index



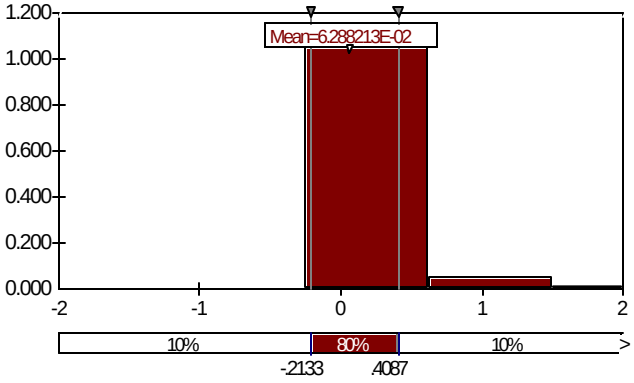
Distribution for Venture period only TRC CE/F89



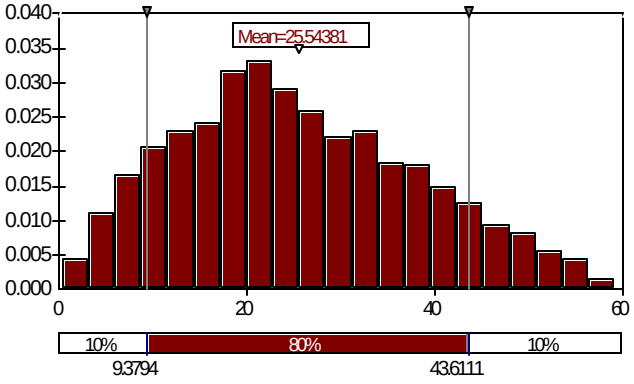
Distribution for Venture + Post Levelized Cost Alliance/E91

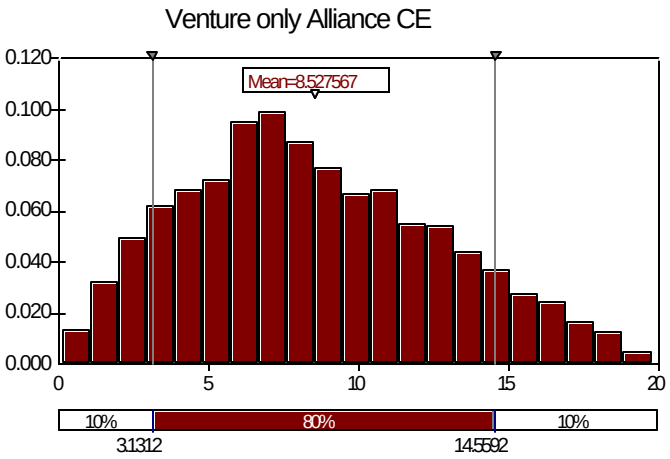


Distribution for Venture Period Only Levelized Cost All...



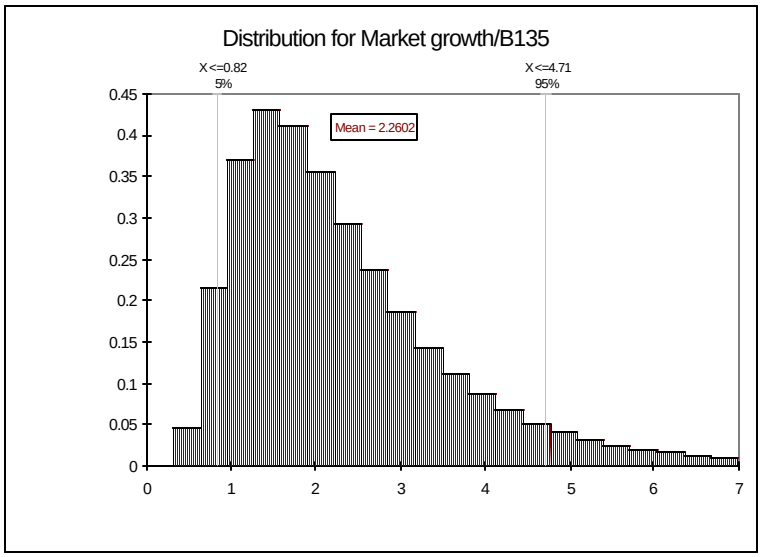
Distribution for Venture + Post Alliance CE/F91



