

Market Potential 72% Consumer Confidence 83% Brand Recognition 82% Energy Savings 69%  
3% Energy Efficiency 27% Product Awards 77% Customer Satisfaction 74% Market Share

**research/into/action**<sup>inc</sup>

## *Final Report*

# **PRODUCTION EFFICIENCY PROGRAM: PROCESS EVALUATION AND IMPACT EVALUABILITY ASSESSMENT**

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## EXECUTIVE SUMMARY

The Energy Trust of Oregon, Inc. (Energy Trust) was incorporated as an Oregon nonprofit public benefit corporation in March 2001, to fulfill a mandate to invest “public purposes funding” for new energy conservation and related activities in Oregon. It receives funding from a three-percent public purpose charge to the rates of the two investor-owned electric utilities in the state. The Energy Trust has a responsibility to report to the Oregon Public Utilities Commission (OPUC) on how it is spending its funding and what it achieves.

The Energy Trust launched the Production Efficiency program in May 2003.<sup>1</sup> The primary goal of the program is the acquisition of large volumes of electric savings at modest cost from a wide variety of efficiency strategies for industrial processes. Available to both industrial and institutional customers of the state’s investor-owned electric utilities, the program addresses both new and existing industrial manufacturing processes and process support systems.

By the end of 2004, the program had enrolled 519 projects with incentive commitments of \$21,742,410 and estimated savings of 150,768,978 kWh (roughly 17.2 average megawatts)—about 80% of the established goal.

This document updates a previous process evaluation completed for the Production Efficiency program in early 2004. To accomplish the update, the evaluation team interviewed representatives from all of the organizations involved in implementing the program and asked specific questions of participant contacts to reveal the program’s strengths and weaknesses.

The document also assesses the impact evaluability of the first group of completed Production Efficiency projects. As an outcome of this assessment, the evaluation team developed adjusted energy and demand impacts for 30 projects for which they conducted site visits; the onsite sample comprised 90% of program savings as of mid-2004.

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<sup>1</sup> The program launched under the name Industrial Process Efficiency Initiative program.

## SUMMARY OF CONCLUSIONS

The Production Efficiency program is successful from a number of perspectives. It has conducted a large number of projects with a variety of industrial firms and is acquiring large quantities of cost-effective energy savings. Industrial participants are happy with the program, especially with the services they receive from program staff. We offer specific conclusions on research issues raised by Energy Trust staff.

### 1. Are the Production Efficiency projects sound?

**Yes, the projects appear to be sound.** Overall, the evaluation team judged the 30 site-investigated projects as attaining 103% of the energy savings ascribed to them in the program database. This study was conducted early in the program and thus investigated too few projects to provide estimates of the realization and free-rider rates suitable to extrapolation to future program accomplishments. Even for the projects investigated, time and resource constraints precluded thorough investigations of some sites.

### 2. Are any changes needed in project documentation to better support an impact evaluation?

**Yes, project documentation needs to be improved to better support an impact evaluation.** The evaluation team found the documentation supporting roughly half of the 30 projects investigated onsite lacked a clear statement of the estimated energy consumption of the affected equipment before and/or after the energy efficiency action. The evaluation team faced significant challenges to determine exactly what data were explicitly contained in the project files, not to mention what data could be inferred, because the project studies do not include a summary statement clearly identifying the project's consumption and demand figures, or key assumptions such as operating hours. For 6 of the 30 projects, the evaluation team deemed the savings and for another 4 projects, the team assigned zero savings; in most cases this treatment was necessitated by inadequate analyses or documentation; these cases comprise 43% of total investigated savings.

### 3. How are industrial firms responding to the program?

**Industrial firms are participating in large numbers and participants span all ten of the industry-type categories tracked by the program.** Of the first 53 projects completed, approximately 10 improved the overall efficiency of the

systems serving the facilities' production; the remaining projects improved the efficiency of specific components or equipment used.

**4. What are the roles that incentives and project non-energy benefits play in the decisions of industrial firms to participate in the program?**

**Program contacts speculated that the magnitude of program participation might not be adversely affected by reducing the incentive somewhat** (say, to 40% of project costs from the current 50%), but added that, of course, they cannot predict this with certainty. Contacts did not believe non-energy benefits substitute for direct program incentives in customer decision-making, as too much uncertainty surrounds them. Contacts emphasized the importance of a simple, non-negotiated incentive structure—a strength of the current program—and incentives that change only slowly and after ample warning has been given to the market.

**5. Have there been any changes in the program in response to the findings and recommendations of the first process evaluation?**

**Most changes in program implementation have come from the Energy Trust's responsiveness to recommendations made in the previous evaluation.** Specifically, the Energy Trust has become much more responsive in day-to-day program management and decision-making, and its contracting processes are improved. Most contacts feel the Energy Trust (more specifically, its Board of Directors) has yet to provide clear direction for addressing competing objectives with limited resources, yet all contacts report program activities are consciously directed towards meeting the variety of Trust objectives. Staff of the Program Management Contractor (PMC) report modest changes undertaken in response to program evaluation findings.

**6. How well is the model working of relying principally on market actors for program delivery and secondarily on program staff?**

**Changes since program inception have increased reliance on contracted Production Efficiency staff for program delivery, away from market actors (i.e., established firms that provide services to the market); however, planned changes would reverse this trend.** The Energy Trust originally conceived that Production Efficiency would rely on promotion by existing market actors—consulting engineers and vendors hired by the PMC to serve the program as Allied Technical Analysis Contractors (ATACs) and Program Delivery Contractors (PDCs). At the outset of Production Efficiency, interviews conducted by the

evaluation team confirmed that the ATACs were marketing the program. However, the ATACs reported losing customers they had brought to the program. A year later, this current evaluation has found very little marketing by ATACs. Thus, this intended use by the program of established market players has decreased. Looking forward, the PMC is developing plans to deliver the program to smaller industrial firms that will likely depend heavily on equipment vendors. The PMC anticipates the program will only be able to cost-effectively serve smaller firms if it enables vendors to readily propose energy-efficient equipment.

### 7. How well is the model working of using a PMC for program delivery?

**The current PMC model in many respects serves the program very well, yet it has limitations that could be reduced were the Energy Trust to modify the PMC's role.** The use of a PMC for program delivery has, as the Energy Trust anticipated when it created the role, enabled the program to launch quickly and effectively. Nonetheless, the evaluation has found two areas of significant weakness for program that appear to owe more to the way the Energy Trust has structured the PMC's role than to the specific characteristics of the current PMC.

One, the current PMC's role has the effect of pulling the PMC in opposite directions, as it is required to both deliver large amounts of savings at a low cost and to determine the appropriate degree of analysis and documentation—activities that drive up program costs. Two, the evaluation has found several problems that stem from the role of the PMC as a client of the PDCs and ATACs, with whom the PMC has contracted for program delivery services. As all of these firms could potentially be hired by the Energy Trust for any of these roles, firms that compete with each other for consulting work are expected by the program to subordinate their individual interests when they make program-related decisions.

Finally, under the current implementation approach, the Energy Trust lacks an independent source of information about the market and about the performance of PDCs and ATACs. Consequently, the Energy Trust's evolution of the program and its oversight of the PMC primarily rest on information the PMC has provided it.

## SUMMARY OF RECOMMENDATIONS

- 1. The Energy Trust should ensure the adoption of procedures, formats or standards that will improve the quality of project analyses and documentation and facilitate impact evaluation.**
- 2. The Energy Trust should conduct a full-scale impact evaluation of the Production Efficiency program after December 31, 2005.**
- 3. Energy Trust staff should meet more frequently with program participants to further build relationships with customers and should meet periodically with the PDCs to obtain feedback and discuss lessons learned.**
- 4. The Energy Trust should consider contracting directly with each of the firms involved in program delivery, contracting with the PDCs to attain energy savings goals and with the PMC to provide program support services to the Trust and to the PDCs and ATACs.**

The Energy Trust should consider contracting directly with the PMC, with each PDC, and with each ATAC. Such contracting will bring the Energy Trust closer to the industrial market and into direct contact with the firms delivering the program to that market. It would simplify the program contracting processes by removing the Energy Trust from contracts to which it is not a party and it will enable existing conflicts of interest to be untangled. Each PDC would be assigned energy goals and a specific, unique market, whose size has been estimated. The contract terms would be crafted so that it is in the interest of PDCs to have ATACs market the program to industrial firms in their assigned markets. The Energy Trust should consider contracting with the PMC to conduct most of the program support services currently performed by the PMC. These activities include, at a minimum: developing marketing strategies and approaches, assisting the PDCs in marketing, and program tracking. As well, the PMC would continue to assign and review technical studies to a level of quality defined by the Energy Trust, since study review would not pull the PMC in two directions once the PMC is no longer responsible for cost-effectively meeting an energy savings goal.

**Executive Summary**

## 1. INTRODUCTION

The Energy Trust of Oregon, Inc., was incorporated as an Oregon nonprofit public benefit corporation in March 2001, to fulfill a mandate to invest “public purposes funding” for new energy conservation, for the above-market costs of new renewable energy resources and to support new market transformation in Oregon. It receives funding from a three-percent public purpose charge to the rates of the two investor-owned electric utilities in the state—Pacific Power and Portland General Electric Company (PGE). The Energy Trust has a responsibility to report to the Oregon Public Utilities Commission (OPUC) on how it is spending its funding and what it achieves.

The Energy Trust hired the team of Research Into Action, Inc. and MetaResource Group to conduct this process evaluation update and impact evaluability assessment of its Production Efficiency program, launched in May 2003. This report provides an assessment of the program approximately 18 months into implementation, with the intent of facilitating continual improvement. The Production Efficiency program continues to evolve, with adaptation and learning occurring throughout—by the program implementation contractors and on the part of the participating firms themselves. The interviews and surveys conducted for the evaluation were completed by the end of February 2005. Program status is current as of December 31, 2004.

This chapter is organized into three sections:

- *Program Description*—describes the program’s goals, objectives and methods.
- *Evaluation Approach*—describes the data sources and methods used in this evaluation.
- *Organization of the Report*—identifies the subsequent chapters in this report.

## PROGRAM DESCRIPTION

The Production Efficiency program is available to all industrial and select institutional customers of Pacific Power and PGE. Both new and existing industrial

## 1. Introduction

manufacturing processes and process support systems are within the program's purview. The stated program goals are to achieve:

- A significant increase in industrial electric efficiency activity,
- Low-cost savings, and
- Broad participation.

A specific program objective was to secure 20.6 average megawatts (approximately 180,000,000 kWh) over the eighteen-month period ending December 2004, at a cost to the Energy Trust of one cent per levelized kilowatt-hour.