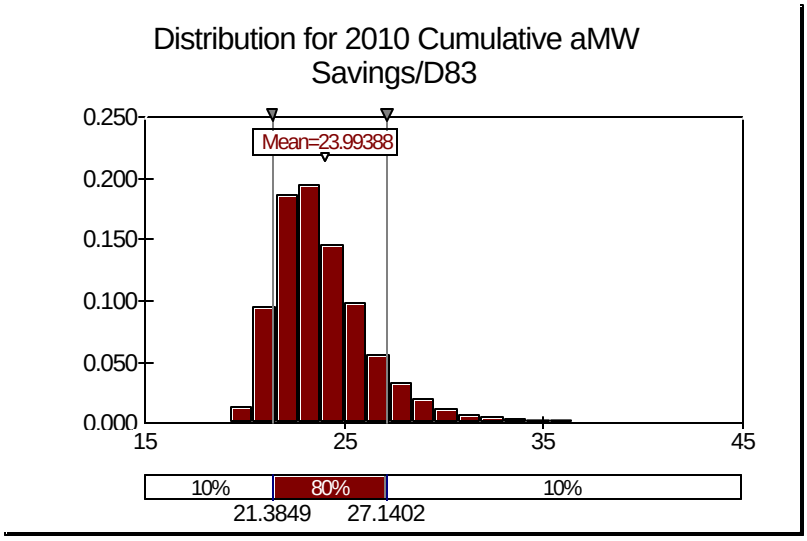


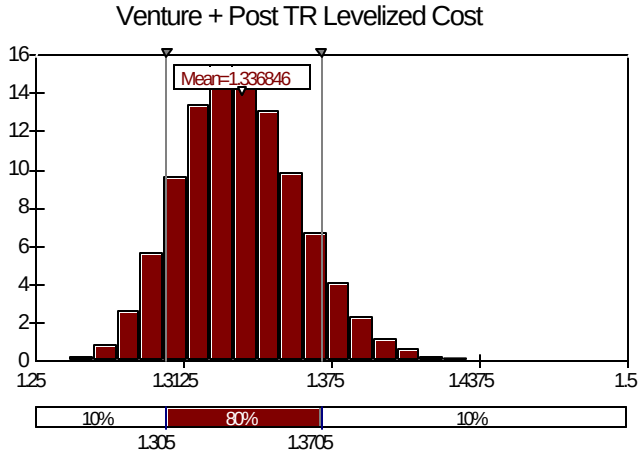
MagnaDrive

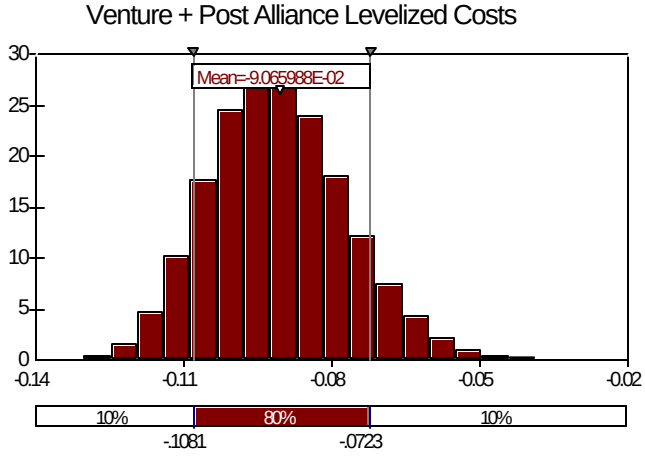
Input Assumptions



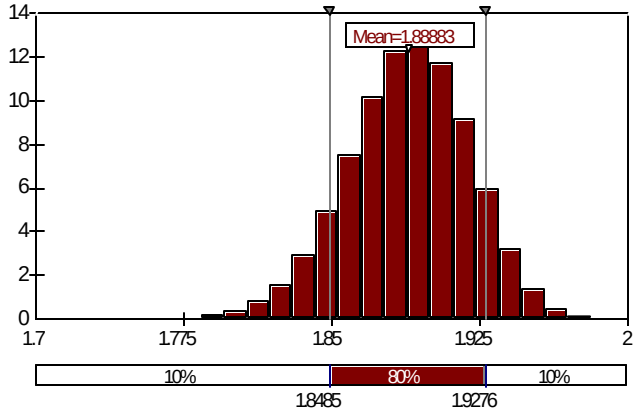
Output Results



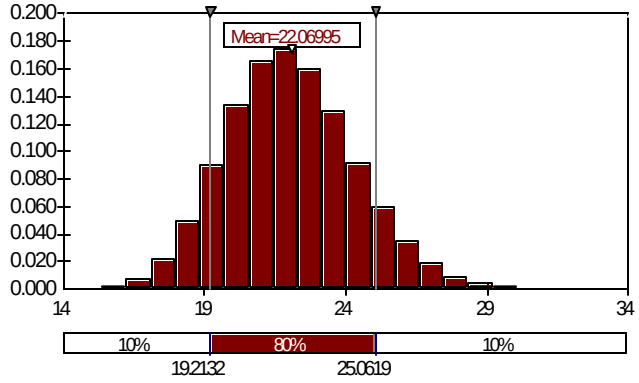




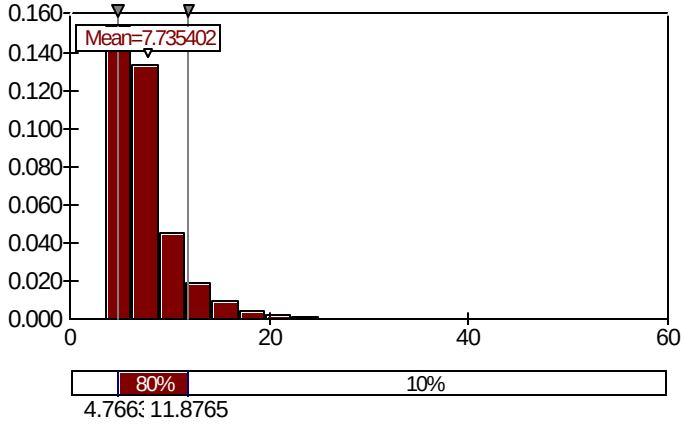
Distribution for Venture + Post TR CE/F88



Distribution for Venture + Post Alliance CE/F91



Distribution for Venture Only Levelized Cost TRP/E92



C DOCUMENT LOG

Category	Subcategory	Document Name	Date Received	From Where	Author(s)	Date of Report
Annual Report	1999 Annual Report	Efficiency Opportunities in Silicon Crystal Growing Facilities Redesign of Crystal Grower Hot Zones	5/8/2003	NEEA website	**Siemens Solar Industries** Greg Mihalik Bryan Fickett	No date
Assessment	Baseline Assessment Executive Summary	Energy Star Residential Lighting Fixtures Program Market Progress Evaluation Report #1	5/8/2003	NEEA website	**Pacific Consulting Services** **Shel Feldman Management Consultants**	Nov-98
Assessment	Baseline Market Assessment Executive Summary	Super Good Cents Manufactured Housing Venture Executive Summary	5/8/2003	NEEA website	**Pacific Energy Associates, Inc.** Dave Hewitt Jeff Pratt Gary Smith	Aug-98
Assessment	Market Assessment	Opportunities for Industrial Motor Systems in the Pacific Northwest	5/8/2003	NEEA website	**Easton Consultants, Inc.** **Xenergy, Inc.**	Dec-99
Data Request	Alliance Portfolio	Alliance Portfolio Cost Effectiveness (2002 Numbers)	4/29/2003	Margie Gardner		
Data Request	Chapter 6 Draft Fourth Northwest Power Plan	Resource Issues in Competitive Markets	5/12/2003	Liz Saunders		
Data Request	Comprehensive Review of the Northwest Energy System	Final Report Toward a Competitive Electric Power Industry for the 21st Century December 12, 1996	5/12/2003	Liz Saunders		Dec-96
Data Request	Contact Report	Comprehensive Contact Report	5/12/2003	Liz Saunders		May-03
Data Request	Memorandum of Agreement	Among Regional Parties in Support of the Northwest Energy Efficiency Alliance October 15, 1999	4/29/2003	Margie Gardner		Oct-99
Data Request	Memorandum of Agreement	Northwest Energy Efficiency Alliance October 31, 1996	4/29/2003	Margie Gardner		Oct-96
Data Request	Operational Audit	Northwest Energy Efficiency Alliance Operational Audit December 21, 1998	5/12/2003	Liz Saunders	**Price Waterhouse Coopers**	Dec-98
Data Request	Overview	Overview of Concluded Alliance Projects	4/29/2003	Margie Gardner	**Northwest Energy Efficiency Alliance**	
Data Request	Overview	Overview of Current Alliance Projects	4/29/2003	Margie Gardner	**Northwest Energy Efficiency Alliance**	
Data Request	Staff Recommendations	Staff Recommendation Memoranda (Multiple)	4/29/2003	Margie Gardner		
Evaluation	Baseline Market Evaluation	Evaporator Fan VFD Initiative	5/8/2003	NEEA website	**Macro International, Inc.**	Apr-99
Evaluation	Market Baseline Evaluation	BacGen BioWise Project, No. 1 (3/00)	5/8/2003	NEEA website	**Quantum Consulting, Inc.** **Adolfson Associates, Inc.**	Mar-00
Evaluation	Market Baseline Evaluation	Efficient Building Practices Initiative, No. 1	5/8/2003	NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Marjorie R. McRae, PhD **Dethman & Tangora, LLC** Linda Dethman	Mar-01