The program's energy savings goal has evolved over time. At its meeting on March 5, 2003, the Energy Trust Board approved the two-year Production Efficiency (PE) program design, capable of saving an anticipated 19 average megawatts at an estimated cost of \$13.9 million. Aspen Systems Corporation (Aspen) was awarded the contract to manage the program and began program services in July 2003. Following an Energy Trust Board action in April 2003, the Energy Trust reduced the contract dollar amount by \$2.4 million and decreased the projected savings goal to 17.2 average megawatts (150,000 annual megawatt hours). This action shifted funds from the Aspen contract to cover Energy Trust program-related costs. In August 2003, wastewater treatment projects were transferred from the Building Efficiency program to PE—effectively raising the program's value to \$15.6 million and increasing the savings projections from 17.2 to 20.6 average megawatts.<sup>2</sup>

By the end of 2004, the Production Efficiency program had reserved all of the incentive funds budgeted through incentive commitments of \$14 million for 124 enrolled projects, representing an estimated savings of 12 average megawatts (106,300 megawatt hours). By the end of 2004, the program had enrolled 519 projects, with incentive commitments of \$21,742,410 and estimated savings of 150,768,978 kWh, or about 17.2 average megawatts. (See Chapter 2 for additional status information.)

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<sup>2</sup> From Board Decision: Extension of the Contract Term for the Building Efficiency and Production Efficiency Program Management Contract with Aspen Systems. July 29, 2004



## Program Approach

Rather than focusing entirely on equipment replacement or upgrade projects, Production Efficiency is also open to projects involving substantial changes to the production process itself. The inclusion of such projects significantly distinguishes the program from its predecessors operated by the electric utilities. Process efficiency projects, in contrast to those for equipment replacement alone, imply larger energy savings and typically have lower per-unit energy-acquisition costs. These projects often have non-energy benefits that are greater as well, both in absolute and relative terms, than those associated with equipment replacement projects—for example, reduced emissions, better labor utilization, reduced maintenance costs and improved pressure regulation can all result from these projects.<sup>3</sup>

The PE program is also able to accommodate projects that result in increased facility output through changes that increase the energy efficiency of the process and reduce electricity per unit of output. These projects may free up resources that enable an organization to increase plant output and total energy used at the meter, provided the projects are cost-effective with the assumption that facility output remains constant. Projects like this are approved on a case-by-case basis.<sup>4</sup>

Incentives for design, installation and materials are calculated for each project to bring the payback of energy-efficiency measures down to eighteen months for the customer, capped at 50% of measure cost.<sup>5</sup> Should the project's actual cost exceed its estimated costs, incentives may be proportionately increased, up to a maximum of 120% of the initial incentive offer. It is also possible for a participant to recoup a portion of project costs in excess of 120% of the estimated costs, provided the firm reapplies to the program using the actual cost data, though acceptance of the new application is contingent on the availability of funds.

The Production Efficiency program launched with a per-customer incentive cap of \$500,000 per calendar year. In November 2003, following the identification of

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<sup>3</sup> About one-third of the 30 largest projects completed by September 20, 2004, and investigated by this evaluation through site visits were changes to industrial processes, while the balance was changes to ancillary systems or equipment replacements. The remaining 24 completed projects contacted by telephone for this evaluation were smaller equipment replacement projects.

<sup>4</sup> None of the projects investigated by this evaluation had as its primary intent a desire to expand output.

<sup>5</sup> For measures contracted during 2003, there was also a special promotional incentive of an additional four cents per first year kilowatt-hour savings, with the proviso that the bonus incentives not exceed 50% of measure cost. Participants receiving the kicker potentially received a total incentive equal to the project cost.

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several very large projects with high energy savings potential, the Energy Trust's Board of Directors approved a waiver of the incentive cap on a case-by-case basis for certain extraordinarily cost-effective projects. The waiver allows an industrial facility a once-in-a-lifetime opportunity to exceed the incentive cap.

The program offers free analytical services to identify potential efficiency projects. It pays 100% of the cost for detailed technical analysis studies for prospective efforts, provided the customer agrees to initiate the project within six months of the study's completion.

### Program Delivery

The Energy Trust contracted with Aspen Systems Corporation (Aspen) to serve as the Program Management Contractor (PMC) for the first 18 months of the program (through December 31, 2004), with an option to continue a third year if requested by the Trust. In October 2004, the Energy Trust Board approved a staff-recommended extension of Aspen's contract through September 30, 2005.

The PMC oversees the program through four Program Delivery Contractors (PDCs). The terms of the PDCs' subcontracts with the PMC mirror those of the PMC's contract with the Energy Trust. The responsibilities of three of the PDCs are defined by geographic area, with one PDC assigned to southern Oregon, one to eastern Oregon and one to northwestern Oregon (including the Willamette Valley). The fourth PDC is responsible for all pulp and paper facilities in Oregon and may also serve primary metals facilities throughout the state, as well as wood products facilities located in northwestern Oregon.

The PMC also manages a network of Allied Technical Analysis Contractors (ATACs), who conduct detailed audits (also referred to as detailed studies and as technical analysis [TA] studies). The ATACs are diverse in size and type. They include engineering firms, equipment vendors and three of the four PDCs, who are also authorized to conduct TA studies.

The PMC provides overall management to the process of project identification and completion. The PDCs and, to a much lesser extent, ATACs market the program to industrial firms. They assess the interest of prospective participants in efficiency programs, the facilities' ability to undertake efficiency measures and the best direction for further activities. This assessment leads to a scoping study for facilities having the interest and ability to pursue an efficiency project, or the

assessment may itself constitute a scoping study. The scoping study results in a recommended list of measures for further study or for immediate action.<sup>6</sup>

The program relies on three levels of technical analysis to assure that the level of study for a given project is useful, timely and cost-effective. The different levels of study are intended to allow the technical/engineering review to be tailored to each project. The review process begins with a scoping study that simply identifies opportunities and verifies existing processes and equipment. The scoping study is typically followed by a short technical analysis study, paid for by the Energy Trust up to a cost (typically) of \$3,000. The emphasis of these studies is upon quick identification of projects and expected savings. Such studies offer industrial facilities a risk-free introduction to the program. If further evaluation is warranted, the PMC may require a third, even more detailed assessment.

The completed studies (at whatever level is required) provide information needed by the PMC Technical Manager to determine whether or not the identified projects meet the Energy Trust's cost effectiveness criteria. The Technical Manager does this by using an Excel spreadsheet designed by the Energy Trust.

After a review of the studies by the PDC and the PMC, an incentive offer for cost-effective projects is presented to the customer by the PDC. Upon the customer's acceptance of the offer, it is signed by the PMC. If requested, the PDC will help the customer to identify qualified vendors to perform the specified equipment and measure installation and process changes.

When a project has been completed, the PDC verifies project installation and delivers the incentive payment to the customer. Throughout the process, the PDC facilitates the completion of all program-related forms and delivers them to the PMC for processing.

### PRIOR PROGRAM EVALUATIONS

The current evaluation follows a process evaluation of the Production Efficiency program conducted at the end of its first six months of operation.<sup>7</sup> The first process evaluation offered seven recommendations, included here. (Chapter 4, Program

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<sup>6</sup> A scoping study is defined in the Energy Trust's *Board Meeting Minutes* of March 5, 2003, page 6.

<sup>7</sup> The Energy Trust's website makes available this report, entitled: *Production Efficiency Program: End-of-First Year Progress Evaluation*. See: [Energytrust.org/Pages/about/library/reports/062204\\_PE\\_MPER1.pdf](http://Energytrust.org/Pages/about/library/reports/062204_PE_MPER1.pdf).

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Changes Since the Last Evaluation, provides the current status of responses made to the recommendations by the Energy Trust and the PMC.)

Recommendations from the first process evaluation:

1. Congratulate program staff and contractors for a job well done.
2. Clarify for ATACs the current process for selecting an ATAC for a project. Continue to investigate the experiences of ATACs in marketing the program and bringing customers in.
3. Provide increased technical guidance for PDCs and ATACs.
4. Conduct a preliminary investigation of program impacts to ensure the data necessary to support a comprehensive impact evaluation are available.
5. Seek ways to expedite contracts, communications with the market and program policy decisions.
6. Prepare for potential participants written materials detailing steps for program participation.
7. Give clear guidance to contractors as to how to pursue conflicting objectives.

## EVALUATION OBJECTIVES

The current evaluation has three primary objectives:

- To provide a process evaluation update for the program after eighteen months of operation;
- To provide an assessment of the impact evaluability of the program—that is, the sufficiency of program documentation to support an impact evaluation; and

- To provide a determination of adjusted savings, free-ridership and spillover for completed projects.<sup>8</sup>

These three primary objectives consolidate a number of program research issues Energy Trust staff discussed with the evaluation team on several occasions. These research issues include:

1. Are the Production Efficiency projects sound?
2. Are any changes needed in project documentation to better support an impact evaluation?
  - a. Include an assessment of project impacts, free-ridership and spillover.
3. How are industrial firms responding to the program? Including:
  - a. What sizes of industrial firms are participating?
  - b. Are participants learning about all efficiency programs, especially the Energy Trust's Building Efficiency Program and the State of Oregon's Business Energy Tax Credits (BETC)?
  - c. What participation can be expected from the semi-conductor sector, one of Oregon's largest industries?
4. What are the roles that incentives and project non-energy benefits play in the decisions of industrial firms to participate in the program?  
Specifically:
  - a. Can incentives be reduced without reducing program participation?
  - b. Should non-energy benefits be calculated in project cost-effectiveness analyses?
  - c. Are participants using the two-cent per kWh incentive offered for projects with paybacks less than 18 months?

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<sup>8</sup> We investigated all projects completed through September 20, 2004, a date selected to include as many projects as possible while providing enough time to complete the investigation by early 2005. Free-ridership estimation provides an indication of the likelihood the identical project would have been undertaken at about the same time in the absence of incentives. Spillover assessment indicates the extent to which participants go on to install additional energy efficient equipment without requesting incentives.

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5. Have there been any changes in the program in response to the findings and recommendations of the first process evaluation?
6. How well is the model working of relying principally on market actors (i.e., established firms that provide services to the market) for program delivery, and secondarily on program staff (e.g., PMC)?
7. How well is the model working of using a PMC for program delivery?

## EVALUATION APPROACH

This evaluation employed four basic methods to achieve its objectives, including in-depth interviews with program implementers, project file reviews, customer onsite visits and customer telephone interviews. The evaluation team also reviewed information from the program database, notes from Energy Trust meetings and other program documents.

### In-depth Interviews

The process component of the evaluation also included in-depth interviews with program staff and contractors. The in-depth interviews lasted approximately one-and-a-half to two hours and were held in January 2005. Individuals contacted for in-depth interviews included:

- Two Energy Trust program staff;
- Three staff members of the Program Management Contractor (PMC);
- Staff of all four Program Delivery Contractors (PDCs);
- Ten Allied Technical Analysis Contractors (ATACs)<sup>9</sup> and vendors conducting program studies; and
- The executive director of Industrial Customers of Northwest Utilities (ICNU).

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<sup>9</sup> The ATACs include three firms that also serve as PDCs, three firms that sell engineering and design services and four firms that sell products.

The in-depth interviews focused on changes in the program during 2004, the lessons learned during implementation, contractor impressions of the program and implementation details including technical assumptions, customer interactions, relationships between contractors and project coordination.

### Onsite Investigations and Interviews with Industrial Firm Participants

As of September 20, 2004, 42 industrial participants had completed 53 projects at their various facilities (see Table 1.1).<sup>10</sup> By the end of 2004, an additional 79 projects were completed, for a total of 132. Of the projects completed by September 20, about 90% of the total estimated savings accrued from 20 participants. We conducted onsite investigations of 30 projects conducted by these 20 participants. For the remaining 22 participants, whose 23 projects comprised about 10% of total savings, we attempted to complete telephone interviews to support the evaluation. We completed phone interviews with 17 of these participants.

**Table 1.1**  
**COMPLETED PROJECTS AND SAVINGS**

METRIC	TOTAL	LARGER PROJECTS (TOP ~90%)	SMALLER PROJECTS (BOTTOM ~10%)
Number of Projects	53	30	23
Number of Participants	42	20	22
Total Estimated Savings (kWh)	20,951,990	18,725,337	2,226,653
Percent of Estimated Savings (kWh)	100%	89%	11%

These onsite investigations and phone interviews addressed all three evaluation goals: the process evaluation update; the impact evaluability assessment; and the determination of adjusted project savings, free-ridership and spillover.

<sup>10</sup> Some firms have multiple projects at one facility or multiple projects at multiple facilities. At firms with multiple projects, each project may have its own manager, or one individual may manage several projects. For our research, we needed to interview people familiar with the projects. We use the term "participant" to refer to the entity represented by the person we spoke to about the project. So in some cases, a "participant" is the firm and in other cases the "participant" is one of a firm's multiple locations, depending on how that firm chose to manage its energy efficiency projects.

## 1. Introduction

Site visits were conducted in order to assess both evaluability and adjusted energy and demand savings impacts. The primary savings adjustment methodology involved applying engineering calculations to short-term metering, the approach used with 21 of the 30 projects (70%). For two sites, customer-provided data were used to adjust the savings estimates; and for two other sites, observations made onsite were used to adjust the estimates. For five projects (17%), the available data did not support or did not warrant an adjustment to the savings and the program-reported savings estimate was not revised; these savings estimates were deemed.

Before conducting each site visit, the evaluators examined the available project reports and any documents verifying savings in the project files; they then arranged to meet with the facility staff most familiar with the Production Efficiency project. The site visit typically included four elements: 1) a walk-through of the facility with the site contact, focusing on the installed energy efficiency measures; 2) an interview with the site contact and others as needed to understand plant and measure operation; 3) where possible, collection of data from the participants' own energy monitoring and control systems; and 4) where appropriate and practical, installation of short-term metering of the project or system (usually for one week).

During the site visits, participants were asked questions designed to reveal several process-related issues, including their experience participating in the program and their satisfaction with the program and with the measures installed. The engineer conducting the site visit and interviews also asked about participants' previous experience with energy efficiency programs and about the organizational decision-making process required for capital projects. Similar questions were asked during phone interviews with the participants with smaller projects.

### **Free-Rider and Spillover Assessment**

Both the site visits and the telephone interviews contained questions designed to elicit measures of free-ridership and spillover. Free-ridership was assessed through reviewing responses to a series of questions about project timing, the importance of incentives, the organization's overall approach to energy efficiency, and the likelihood that the customer would have installed the efficiency measures without incentives. Spillover was assessed by asking about additional energy efficiency measures installed following participation in the program and whether the program had influenced the decision to take this further action.

Chapter 5 provides a more detailed discussion of the methodologies used to assess participant's projects.



## ORGANIZATION OF THE REPORT

This introductory chapter gives background on the program and frames the results of this evaluation. The report has seven additional chapters:

- *Chapter 2. Program Status*
- *Chapter 3. Program Implementation Activities and Experiences*
- *Chapter 4. Program Changes Since Last Evaluation*
- *Chapter 5. Participating Industrial Firms' Feedback*
- *Chapter 6. Methodology for Impact Evaluability Assessment, Savings Adjustment and Assessment of Free-Rider/Spillover Effects*
- *Chapter 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effects*
- *Chapter 8. Conclusions and Recommendations*

Two appendices follow the body of the report.

- *Appendix A. Project Savings Evaluation Summaries*
- *Appendix B. Interview Guides and Survey Instruments*

1. Introduction

## 2. PROGRAM STATUS

This chapter presents measures of program accomplishments and activities from the inception of the Production Efficiency program in May 2003 until the end of 2004. All data presented in the chapter were provided by the PMC; most of the data were derived from the PMC's project tracking database (using Microsoft Excel software).

From program inception through 2004, 132 projects, representing an estimated 104 million kWh of energy savings, have been completed at participating industrial facilities (see Table 2.1).

**Table 2.1**

### TOTAL PRODUCTION EFFICIENCY PROJECTS: PROJECT DESCRIPTORS BY PROJECT STATUS

DESCRIPTOR	PRE-COMMITTED	COMMITTED	COMPLETED	TOTAL
<b>Number of Projects</b>	267 (51%)	120 (23%)	132 (25%)	519 (100%)
<b>Study Costs</b>	\$638,942* (43%)	\$427,841 (29%)	\$412,681 (28%)	\$1,479,463* (100%)
<b>Incentives</b>	—	\$8,043,752 (37%)	\$13,698,658 (63%)	\$21,742,410 (100%)
<b>KWh Savings</b>	—	46,564,000 (31%)	104,204,978 (69%)	150,768,978 (100%)
<b>Cost (incentives + studies) per kWh of Savings</b>	—	\$0.18	\$0.14	\$0.15**

\* For pre-committed projects, study costs are calculated from all 146 pre-committed projects for which data were available. When study costs are not available, this is usually because the project is under discussion with the potential participant, yet a study has not been completed.

\*\* Calculated using study costs for committed and completed projects only.

Another 120 projects are committed; on these, the participants have agreed to go forward by signing a contract with the Energy Trust, including detailed descriptions

## 2. Program Status

of the project, project cost estimates and incentive amounts the Energy Trust will pay (subject to adjustments based on actual costs). Committed projects have an estimated energy savings of about 46 million kWh. An additional 267 projects are in the scoping phase, but not yet committed; study costs incurred to date for pre-committed projects amount to nearly \$640 thousand. In all, 519 projects are at some stage of participation in PE.

Including incentives and study costs, the cost per kWh of savings for committed projects was 18¢, with the savings from completed projects at 14¢ per kWh, 4¢ less expensive.

Table 2.2 provides the distribution of committed and completed projects by size in terms of estimated kWh savings.

**Table 2.2**  
**NUMBER OF PROJECTS BY SIZE (IN ESTIMATED KWH SAVINGS) AND PROJECT STATUS**

SIZE CATEGORY	PORTION COMMITTED	PORTION COMPLETED	TOTAL
Less than 100,000 kWh	61%	39%	67
100,001 to 200,000 kWh	54%	46%	41
200,001 to 300,000 kWh	48%	52%	31
300,001 to 400,000 kWh	46%	54%	24
400,001 to 500,000 kWh	50%	50%	20
500,001 to 1,000,000 kWh	26%	74%	27
1,000,001 to 10,000,000 kWh	54%	46%	26
10,000,000 kWh or More	0%	100%	2
<b>TOTAL</b>	<b>50%</b>	<b>50%</b>	<b>238</b>

## PROJECTS BY UTILITY

A slightly greater number of participating projects are or will be taking place within PacifiCorp's service area than within PGE's service area (Table 2.3).

**Table 2.3**  
**NUMBER OF PROJECTS, ESTIMATED SAVINGS AND INCENTIVES BY UTILITY**

UTILITY	PORTION PRE-COMMITTED	PORTION COMMITTED	PORTION COMPLETED	TOTAL
<b>NUMBER OF PROJECTS</b>				
PacifiCorp	49%	21%	30%	312
PGE	55%	26%	19%	206
<b>TOTAL</b>	<b>50%</b>	<b>23%</b>	<b>25%</b>	<b>518*</b>
<b>ESTIMATED SAVINGS (IN KWH)</b>				
PacifiCorp	—	24%	76%	124,842,370
PGE	—	62%	38%	25,926,608
<b>TOTAL</b>	<b>—</b>	<b>31%</b>	<b>69%</b>	<b>150,768,978</b>
<b>INCENTIVES</b>				
PacifiCorp	—	27%	73%	\$16,943,688
PGE	—	71%	29%	\$4,798,722
<b>TOTAL</b>	<b>—</b>	<b>37%</b>	<b>63%</b>	<b>\$21,742,410</b>

\* One pre-committed project, whose utility the program database listed as "other," was excluded.

Committed and completed projects taking place in PacifiCorp's service area are estimated to save almost 125 million kWh, while savings due to projects taking place in PGE's territory amount to a substantially smaller 26 million kWh. For PacifiCorp, most of the savings (76%) are accounted for by completed projects; while for PGE, committed projects comprise most of the savings (62%).

Table 2.4 also provides the amount of incentive dollars going to committed and completed projects within the service areas of the two investor-owned Oregon electric utilities.

With more than two-thirds (70%) of participating projects (at any stage of completion) within PacifiCorp's service area, committed and completed projects in the service area are receiving 78% of program incentives so far committed, and account for 83% of the total estimated savings.

## 2. Program Status

**Table 2.4**  
**COMPARING PROJECTS, SAVINGS AND INCENTIVES BY UTILITY**

UTILITY	NUMBER OF PROJECTS		ESTIMATED ENERGY SAVINGS		INCENTIVES	
	COUNT	PERCENT	KWH	PERCENT	DOLLARS	PERCENT
<b>PacifiCorp</b>	312	70%	124,842,370	83%	\$16,943,688	78%
<b>PGE</b>	206	30%	25,926,608	17%	\$4,798,722	22%
<b>TOTAL</b>	<b>518*</b>	<b>100%</b>	<b>150,768,978</b>	<b>100%</b>	<b>\$21,742,410</b>	<b>100%</b>

\* One pre-committed project, whose utility the program database listed as "other," was excluded.

## PROJECTS BY PDC

Among PDCs, Energy Services Group (a subsidiary of PGE) has the greatest number of projects (179) at some stage of participation; RHT Energy Solutions was close behind, with 146 projects (see Table 2.5).