Evaluation	Market Baseline Evaluation	EZ Sim: Billing Simulation for Small Commercial Facilities	5/8/2003	NEEA website	**Pacific Consulting Services**	Mar-99

Evaluation	Market Baseline Evaluation	Fan Speed Reduction in Pneumatic Conveying Systems in the Secondary Wood Products Industry, No. 1 (12/99)	5/8/2003 NEEA website	**SBW Consulting, Inc.** **Quantum Consulting, Inc.** **Argo Blower & Mfg. Co.**	Dec-99
Evaluation	Market Baseline Evaluation	Northwest Residential Ducts	5/8/2003 NEEA website	XENERGY, Inc.	Jan-99
Evaluation	Market Baseline Evaluation	Performance-Tested Comfort Systems, No. 2	5/8/2003 NEEA website	**XENERGY, Inc.**	Dec-00
Evaluation	Market Baseline Evaluation Exec. Summary	Energy Star Residential Lighting Fixtures	5/8/2003 NEEA website	**Pacific Consulting Services**	Aug-98
Evaluation	Market Progress Evaluation	Architecture & Energy Program, Final Report	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Marjorie R. McRae, PhD	Jun-01
Evaluation	Market Progress Evaluation	Architecture & Energy Program, No. 1	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Marjorie R. McRae, PhD	Aug-99
Evaluation	Market Progress Evaluation	Building Operator Certification, No. 3 (5/00)	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Sharon A. Baggett, PhD Marjorie R. McRae **Stellar Processes, Inc.** Dave Robison, PE	May-00
Evaluation	Market Progress Evaluation	Building Operator Certification, No. 6	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Marjorie R. McRae, PhD A.G. Flynn	Mar-01
Evaluation	Market Progress Evaluation	Building Operators Certification Program, Washington State, Report Summary	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Sharon A. Baggett, PhD **Stellar Processes, Inc.** Dave Robison, PE	May-98
Evaluation	Market Progress Evaluation	Commissioning In Public Buildings Project, No. 2 (12/99)	5/8/2003 NEEA website	**Quantum Consulting, Inc.**	Dec-99
Evaluation	Market Progress Evaluation	Commissioning In Public Buildings Project, No. 3	5/8/2003 NEEA website	**Quantum Consulting, Inc.**	Feb-03
Evaluation	Market Progress Evaluation	Drive Power Initiative, No. 1 (3/00)	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Jennifer Stout Fred Gordon Steven Scott, PE	Mar-00
Evaluation	Market Progress Evaluation	Drive Power Initiative, No. 2	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Jennifer Stout Fred Gordon Steven Scott, PE	Feb-01
Evaluation	Market Progress Evaluation	Drive Power Initiative, No. 3	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Jennifer Stout Steven Scott Fred Gordon	Nov-01
Evaluation	Market Progress Evaluation	Drive Power Initiative, No. 4	5/8/2003 NEEA website	**Currents Consulting** Jennifer Stout Steven Scott	Mar-03