**Table 2.5**  
**NUMBER OF PROJECTS BY PROGRAM DELIVERY CONTRACTOR**

PDC	PORTION PRE-COMMITTED	PORTION COMMITTED	PORTION COMPLETED	TOTAL
<b>Cascade Energy Engineering (Cascade Energy)</b>	58%	18%	24%	45
<b>Efficiency Services Group (ESG)</b>	48%	27%	25%	179
<b>Harris Group</b>	60%	16%	24%	97
<b>RHT Energy Solutions (RHT)</b>	49%	21%	30%	146
<b>TOTAL*</b>	<b>53%</b>	<b>22%</b>	<b>26%</b>	<b>467</b>

\* Excludes 52 of the 519 total participating projects; these projects were conducted under the marketing umbrella of the PMC rather than a PDC.

RHT Energy Solutions’ projects comprise the greatest estimated savings, at about 58 million kWh (see Table 2.6). Harris Group has the second greatest savings among PDCs, at about 48 million kWh.

**Table 2.6**  
**ESTIMATED SAVINGS (IN KWH) OF COMMITTED/COMPLETED PROJECTS BY PDC**

PDC	PORTION COMMITTED	PORTION COMPLETED	TOTAL
Cascade Energy Engineering	17%	83%	7,369,031
Efficiency Services Group	40%	60%	27,179,111
Harris Group	37%	63%	48,396,048
RHT Energy Solutions	20%	80%	57,835,318
<b>TOTAL*</b>	<b>30%</b>	<b>70%</b>	<b>140,779,508</b>

\* Excludes 52 of the 519 total participating projects; these projects were conducted under the marketing umbrella of the PMC rather than a PDC. Estimated savings from these projects amount to 9,989,470 kWh; see Table 2.1 for total program savings including these 52 projects.

Table 2.7 shows a comparison of the number of projects (at any stage) each PDC has and the amount of savings estimated to result from each PDC’s committed and completed projects.

## 2. Program Status

**Table 2.7**  
**COMPARING PROJECTS AND SAVINGS BY PDC**

PDC	NUMBER OF PROJECTS		ESTIMATED ENERGY SAVINGS	
	COUNT	PERCENT	kWh	PERCENT
<b>Cascade Energy Engineering</b>	45	10%	7,369,031	5%
<b>Efficiency Services Group</b>	179	38%	27,179,111	19%
<b>Harris Group</b>	97	21%	48,396,048	34%
<b>RHT Energy Solutions</b>	146	31%	57,835,318	41%
<b>TOTAL</b>	<b>467</b>	<b>100%</b>	<b>140,779,508</b>	<b>100%</b>

\* Excludes 52 of the 519 total participating projects; these projects were conducted under the marketing umbrella of the PMC rather than a PDC. Estimated savings from these projects amount to 9,989,470 kWh; see Table 2.1 for total program savings including these 52 projects.

The four PDCs receive funding from the PMC for their efforts in marketing the program to potential participants and assisting participants as their projects move toward completion. Table 2.8 displays the amount of funding awarded to each PDC for these activities from the inception of PE through the end of 2004, and from inception through September 2005. The amounts do not reflect PDC expenditures to date; PDCs may have carried forward 2004 funding with the intent to spend it in 2005.

The proportion of funding allocated to each PDC is within a few percentage points of the proportion of projects each PDC is or has been responsible for. The proportion of funding corresponds most closely with the funds allocated through 2005 for Cascade Energy Engineering (Cascade Energy) and Efficiency Services Group (ESG), and is between the 2004 and 2005 proportional allocations for Harris Group and RHT Energy Solutions (RHT). The funding allocation is less commensurate with proportion of energy savings by PDC than it is with number of projects.<sup>11</sup>

<sup>11</sup> As described more fully in chapter 3's subsection *Marketing to Smaller Industrial Firms*, we unsuccessfully sought annual kWh consumption data (or estimates of consumption) for all program-eligible industrial facilities. We had hoped to use these data to, among other things, estimate the size of the market (in terms of total electrical consumption) assigned to each PDC. The analysis was unsuccessful.



**Table 2.8**  
**COMPARING PDC FUNDING BY PDC**

PDC	THROUGH 2004		THROUGH SEPT 2005	
	DOLLARS	PERCENT	DOLLARS	PERCENT
<b>Cascade Energy Engineering</b>	\$422,917	15%	\$572,917	12%
<b>Efficiency Services Group</b>	\$939,546	33%	\$1,614,546	35%
<b>Harris Group</b>	\$634,375	22%	\$934,375	20%
<b>RHT Energy Solutions</b>	\$845,833	30%	\$1,520,833	33%
<b>TOTAL</b>	<b>\$2,842,671</b>	<b>100%</b>	<b>\$4,642,671</b>	<b>100%</b>

### PROJECTS BY ATAC

Cascade Energy Engineering is the ATAC for 97 projects, which is the greatest number of projects served by a single ATAC (see Table 2.9). Harris Group nearly matches that number, serving as ATAC for 92 projects. These two ATACs are also PDCs. Following these two ATACs in terms of most studies conducted are Compression Engineering (an engineering consulting firm), BacGen (a combination vendor and engineering consulting firm that works directly under the marketing umbrella of the PMC, rather than a PDC), Rogers (a vendor) and Compression Engineering (an engineering consulting firm).

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**Table 2.9**  
**NUMBER OF PROJECTS BY ATAC**

ATAC	PORTION PRE-COMMITTED	PORTION COMMITTED	PORTION COMPLETED	TOTAL
BacGen	47%	34%	19%	53
Cascade Energy	56%	24%	20%	97
CH2M Hill	67%	33%	0%	3
Compression	56%	17%	27%	60
Enerlia	75%	0%	25%	4
Evergreen	54%	11%	35%	37
Harris Group	62%	14%	24%	92
Ingersoll-Rand	17%	33%	50%	6
MWH	100%	0%	0%	1
Other*	0%	74%	26%	23
PE Consulting	100%	0%	0%	1
QEI	80%	8%	12%	26
RHT	68%	20%	12%	25
Rogers Machinery	52%	16%	32%	44
Vendor**	0%	56%	44%	32
Washington Gp	47%	0%	53%	15
<b>TOTAL</b>	<b>52%</b>	<b>23%</b>	<b>25%</b>	<b>519</b>

\* Studies conducted by "other" ATACs include those conducted for the industrial firm prior to its participation in the PE program, such as by the firm's utility or with the assistance of the Northwest Energy Efficiency Alliance.

\*\* Two vendors—Baxter Air Engineering and Pacific Fluid Systems—have performed studies for participating projects.

Committed and completed projects for which Harris Group serves as an ATAC are estimated to save nearly 67 million kWh, which is more than four times greater than the estimated savings of any other ATAC's projects (see Table 2.10). The Harris Group conducts studies primarily for firms in the pulp and paper industry. Next highest project savings accrued to studies conducted by Cascade Energy,

followed by studies conducted by the two non-ATAC vendors, then studies conducted industrial firms prior to their participation in PE, and finally studies conducted by BacGen.

Table 2.10

## ESTIMATED SAVINGS (IN KWH) OF COMMITTED/COMPLETED PROJECTS BY ATAC

ATAC	PORTION COMMITTED	PORTION COMPLETED	ESTIMATED SAVINGS (KWH)
BacGen	50%	50%	9,989,470
Cascade Energy	49%	51%	15,692,160
CH2M Hill	100%	0%	204,126
Compression	26%	74%	7,243,677
Enerzia	0%	100%	478,799
Evergreen	28%	72%	5,696,633
Harris Group	21%	79%	66,867,458
Ingersoll-Rand	30%	70%	869,376
Other	22%	78%	12,976,921
QEI	11%	89%	2,068,109
RHT	24%	76%	7,072,989
Rogers Machinery	56%	44%	6,460,316
Vendor	51%	49%	14,259,474
Washington Gp	0%	100%	889,470
<b>TOTAL</b>	<b>31%</b>	<b>69%</b>	<b>150,768,978</b>

Total study costs for all projects, at any stage, amount to nearly \$1.5 million (see Table 2.11).

## 2. Program Status

**Table 2.11**  
**ACTUAL STUDY COSTS OF COMMITTED/COMPLETED PROJECTS BY ATAC**

ATAC	PORTION PRE-COMMITTED	PORTION COMMITTED	PORTION COMPLETED	TOTAL
BacGen	9%	61%	30%	\$425,542
Cascade Energy	36%	30%	34%	\$165,817
CH2M Hill	57%	43%	0%	\$8,800
Compression	55%	16%	29%	\$133,940
Enerlia	76%	0%	24%	\$11,450
Evergreen	50%	24%	26%	\$34,858
Harris Group	69%	10%	21%	\$475,243
Ingersoll-Rand	16%	19%	65%	\$10,700
MWH	—	—	—	\$0
Other	—	—	—	\$0
PEConsulting	100%	0%	0%	\$4,600
QEI	70%	4%	26%	\$48,139
RHT	31%	35%	34%	\$23,509
Rogers Machinery	45%	20%	35%	\$114,200
Vendor	—	—	—	\$0
Washington Gp	49%	0%	51%	\$22,665
<b>TOTAL</b>	<b>43%</b>	<b>29%</b>	<b>28%</b>	<b>\$1,479,463</b>

Table 2.12 gives a comparison of the number of projects, estimated energy savings and study costs for each ATAC. The proportion of study costs track closely with the proportion of energy savings for almost all ATACs. At the extremes are BacGen and Harris Group. BacGen's study costs, as a proportion of total PE study costs, are considerably higher than their projects' energy savings (as a proportion of total PE savings), and Harris Group study costs are considerably lower than their projects' energy savings (both considered as proportions of the cost and savings totals for the PE program).

**Table 2.12**  
**COMPARING PROJECTS, SAVINGS AND STUDY COSTS BY ATAC**

ATAC	NUMBER OF PROJECTS		ESTIMATED ENERGY SAVINGS		STUDY COSTS	
	COUNT	PERCENT	kWh	PERCENT	DOLLARS	PERCENT
BacGen	53	10%	9,989,470	7%	\$425,542	29%
Cascade Energy	97	19%	15,692,160	10%	\$165,817	11%
CH2M Hill	3	1%	204,126	0%	\$8,800	1%
Compression	60	12%	7,243,677	5%	\$133,940	9%
Enerfia	4	1%	478,799	0%	\$11,450	1%
Evergreen	37	7%	5,696,633	4%	\$34,858	2%
Harris Group	92	18%	66,867,458	44%	\$475,243	32%
Ingersoll-Rand	6	1%	869,376	1%	\$10,700	1%
MWH	1	0%	0	0%	\$0	0%
Other	23	4%	12,976,921	9%	\$0	0%
PEConsulting	1	0%	0	0%	\$4,600	0%
QEI	26	5%	2,068,109	1%	\$48,139	3%
RHT	25	5%	7,072,989	5%	\$23,509	2%
Rogers Machinery	44	8%	6,460,316	4%	\$114,200	8%
Vendor	32	6%	14,259,474	9%	--	--
Washington Gp	15	3%	889,470	1%	\$22,665	2%
<b>TOTAL</b>	<b>519</b>	<b>100%</b>	<b>150,768,978</b>	<b>100%</b>	<b>\$1,479,463</b>	<b>100%</b>

## PROJECT BY INDUSTRY

More participating projects (147 of the 519 total) are taking place at wood processing facilities than any other industry type (see Table 2.13). That number is

## 2. Program Status

almost twice that of the industry with the next most projects—general manufacturing, at 83 projects.

**Table 2.13**  
**NUMBER OF PROJECTS BY INDUSTRY**

INDUSTRY	PORTION PRE-COMMITTED	PORTION COMMITTED	PORTION COMPLETED	TOTAL
Agricultural	52%	35%	13%	23
Municipal	47%	33%	20%	51
Distribution	67%	22%	11%	9
Electrical	50%	50%	0%	2
Food Processing	54%	29%	17%	59
General Manufacturing	39%	31%	30%	83
High Tech	59%	2%	39%	44
Metals	58%	31%	12%	26
Pulp & Paper	56%	20%	24%	75
Wood Processing	52%	17%	31%	147
<b>TOTAL</b>	<b>51%</b>	<b>23%</b>	<b>25%</b>	<b>519</b>

In addition to having the greatest number of participating projects among industries, the wood processing sector also has the greatest savings estimated to result from the projects, at almost 60 million kWh (see Table 2.14). The pulp and paper industry also had a high number of estimated savings at almost 47 million kWh.

Table 2.14

## ESTIMATED SAVINGS (IN KWH) OF COMMITTED/COMPLETED PROJECTS BY INDUSTRY

INDUSTRY	COMMITTED	COMPLETED	TOTAL
Agricultural	57%	43%	3,894,017
Municipal	50%	50%	9,918,183
Distribution	95%	5%	1,740,935
Electrical	100%	0%	480,971
Food Processing	61%	39%	5,472,841
General Manufacturing	47%	53%	7,678,542
High Tech	9%	91%	12,025,834
Metals	72%	28%	2,853,706
Pulp & Paper	37%	63%	46,976,678
Wood Processing	16%	84%	59,727,271
<b>TOTAL</b>	<b>31%</b>	<b>69%</b>	<b>150,768,978</b>

Table 2.15 provides a comparison of the number of projects and estimated savings by industry presented in the two preceding tables. Projects taking place at wood processing facilities made up 28% of the total participating, but accounted for 40% of the estimated savings from committed and completed projects.

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**Table 2.15**  
**COMPARING PROJECTS AND SAVINGS BY INDUSTRY**

INDUSTRY	NUMBER OF PROJECTS		ESTIMATED ENERGY SAVINGS	
	COUNT	PERCENT	kWh	PERCENT
Agricultural	23	4%	3,894,017	3%
Municipal	51	10%	9,918,183	7%
Distribution	9	2%	1,740,935	1%
Electrical	2	0%	480,971	0%
Food Processing	59	11%	5,472,841	4%
General Manufacturing	83	16%	7,678,542	5%
High Tech	44	8%	12,025,834	8%
Metals	26	5%	2,853,706	2%
Pulp & Paper	75	14%	46,976,678	31%
Wood Processing	147	28%	59,727,271	40%
<b>TOTAL</b>	<b>519</b>	<b>100%</b>	<b>150,768,978</b>	<b>100%</b>

## PROJECTS BY PROCESS

With regard to the type of industrial process addressed by participating projects, compressed air was the most frequently addressed, with 157 projects (see Table 2.16). A relatively high number (87) of projects addressed the primary process occurring at the facility. The processes of air abatement, compressed air, pumping, refrigeration and the like—in fact, all processes shown in the table with the exception of primary process and secondary process—are activities that occur among many industry types in similar ways, using similar equipment. They are specific industrial end-uses for electricity. The primary and secondary processes are more catch-all terms for the activities (both principal and ancillary) occurring at an industrial site that are specific to the fabrication of the facility’s product and not common to industry in general.



**Table 2.16**  
**NUMBER OF PROJECTS, BY INDUSTRIAL PROCESS**

PROCESS	PORTION PRE-COMMITTED	PORTION COMMITTED	PORTION COMPLETED	TOTAL
Air Abatement	51%	18%	31%	45
HVAC	64%	8%	28%	39
Compressed Air	51%	26%	23%	157
Fresh Water	54%	33%	13%	24
Hydraulics	42%	25%	33%	12
Pumping	57%	35%	9%	23
Primary Process	53%	26%	21%	87
Refrigeration	59%	24%	16%	37
Secondary Process	43%	13%	44%	70
Wastewater	40%	32%	28%	25
<b>TOTAL</b>	<b>51%</b>	<b>23%</b>	<b>25%</b>	<b>519</b>

Participating projects that address facilities' primary processes comprise the greatest amount of estimated energy savings among processes, at about 74 million kWh (see Table 2.17). That number is nearly four times greater than the savings estimated to result from projects addressing any other process. This finding reflects, in part, the catchall nature of the term "primary process."

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**Table 2.17**  
**ESTIMATED SAVINGS (IN KWH) OF COMMITTED/COMPLETED PROJECTS BY**  
**INDUSTRIAL PROCESS**

PROCESS	PORTION COMMITTED	PORTION COMPLETED	TOTAL
Air Abatement	41%	59%	14,005,363
HVAC	14%	86%	11,445,817
Compressed Air	46%	54%	19,334,119
Fresh Water	67%	33%	2,775,141
Hydraulics	6%	94%	3,281,834
Pumping	67%	33%	3,966,742
Primary Process	22%	78%	74,197,839
Refrigeration	71%	29%	5,074,693
Secondary Process	26%	74%	9,748,514
Wastewater	42%	58%	6,938,916
<b>TOTAL</b>	<b>31%</b>	<b>69%</b>	<b>150,768,978</b>

While projects addressing the primary process at facilities make up only 17% of the total participating projects (at any stage), committed and completed projects addressing the primary process at facilities are estimated to result in almost half (49%) of the total savings from committed and completed projects (Table 2.18).

**Table 2.18**  
**COMPARING PROJECTS AND SAVINGS BY INDUSTRIAL PROCESS**

PROCESS	NUMBER OF PROJECTS		ESTIMATED ENERGY SAVINGS	
	COUNT	PERCENT	kWh	PERCENT
Air Abatement	45	9%	14,005,363	9%
HVAC	39	8%	11,445,817	8%
Compressed Air	157	30%	19,334,119	13%
Fresh Water	24	5%	2,775,141	2%
Hydraulics	12	2%	3,281,834	2%
Pumping	23	4%	3,966,742	3%
Primary Process	87	17%	74,197,839	49%
Refrigeration	37	7%	5,074,693	3%
Secondary Process	70	13%	9,748,514	6%
Wastewater	25	5%	6,938,916	5%
<b>TOTAL</b>	<b>519</b>	<b>100%</b>	<b>150,768,978</b>	<b>100%</b>

Table 2.19 gives the number of ATAC firms that have done studies addressing each industrial process, how many studies the ATAC firm has done of the process and the average cost (in cents) of their studies per kWh of estimated energy savings. For each process, the table shows the range in average study costs per estimated kWh across ATACs addressing the process.

The data in the Table 2.19 were developed by grouping all projects by process and ATAC (e.g., all compressed air studies by Compression Engineering) summing for all projects in each group the total project costs and total project savings, and dividing these two sums to get the average cost in cents per kWh. The number of studies reported in the table's middle column indicates the number of studies from which the average cost was calculated.

## 2. Program Status

**Table 2.19**  
**AVERAGE COST OF STUDIES BY INDUSTRIAL PROCESS AND ATAC FIRM\***

PROCESS	ATAC FIRM	NUMBER OF STUDIES WITHIN PROCESS	AVERAGE COST IN CENTS PER KWH
Air Abatement	Firm 1	3	0.5
	Firm 2	4	0.7
	Firm 3	2	2.3
HVAC	Firm 1	8	0.3
	Firm 2	1	0.6
	Firm 3	1	0.6
	Firm 4	1	7.4
Compressed Air	Firm 1	20	1.1
	Firm 2	14	1.1
	Firm 3	4	1.1
	Firm 4	6	1.2
	Firm 5	2	4.2
Fresh Water	Firm 1	11	7.5
Hydraulics	Firm 1	3	1.6
	Firm 2	1	2.2
Pumping	Firm 1	3	0.4
	Firm 2	1	8.4
Primary Process	Firm 1	11	0.2
	Firm 2	5	0.3
	Firm 3	1	0.6
	Firm 4	1	1.9
Refrigeration	Firm 1	15	1.3
			Continued

PROCESS	ATAC FIRM	NUMBER OF STUDIES WITHIN PROCESS	AVERAGE COST IN CENTS PER KWH
Secondary Process	Firm 1	2	0.5
	Firm 2	3	0.8
	Firm 3	3	0.9
	Firm 4	8	1.3
	Firm 5	3	1.9
Wastewater	Firm 1	12	0.4
	Firm 2	1	0.9

\* Note the ATACs are ordered within each process from lowest to highest average study costs. Not all ATACs worked on all processes, nor do ATACs have the same comparative ranking across processes (for example, a given ATAC does not always have the lowest average cost). Thus, it would be incorrect to interpret the table as reporting that "Firm 1" is the same ATAC for each process. The correct interpretation is that "Firm 1" is the lowest cost ATAC for that process.

The reader will note that for every process except "secondary process," the ATACs with the highest costs have conducted only one or two studies. The current evaluation did not explore the hypothesis that commonly the first one or two studies by an ATAC for a given process cost more in relation to estimated savings than do subsequent studies. An alternative hypothesis is that the PMC directed work away from ATACs that conducted studies at relatively higher costs. Still other hypotheses might be posited and explored. For example, one of the highest average cost values (7.4¢ per kWh) occurred for HVAC. The project addressed evaporative cooling in the metals industry. The other HVAC projects, conducted by two other ATACs, averaged 0.3¢ and 0.6¢, yet none of these other projects involved either evaporative cooling or the metals industry. Thus, it may be project-specific characteristics that drive for the variation observed among average costs.