Evaluation	Market Progress Evaluation	Efficient Building Practices Initiative, No. 2, Final Report	5/8/2003 NEEA website	**Dethman & Tangora, LLC** Linda Dethman **Research Into Action, Inc.** Jane S. Peters, PhD Marjorie R. McRae, PhD	Jul-01
Evaluation	Market Progress Evaluation	Energy Ideas Clearinghouse	5/8/2003 NEEA website	**Quantec, LLC** Scott Dimetrosky Michael Luevane M. Sami Khawaja, PhD	Jun-01
Evaluation	Market Progress Evaluation	Energy Ideas Clearinghouse	5/8/2003 NEEA website	**Quantec** Scott Dimetrosky M. Sami Khawaja, PhD **Jupiter Communications** **Gilmore Research Group**	May-00
Evaluation	Market Progress Evaluation	Energy Ideas Clearinghouse, No. 1 (12/99)	5/8/2003 NEEA website	**Quantec** **Jupiter Communications** **Gilmore Research Group**	Dec-99
Evaluation	Market Progress Evaluation	Energy Ideas Clearinghouse, No. 4	5/8/2003 NEEA website	**Quantec, LLC**	Feb-02
Evaluation	Market Progress Evaluation	Energy Star Residential Lighting Fixture Program, No. 2 (8/99)	5/8/2003 NEEA website	**Pacific Consulting Services** **Shel Feldman Management Consultants**	Aug-99
Evaluation	Market Progress Evaluation	Energy Star Resource-Efficient Clothes Washers, No. 3	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Dave Hewitt Jeff Pratt Gary Smith	May-99
Evaluation	Market Progress Evaluation	Energy Star Resource-Efficient Clothes Washers, No. 4	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Dave Hewitt Jeff Pratt Gary Smith	Nov-00
Evaluation	Market Progress Evaluation	Energy Star Windows Program, No. 3 (3/00)	5/8/2003 NEEA website	**Quantec**	Mar-00
Evaluation	Market Progress Evaluation	Energy Star Windows Program, No. 4	5/8/2003 NEEA website	**Quantec**	Nov-00
Evaluation	Market Progress Evaluation	Energy Star Windows, No. 2 (8/99)	5/8/2003 NEEA website	**Quantec**	Aug-99
Evaluation	Market Progress Evaluation	Energy Star Windows, No. 5	5/8/2003 NEEA website	**Quantec**	Jan-02
Evaluation	Market Progress Evaluation	Evaporator Fan VFD Initiative, No. 2	5/8/2003 NEEA website	**Macro International, Inc.**	Nov-00
Evaluation	Market Progress Evaluation	Evaporator Fan VFD Initiative, No. 3	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Steven Scott, PE Fred Gordon **MetaResource Group**	Jun-02
Evaluation	Market Progress Evaluation	EZ Sim: Billing Simulation for Small Commercial Facilities, No. 2	5/8/2003 NEEA website	**Pacific Consulting Services**	Oct-00
Evaluation	Market Progress Evaluation	Lighting Design Lab	5/8/2003 NEEA website	**Energy Market Innovations, Inc.**	Sep-00
Evaluation	Market Progress Evaluation	Lighting Design Lab, No. 4	5/8/2003 NEEA website	**Energy Market Innovations, Inc.** **Heschong Mahone Group**	Apr-03

Evaluation	Market Progress Evaluation	LightWise, No. 2 (9/99)	5/8/2003 NEEA website	**Dethman & Associates** Linda Dethman **Gilmore Research Group**	Sep-99
Evaluation	Market Progress Evaluation	MagnaDrive, No. 1	5/8/2003 NEEA website	**Quantec** **MarketLink Strategies** **Schiller Associates** **XENERGY**	May-01
Evaluation	Market Progress Evaluation	MagnaDrive, No. 2	5/8/2003 NEEA website	**Quantec, LLC** **Schiller Associates**	May-02
Evaluation	Market Progress Evaluation	Market Progress Evaluation Report, No. 2, Final Report	5/8/2003 NEEA website	**Quantec, LLC** Lauren Miller M. Sami Khawaja, PhD	Apr-03
Evaluation	Market Progress Evaluation	Microelectronics Initiative, No. 1	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Marjorie R. McRae **Shel Feldman Management Consultants** Shel Feldman, PhD	Nov-01
Evaluation	Market Progress Evaluation	Northwest Energy Education Institute, No. 1	5/8/2003 NEEA website	**Shel Feldman Management Consulting** Shel Feldman, PhD	Jun-99
Evaluation	Market Progress Evaluation	Northwest Energy Education Institute, No. 2	5/8/2003 NEEA website	**Shel Feldman Management Consulting** Shel Feldman	Nov-00
Evaluation	Market Progress Evaluation	Premium Efficiency Motors (Exec. Summary)	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Fred Gordon John Jennings Les Tumidaj Will Miller	Jan-98
Evaluation	Market Progress Evaluation	Regional Building Operator Certification, Exec. Summary	5/8/2003 NEEA website	**Research Into Action, Inc.** Sharon A. Baggett, PhD Jane S. Peters, PhD	Oct-98
Evaluation	Market Progress Evaluation	Regional Building Operator Certification, No. 2, Volume 1	5/8/2003 NEEA website	**Research Into Action, Inc.** Sharon Baggett, PhD Jane S. Peters, PhD **Stellar Processes, Inc.** Dave Robison, PE	May-99
Evaluation	Market Progress Evaluation	Regional Building Operator Certification, No. 2, Volume 2	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Sharon A. Baggett, PhD	Jul-99
Evaluation	Market Progress Evaluation	Regional Building Operator Certification, No. 7	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD Marjorie R. McRae, PhD **Stellar Processes, Inc.** Dave Robison, PE	Sep-01
Evaluation	Market Progress Evaluation	Sav-Air Market Transformation Initiative	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Steven Scott, PE Jennifer Stout Fred Gordon	Jun-00

Evaluation	Market Progress Evaluation	Sav-Air Market Transformation Initiative, No. 2	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Steven Scott, PE Jennifer Stout Fred Gordon	Feb-01
Evaluation	Market Progress Evaluation	Sav-Air, No. 3	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Steven Scott, PE Fred Gordon	Mar-02
Evaluation	Market Progress Evaluation	Sav-Air, No. 4	5/8/2003 NEEA website	**MetaResource Group** Steven Scott, PE Jennifer Stout	Mar-03
Evaluation	Market Progress Evaluation	Scientific Irrigation Scheduling, No. 1	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD **Stellar Processes, Inc.** Dave Robison, PE	Dec-99
Evaluation	Market Progress Evaluation	Scientific Irrigation Scheduling, No. 2	5/8/2003 NEEA website	**Research Into Action, Inc.** **Stellar Processes, Inc.**	Oct-00
Evaluation	Market Progress Evaluation	Scientific Irrigation Scheduling, No. 3	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD A.G. Flynn	Nov-01
Evaluation	Market Progress Evaluation	Silicon Crystal Growing Facilities, No. 1	5/8/2003 NEEA website	**TecMRKT Works** John H. Reed Andrew D. Oh Nicholas P. Hall	Aug-99
Evaluation	Market Progress Evaluation	Silicon Crystal Growing Facilities, No. 2	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD **Shel Feldman Management Consultants** Shel Feldman, PhD	Nov-01
Evaluation	Market Progress Evaluation	Super Good Cents Manufactured Housing	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Dave Hewitt Jeff Pratt Gary Smith	Feb-99
Evaluation	Market Progress Evaluation	The Super Good Cents Manufactured Housing Venture, No. 3	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Jeff Pratt Gary Smith	Jun-02
Evaluation	Market Progress Evaluation	WashWise Program	5/8/2003 NEEA website	**Pacific Energy Associates**	Jan-98
Evaluation	Market Progress Evaluation	EZ Conserve, No. 1	5/8/2003 NEEA website	**Quantec, LLC**	Mar-03
Evaluation	Market Progress Evaluation Exec. Summary	Lighting Design Lab	5/8/2003 NEEA website	**TecMRKT Works** John H. Reed Andrew D. Oh Nicholas P. Hall	Apr-99
Evaluation	Market Progress Evaluation Exec. Summary	LightWise, No. 1	5/8/2003 NEEA website	**The Gilmore Research Group** Heidi Hermenet, ed.	Jan-99
Evaluation	Market Progress Evaluation Exec. Summary	WashWise, No. 2	5/8/2003 NEEA website	**Pacific Energy Associates, Inc.** Dave Hewitt Jeff Pratt Gary Smith	Jul-98