## 2. Program Status

### 3. PROGRAM IMPLEMENTATION ACTIVITIES AND EXPERIENCES

This chapter describes the implementation activities and the experiences of staff and contractors for the Production Efficiency program. It is based on findings from in-depth, open-ended interviews conducted during January and February 2005 with:

- Two Energy Trust program staff;
- Three staff members of the Program Management Contractor (PMC);
- Staff of all four Program Delivery Contractors (PDCs);
- Nine Allied Technical Analysis Contractors (ATACs) and one vendor conducting program studies; and
- The executive director of Industrial Customers of Northwest Utilities (ICNU).

The nine ATACs include three firms that also serve as PDCs, four firms that sell engineering and design services, and two firms that sell products and services. In addition, we interviewed one vendor that has conducted technical studies for the program. Not interviewed were one additional ATAC that provides engineering and design services and one additional vendor that has conducted program technical studies.

This chapter is organized into the following seven sections, in addition to a summary:

- *Program Accomplishments*—in the eyes of implementation staff and contractors
- *The Energy Trust as a Program Sponsor*—evolution of the Trust in its role as sponsor since its inception in 2003 to the present
- *Contracting Program Implementation*—through a PMC
- *Program Structure*—including subsections on the PMC's role, the PDCs' role, ATAC and vendor roles, and a program process diagram

### 3. Program Implementation Activities and Experiences

- *Program Marketing*—including subsections on the PMC’s marketing role, the PDCs’ marketing role, marketing via ATACs, Energy Trust marketing, and marketing to smaller industrial firms
- *Project Development*—including project identification and scoping, technical analysis, and technical study considerations
- *Integration of Multiple Efficiency Programs*

## PROGRAM ACCOMPLISHMENTS

We asked contacts for their impressions of the program’s accomplishments over the past 18 months. They identified a number of key accomplishments, not the least of which is that the program is available to provide incentives to utility industrial customers for energy efficiency projects related to their production processes. Other accomplishments include:

- ***The ease of participation and simplicity of program requirements.*** The program offers a straightforward calculation of incentives. Incentives for design, installation and materials are calculated for each project to bring the payback of energy-efficiency measures down to eighteen months for the customer, capped at 50% of measure cost. Respondents indicate this approach contrasts favorably with most programs offering comparably large incentives, which often require lengthy incentive negotiations. Program contacts described set incentives as greatly facilitating industrial firms’ organizational decision-making process. Contacts report that set incentives make it very easy for facility managers to get approval from upper management.
- ***Incentive levels adequate to spur action.*** Incentives levels were described as “serious incentives for serious projects.” Contacts described the value of having incentive levels that were high enough to get the attention of decision-makers at industrial facilities.
- ***The ability of the program to generate leads through the marketing by PDCs and effective customer outreach.*** Contacts described more active and effective marketing of the program than they experienced with previous utility efforts. The PDCs all have existing relationships with industrial firms and build on those for program marketing. They also have created new relationships through effective outreach strategies.



### 3. Program Implementation Activities and Experiences

- **The ability of the program to accommodate increased plant output** through changes that increase the energy efficiency of the process and reduce electricity per unit of output. Projects that support this type of change are approved on a case-by-case basis and typically are evaluated for cost-effectiveness, assuming that plant output remains the same.<sup>12</sup>
- **The delivery of large energy (kWh) savings.** According to contacts, the program is expanding and stretching its own limits regarding the size and scope of the projects it will consider.
- **The effective tie-in with the Business Energy Tax Credit (BETC) program.** Participants are utilizing the BETC and BETC pass-through options.

#### THE ENERGY TRUST AS A PROGRAM SPONSOR

Representatives from virtually every organization involved in program implementation noted the Energy Trust appeared more stable and more confident as an organization than it had during the program's start-up phase in 2003. Contacts reported the Energy Trust had matured through launching and managing a portfolio of programs and acquiring energy savings.

A new program manager was hired for Production Efficiency in September 2004. PMC staff have frequent, often daily, interactions with the Energy Trust program manager. They report that the new program manager is very responsive. They described being impressed with his knowledge and his ability to maneuver through the Energy Trust's processes to make decisions and get feedback to program implementers in a timely fashion.

We asked ATAC and PDC contacts how they would characterize their interactions with the staff at the Energy Trust. Few contacts reported interacting with Energy Trust staff directly. Energy Trust staff confirmed this observation and described having had little time to meet with either PDCs and ATACs or participants.

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<sup>12</sup> According to the PMC program manager, lumber mill dry kilns provide a common example. Replacing constant speed motors with premium efficiency motors and variable frequency drive (VFD) controls, where humidity levels control the VFDs, motor energy can be reduced and the time to dry the lumber is also reduced. These efficiencies are the basis for the estimated kWh saved. Second, shortening the drying time provides an opportunity for the kiln to increase through-put using the freed-up time.

### 3. Program Implementation Activities and Experiences

The Energy Trust program manager described his first six months with the program as dedicated to learning about the program design, its implementation, and program metrics and characteristics (e.g., cost of power, levelized costs, payback timelines, types of equipment), as well as learning from the program experiences of his colleagues and supervisor. He worked with the PMC to improve program operation—“simple things, such as responding to questions and getting things signed.” The program manager described the importance of holding contractors responsible while taking those actions necessary to facilitate program activity. As an example, he mentioned his willingness to make decisions while in meetings with the PMC, rather than deferring decisions until he had consulted with his supervisor. He plans to meet with participants in their facilities in the coming year.

Energy Trust contacts recognize they will need to stay responsive to keep program activities and projects moving forward—responsive about simple things like getting signatures and answering questions, as well as by working to keep the program’s momentum up through cooperative activities and building mutual trust with program contractors.

Several PMC and PDC contacts, as well as representatives of large industrial firms, mentioned the issue of equity in program funding—equity in terms of the utility customer sector, participant sizes, industry types, and utility service territories (PGE and Pacific Power)—and expressed concern that the Energy Trust has not provided a clear direction on this issue.<sup>13</sup> Program contacts observed that the Energy Trust is subject to considerable political pressure from diverse parties with divergent views on what constitutes equity. The Energy Trust conducts its formative business in open meetings and receives a high level of input from the OPUC, the Conservation Advisory Council, the Renewable Advisory Council, professional associations and even the legislature.

Program contacts note that this input continues to create intense political pressure on the Trust, which processes the concerns and input it receives and translates them into program designs and procedures. The conflict between securing the most cost-effective energy savings and assuring an equitable distribution of program dollars among customer groups has spurred debate among Energy Trust Board members that appears to some contacts as irresolvable.

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<sup>13</sup> For example, projections indicate an inequity between PacifiCorp and PGE customers, with a shortfall for services to PGE customers by \$2 million in 2005 and the converse for PacifiCorp.

### 3. Program Implementation Activities and Experiences

Contacts noted that the Energy Trust has yet to articulate a policy statement to guide resource acquisition under conflicting objectives. On the one hand, its mandate is to acquire a quantity of energy savings that exceeds those previously acquired in the state, at a cost less than previous acquisitions. On the other hand, it aspires to provide all types of industrial facilities with efficiency services. The PMC and PDCs report they are developing strategies to reach all types of facilities. However, the PMC clearly states it will do so only to the extent that it doesn't affect its delivery goal, specified in its contract with the Energy Trust by a single metric: total savings acquired. Furthermore, the PMC notes that the overall program cost-effectiveness is tied to the cost-effectiveness criteria applied to each project. This criteria is established by the Energy Trust, not the PMC.

However, these issues do not appear to be affecting the perspectives of industrial firms. Representatives of large industrial firms report that their organizations appreciate having substantial efficiency program funding available to them, and several contacts noted the large volume of comparatively inexpensive savings potential in the industrial sector.

## CONTRACTING PROGRAM IMPLEMENTATION

### Energy Trust Contracting with the PMC

The Energy Trust relies on outsourced program management contractors to implement a majority of its energy efficiency programs, including Production Efficiency. The PMC model offers the Energy Trust a way to quickly launch programs that leverage existing marketplace expertise without having to increase Trust staffing. Aspen Systems, Inc. was selected as the PMC for the Production Efficiency program because Aspen Systems was already running the Energy Trust's Building Efficiency program and the Energy Trust was interested in the most expedient path to making a program available to the industrial market. It was thought that leveraging the administrative and marketing efforts already underway at Aspen Systems would result in maximum speed and efficiency in a program launch.

Energy Trust staff report having no concerns about the PMC role in general and feeling confident in the activities of the current PMC. The PMC's contract was due to expire at the end of December 2004; however, it was extended to September 2005.

The PMC and PDCs were dissatisfied with the eleventh-hour timing of their contract extensions. Although Energy Trust staff had reassured them the PMC's contract extension was coming and the PMC said it would extend its contracts with

### 3. Program Implementation Activities and Experiences

the PDCs subsequent to that, all PMC and PDC contacts described the timing as anxiety provoking.

Energy Trust staff explained the contract extension process. It began in May, because prior to that time the program had not been operating long enough to determine the appropriateness of extending the PMC's contract. The decision was deliberated over several months in advisory committee meetings. The Energy Trust Board approved the contract extension in August. The contract between the Energy Trust and Aspen Systems (to continue as PMC) was signed in mid-December. Once the PMC's contract was signed, the PMC signed contracts with the PDCs in the last week of December 2004, renewing them for work starting January 1, 2005.

The Energy Trust staff member interviewed was very satisfied with the service he had received from the organization's contracts group; he attributed the elapsed time from Board approval in August to contract signing in December to back-and-forth between the two parties. In contrast to his highly-satisfied assessment, the PMC contact described the process as improved from the first year of program operation (2003), yet still too long. The PMC contact puts the onus on the Energy Trust and hopes it will continue to improve.

The PDCs did not know the ins and outs of the contracting process and so had no comment on Energy Trust activities. They were distressed, however, that their contract renewal came days before their original contract was to expire.

The contract with the current PMC will expire in September 2005. Prior to the expiration, in May 2005, the Energy Trust plans to release an RFP for program management of the Production Efficiency program. The current PMC is eligible to bid.

The Energy Trust program manager began drafting the new RFP early this year. According to program contacts, the new RFP will likely address some of the issues related to equity by encouraging equitable distribution of projects by both size and geography and seek ideas for new or innovative directions for the program.

At this juncture of re-issuing the program implementation RFP, Energy Trust staff describe themselves as now taking a step back to get the big view of the program and the market. Energy Trust staff want to reassess the incentive structure and expand components of the program, including development of a cost effective approach to reaching smaller industrial firms. (This is already underway; the PMC technical manager—in collaboration with the Energy Trust program manager and with input from the PDCs—has begun to develop plans to serve small firms without overwhelming the program infrastructure.)

#### The PMC Contracting with the PDCs

The PDCs described disappointment about the contracting process with the PMC. In mid-2004, following the Energy Trust’s decision to allocate additional funding to the PMC, the PMC asked the PDCs to prepare marketing proposals addressing what activities they would pursue with additional funds, what accomplishments they expected from these activities, and how much additional money the proposal entailed. Only one of the four PDCs received additional money as a result of this process (ESG’s budget was increased by roughly 50%). The other PDCs reported the PMC neither spoke with them about the content of their proposal or about the decision not to fund their proposals. In short, they did the work to craft a proposal and heard nothing. The three PDCs were disappointed, as might be expected, in not receiving additional funding, but expressed greater dissatisfaction with the absence of communication regarding their proposals.

Concerning the extension of their contract through to September 2005, the PDCs report being told by the PMC—and by Energy Trust staff to whom they turned for reassurance—little other than “don’t worry; it will happen.” As they did not receive signed contracts until a few days before their original contracts were set to expire on December 31, 2004, they described feeling very apprehensive (and having to reassure employees who expressed a lot of anxiety); they wished the PMC had kept them apprised of developments.

#### Duration of Program Contracts

The PMC and PDC contacts think the period for program implementation contracts should be three years, with a proviso cause. Short contract periods (like the roughly 18 month period for the initial PE contract) make it difficult to assess the quality of the contractors’ work in time to renew the contract, divert time and attention from program implementation and raise anxiety among contractor staff. In the words of one contact: “Make it a three-year contract. If I’m doing a bad job, fire me.” Energy Trust staff indicated they intend the next program implementation contract to be for three years.

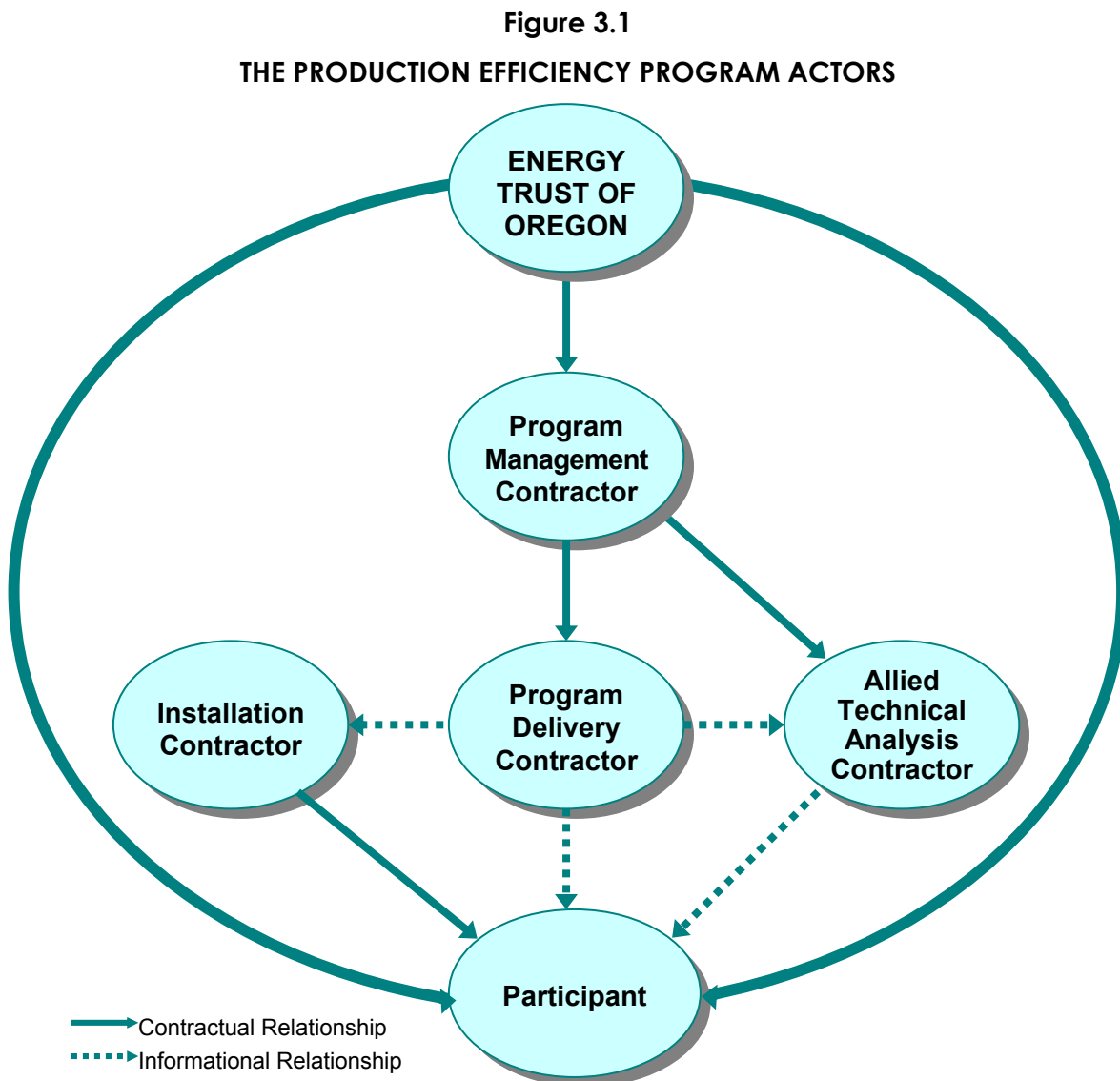
## PROGRAM STRUCTURE

Three major groups work together to deliver the Production Efficiency program to industrial firms: the PMC, the PDCs, and the Allied Technical Analysis Contractors (ATACs). Each group has a specific role and brings a specific skill set to the program. The combined effect is a combination of marketing, engineering and management capacities.

### 3. Program Implementation Activities and Experiences

The PMC was instructed by the Energy Trust to deliver the program via PDCs and ATACs, whose services were to be procured through competitive bidding. The PDCs and ATACs do not have a contractual relationship with the Energy Trust; instead, they operate under contract to the PMC.

The relationships between the PMC, the other program implementation groups, and the participants are represented in Figure 3.1.



### 3. Program Implementation Activities and Experiences

Program contacts describe the relationship between the PMC and the other program actors as “strategic” because each actor brings its own knowledge and skill base to the program. The PDCs are assigned on the basis of either geographic area or industrial type. The ATACs are assigned based on proven technical expertise.

As illustrated in Figure 3.1, the PMC is the hub of information for the program and the Energy Trust is dependent upon them for accurate and timely reporting of the program’s activities and progress. The PDCs and ATACs do not have a direct contractual relationship with the Energy Trust; they work for the PMC, who negotiates their contracts and manages their workflow. The PDCs and ATACs interact with the participants and bring energy-saving projects to the program.

As evidenced by the numbers of efficiency projects identified and completed, the arrangement of PMC, PDCs, and ATACs appears to have worked. However, contacts report working relationships with the PMC that differ in their ease and candor. The PMC has had to determine the best use of the resources housed at each PDC and ATAC, occasionally making decisions that were unpopular with a given PDC or ATAC.

PMC staff indicate an almost constant flow of information between their office and representatives at PDC and ATAC organizations. PDCs and ATACs reported having no joint meetings in 2004 in which they could discuss program activities. PDCs reported gathering together only once in 2004—the PMC called a May meeting of the PDCs to discuss program activities and direction. The PDCs said that they believe the program would benefit from additional meetings of the PDC, where they could discuss creative marketing approaches and industrial efficiency solutions. The PDCs felt they could learn from each other’s successes. As one contact put it: “Periodic meetings would be useful to get all the horses going in the same direction.”

An additional meeting was called by ICNU Executive Director Ken Cannon in January 2005. This meeting focused on coordination issues between the many entities and programs that are targeting industrial firms and was attended by representatives from the Oregon Department of Energy, the Northwest Energy Efficiency Alliance, the Energy Trust of Oregon and the Bonneville Power Administration, as well as the main players in the PE program.

#### **Role of the PMC**

The PMC is responsible for a broad range of implementation activities, including:

### 3. Program Implementation Activities and Experiences

- Overseeing the delivery and implementation management activities of the PDCs
- Coordinating the work of the PDCs and ATACs to manage the pace of marketing and developing outreach approaches in coordination with the Energy Trust
- Assisting vendors, engineering firms and contractors to integrate incentive offers with their products and services
- Assigning and contracting for technical analysis studies
- Processing incentives and disbursing checks
- Developing and maintaining a system for tracking projects and reporting their progress monthly
- Ensuring the program delivers on energy saving goals
- Ensuring the program stays within budget

The PMC Production Efficiency team consists of one full-time staff member—the Production Efficiency Technical Manager—assisted by three other staff members who also support the Building Efficiency program. These staff members include the manager of the PMC office, who is the General Manager of both programs.

The General Manager provides day-to-day oversight of the PMC staff, but is not responsible for day-to-day operations. He described fielding disruptive questions and completing administrative reports so that these requests do not interfere with the work of the program staff. The PMCs' Operations Manager supports the program by tracking program data and monitoring program status and contract compliance, as well as processing incentive and contract payments. The Operations Manager focuses on providing the data tracking and analysis required to implement the program and assure it is on target for goal attainment. He relies on an Aspen Systems- created spreadsheet to track completed 430 and 440 forms and enters data into the Energy Trust's *FastTrack* database as needed to process incentive requests



### 3. Program Implementation Activities and Experiences

and checks.<sup>14</sup> The third staff member is the Administrative Coordinator, who provides administrative support to both programs and to the PMC office generally.

The Program Technical Manager is critical to the implementation of the program. He is responsible for the central activities of the program, including:

- Managing the contracts with the four PDCs, providing direction and feedback and reviewing their monthly status reporting
- Managing the contracts with the ATACs and providing direction and feedback
- Reviewing project scoping studies to determine whether a follow-up technical study is warranted
- Developing the scope of follow-up technical studies and selecting an ATAC from whom to request a study proposal; reviewing the ATAC's proposal to conduct the study, then negotiating the scope and price; and, finally, contracting with the ATAC to conduct the study
- Reviewing technical studies for accuracy and effective communication style; providing feedback and direction to the ATAC until objectives of the study have been met
- Signing incentive offers (Form 420), project review (Form 430), and project completion forms (Form 440)
- Meeting with participants onsite and by phone as needed to discuss the program and their efficiency projects

Program contacts at the PMC report that they are proud of the program's accomplishments and describe working hard to funnel a large volume of energy savings through a small staff. While contacts report that the staff is busy, they also feel they are able to manage the work flow generated by the program.

This finding of adequate PMC staffing contradicts a conclusion reached by the first process evaluation based on the program's experience in 2003. Although the merits of that conclusion might have been debated by some at the time, program conditions

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<sup>14</sup> According to the PMC, its database is considered to be very complete and accurate by Energy Trust staff charged with creating the *FastTrack* database. Energy Trust staff reportedly used the PMC's database to debug *FastTrack* during its initial implementation.