Evaluation	Market Progress Evaluation Report	Energy Star Residential Lighting Program, No. 1	5/8/2003 NEEA website	**ECONorthwest**	Jun-02
Evaluation	Market Progress Evaluation, No. 3	Northwest Energy Education Institute	5/8/2003 NEEA website	**Currents Consulting** Jennifer Stout **MetaResource Group** Steven Scott	Apr-03
Evaluation	Start-Up Process Evaluation Summary	Lighting Design Lab	5/8/2003 NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD	Apr-98
Executive Summary	Final Report Executive Summary	Building Commissioning Practices in New Construction and Existing Building Markets in the Pacific Northwest	5/8/2003 NEEA website	**SBW Consulting, Inc.** **R.W. Beck** **Kaplan Engineering**	Oct-98
Research	Market Research	A Characterization of the Nonresidential Fenestration Market	5/8/2003 NEEA website	**Eley Associates**	Nov-02
Research	Market Research	Baseline Characteristics of the Multi-Family Sector Oregon and Washington	5/8/2003 NEEA website	**Ecotope**	Dec-01
Research	Market Research	Baseline Characteristics of the Non-Residential Sector Idaho, Montana, Oregon and Washington	5/8/2003 NEEA website	**Ecotope** David Baylon Mike Kennedy Shelly Borrelli	Dec-01
Research	Market Research	Baseline Characteristics of the Residential Sector Idaho, Montana, Oregon and Washington	5/8/2003 NEEA website	**Ecotope** David Baylon Shelly Borrelli Michael Kennedy	Dec-01
Research	Market Research	Commercial and Industrial Lighting Study, Volume 1	5/8/2003 NEEA website	**XENERGY Inc.** **Rising Sun Enterprises** **Pacific Energy Associates** **Energy Market Innovations**	Dec-00
Research	Market Research	Commercial Buildings Initiative Target Market Priorities	5/8/2003 NEEA website	**SCHICK CONSULTING** Harold (Skip) Schick **Pacific Energy Associates, Inc.** Les Tumidaj	Sep-02
Research	Market Research	Energy Efficiency within the Pulp and Paper, Water and Wastewater and Irrigation Markets in the Pacific Northwest	5/8/2003 NEEA website	**Ducker Worldwide**	Nov-00
Research	Market Research	Energy Efficient Lighting in New Construction	5/8/2003 NEEA website	**Ecos Consulting** **Benya Lighting Design** **Rising Sun Enterprises**	May-02
Research	Market Research	Market Assessment of the Independently Owned Retail Food Sector in the Pacific Northwest	5/8/2003 NEEA website	**Quantum Consulting Inc.**	Dec-00
Research	Market Research	New Commercial Office Buildings: Developing Strategic Market Transformation Initiatives for Energy Efficiency	5/8/2003 NEEA website	**Washington State University** Rick Kunkle, PE Loren Lutzenhiser, PhD	Sep-01
Research	Market Research	Opportunities for New Appliance Market Transformation Programs in the Pacific Northwest	5/8/2003 NEEA website	**Four Winds Alliance** **D&R International**	Aug-00
Research	Market Research	Pacific Northwest Water and Wastewater Market Assessment	5/8/2003 NEEA website	**Quantum Consulting Inc.** **Adolfson Associates Inc.**	May-01

Research	Market Research	Regional Public Information Program for the Efficient Building Practices Initiative	5/8/2003	NEEA website	**Cole & Weber**	Jul-00
Research	Market Research	Residential Energy Efficient Lighting Consumer Research	5/8/2003	NEEA website	**Regional Economic Research, Inc.**	Apr-00
Research	Market Research	Summary of a Workshop on the Future of Electric Energy Use	5/8/2003	NEEA website	**Northwest Energy Efficiency Alliance** Ben Bronfman	Sep-01
Research	Market Research	Variable Frequency Drives	5/8/2003	NEEA website	**Easton Consultants, Inc.**	Jun-00
Review	Review of Literature 1989-1997	Impacts of Forced Air Distribution Systems on Homes and Potential for Improvements	5/8/2003	NEEA website	**OSU Extension Energy Program** A.B. Boe	Jan-98
Special Report	Special Report	Product Testing: Magna Drive, Report No. 1	5/8/2003	NEEA website	**Motor Systems Resource Facility (MSRF)** **Oregon State University**	Mar-00
Special Report	Special Report-Enhanced Baseline	Public Building Commissioning in the Pacific Northwest, No. 1	5/8/2003	NEEA website	**Quantum Consulting, Inc.** Phil Willems	Jul-99
Special Report Assessment	Special Report Product Assessment	Envinta One-2-Five Pilot	5/8/2003	NEEA website	**Research Into Action, Inc.** Jane S. Peters, PhD	Mar-02
Special Report Review and Recommendations	Organizational Structure Review and Recommendations	Lighting Design Lab	5/8/2003	NEEA website	**Hein Consulting Group** Alanna E. Hein	Jun-00
Study	Case Study	Green City Buildings-Applying the LEED Rating System	5/8/2003	NEEA website	**XENERGY Inc.** **SERA Architects**	Oct-00
Study and Characterization	Baseline Study and Market Characterization	Energy Star High Efficiency Residential Windows	5/8/2003	NEEA website	**Macro International, Inc.**	Dec-98
Staff memo	Portfolio Development Committee	Summary of October Retreat	6/12/2003	on-site	Darlene Nemnich, Portfolio Committee Chair (at the time)	Oct-99
MT Strategy	Commercial Buildings Initiative	CBI/BetterBricks 2003 Proposed Activities and Budget	6/12/2003	on-site	Jeff Harris & Dave Hewitt, others?	Oct-02
memo	internal	Board Committee Charters	6/12/2003	on-site	?	?
powerpoint		How Business is Accomplished	6/12/2003	on-site	Jeff Harris	Jun-02
Staff recommendation memo	internal	Utility Distribution System Efficiency Initiative	6/12/2003	on-site, Susan Hermenet	Jeff Harris, otherss	Jan-03
memo	Portfolio Development Committee	Portfolio Development Committee Agenda and backup materials	6/12/2003	on-site, Jeff Harris	Jeff Harris, others	Jan-03
report	Lighting data	Volume 1: National Lighting Inventory and Energy Consumption Estimate	6/6/2003	download from web	Navigant Consulting - for DOE/EERE	Sep-02
confidential	draft report	CFL Product Sales Data - Report for January -March 2003	6/19/2003	Marci Sanders	contractor (Ecos?)	Jun-03
research	Market Research	CBI Baseline: School Districts Planning Construction	7/30/2003	Lis Saunders		Jul-03
utility report	evaluation	Conservation Kit Program Evaluation: Transforming the Residential Use of CFLs	8/26/2003	Seattle City Light	Debra Tachibana, Seattle City Light	May-03
report	project description	Residential Sector Initiative - DRAFT Project Description Consumer Products	8/26/2003		Alliance staff	Aug-03
spreadsheet	MAR numbers	Alliance Progress Tracker (Year 2002 - Baseline)	9/10/2003	Jeff Harris	Jeff Harris, Susan Hermenet	Apr-03
spreadsheet	NWPPC baselines	NWPPC Space Conditionaing System and Fuel by Housing Type & Vintage	9/10/2003	Tom Eckman	Tom Eckman, NWPPC	?