### 3. Program Implementation Activities and Experiences

have changed since 2003 and the burden on PMC staff has lessened. In 2003, the program was in start-up mode; the PMC was designing program forms and procedures, negotiating PDC and ATAC contracts, providing contractors with direction, marketing the program to some facilities, and was involved in protracted negotiations concerning an extremely large project. These activities were in addition to the ongoing work of negotiating the scope and cost of technical studies, approving studies and committing to participant incentives. This latter set of project activities were at a frenzied pitch in 2003 as a result of the four-cent per kWh incentive kicker offered to projects that committed by the end of the year. Thus, the current finding that the PMC is adequately staffed appears reasonable in light of its experience in 2003.

#### Role of the PDC

The role of the PDC is somewhat comparable to that of account executives for utility efficiency programs, albeit with a few added responsibilities. PDCs are expected to: market the program to both high and mid-level management in industrial companies; provide thorough facility scoping services; review technical analysis studies; offer assistance to participants with program-related paperwork; and assist participants with applications for state tax credits (BETC applications) as requested.

The program relies upon four PDCs to market the program and provide assistance to participants. The four PDCs are:

- ***RHT Energy Solutions.*** RHT serves southern and central Oregon (the area south of Eugene and Redmond) from their office in Medford, Oregon. The founder of RHT formerly was a utility account executive.
- ***Harris Group.*** Harris originally was charged with pulp and paper and primary metals facilities located anywhere in the state, and all other wood products facilities located in northwest Oregon. In mid-2004, the PMC changed Harris' scope; it retains sole responsibility for pulp and paper firms anywhere in the state and now shares responsibility with other PDCs for primary metals and wood products.<sup>15</sup> They serve these participants from a Portland, Oregon, location.

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<sup>15</sup> As a practical matter, most interviewed contacts described the change in terms of Harris having lost the primary metals and wood products markets.

### 3. Program Implementation Activities and Experiences

- **Cascade Energy Engineering.** Cascade serves eastern Oregon through an office in Walla Walla, Washington, and industrial firms in central Oregon north of Redmond from its office in Portland, Oregon. Cascade has particular expertise in refrigeration, compressed air, pumping and food processing.
- **Efficiency Services Group.** ESG, a subsidiary of Portland General Electric, focuses on industrial firms in northwest Oregon, exclusive of pulp and paper. They serve the Willamette Valley north of Eugene to the coast from their office in Tigard, Oregon.

#### Roles of the ATAC and Vendors

The program's Allied Technical Analysis Contractors (ATACs) provide technical analysis studies of facilities' prospective projects. Each ATAC is under contract with the PMC to provide such studies. Each individual study is launched when the PMC accepts a bid submitted by the ATAC for a scope of work and a not-to-exceed cost proposal.

There are currently ten ATACs that support the program through their technical studies. The ATACs vary greatly in size and background, and include engineering firms, equipment vendors and three of the four PDCs. In addition, the PMC occasionally asks two particular equipment vendors that are not under contract as ATACs to conduct technical studies. The studies conducted by non-ATAC vendors address the replacement of a single piece of equipment with a more efficient version.

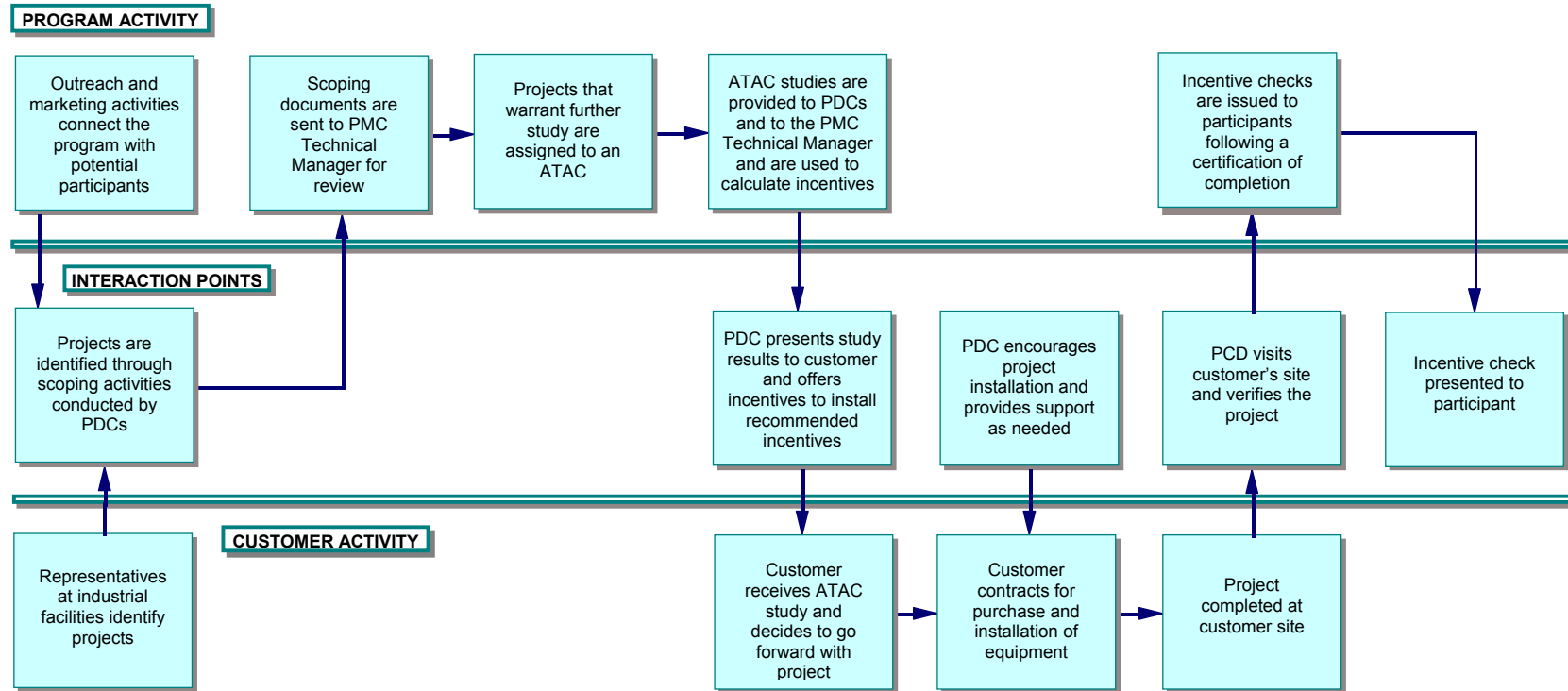
In most cases, the PDC has preliminarily identified an efficiency project through a scoping study. The ATAC conducts a more detailed study of the opportunity the PDC identified. On occasion, the ATAC brings the project opportunity to the PMC or the PDC and then is awarded the technical study.

#### Program Process Diagram

The process diagram (Figure 3.2) reflects a relatively streamlined program design, particularly given the size and complexity of many industrial energy efficiency projects. The upper section of the diagram represents the activities undertaken by the program directly (through the PMC, PDCs and ATACs) and the lower section illustrates the activity required of participants. The center section of the diagram represents the points of participant/program interaction.

### 3. Program Implementation Activities and Experiences

**Figure 3.2**  
**PROGRAM PROCESS DIAGRAM**



### 3. Program Implementation Activities and Experiences

The diagram highlights the central role played by the PDCs, who are involved in each of the points of customer contact: scoping; presenting the ATAC study; project support; and post-project inspection. Some PDCs report that they also hand deliver incentive checks.

While it is possible that complicated projects will go through the study process more than once or require more analysis in scoping, the diagram makes clear that the program facilitates much of the study and cost calculations for participants. The Production Efficiency program design includes only one point of significant deliberation: the customer's decision to go forward with the project. This contrasts with the typical industrial efficiency program that has multiple points of significant deliberation for both the sponsor and the customer: the sponsor's and customer's decision to pursue a technical study, the sponsor's and customer's negotiation of an incentive, and the customer's decision to accept the negotiated offer.

The Production Efficiency program is also distinguished by the role of “project champion” that the PDCs often play. The PDCs often are discussing the facility's needs, the program incentives, and the project with both technical and financial/executive staff. In contrast, utility programs typically were marketed by the utility account manager to one person in the organization, frequently a facilities engineer, who had to champion the project to management.

## PROGRAM MARKETING

The Production Efficiency program leverages the relationship between vendors and engineering firms and their industrial customers by enlisting the help of these market actors in identifying potential projects and bringing them to the program. In this sense, marketing encompasses virtually all customer contact activities from project identification to delivering incentive checks.

### The PMC's Marketing Role

The PMC is responsible for recruiting of a diverse sales force (the PDCs) and managing the pace of marketing. The PMC provides oversight of PDC and trade ally marketing activities, but most of the direct marketing activities are under the purview of the PDCs.

### 3. Program Implementation Activities and Experiences

#### The PDCs' Marketing Role

PDCs are the marketing arm of the program and are responsible for all program activities having a customer-contact component or intent. PDCs contact industrial firms, identify projects and perform scoping studies for facilities, helping them through the program participation processes until the project is complete and the project incentive is paid. The level of support required varies among participants and may include completing program and BETC forms, framing the costs and benefits of a project for decision-makers, or simply maintaining communication.

The PDCs relied mainly upon existing relationships with industrial firms to identify the first wave of potential projects. PDC firms all had a variety of relationships within Oregon's industrial market stemming either from that firm's engineering expertise or from the experience of staff in managing and implementing utility energy efficiency programs in the past. PDCs have also attracted new industrial firms and established relationships with them, primarily through word of mouth, earned media (newspaper articles) and luncheon meetings designed to inform the market of the program opportunity.

Existing relationships are a powerful tool for implementers of energy efficiency programs. Nonetheless, key contacts at both the PDCs and at the PMC acknowledge that future program activities will increasingly depend upon establishing new relationships with industrial firms that are not yet served by the program. Establishing new relationships will likely to require more active marketing and networking on the part of the PDC, although the PMC technical manager is working to develop tools that vendors can use to identify program-eligible opportunities.

Also looking forward, interviewed contacts believe that past participants will likely be a significant source of future projects. Contacts report that there are many firms with which the PDCs have established strong, ongoing relationships. Contacts described how many of these firms are involving PDC staff in the earliest stages of project development, when the firm is articulating its desire for changes to its production process and capacity. Interviewed contacts are optimistic that the program will continue to attract very large projects that result in improved manufacturing efficiency, as well as increased energy efficiency.

All of the key contacts we spoke to acknowledged some tension between the occasionally competing priorities of the Energy Trust. They spoke of struggling to balance the size and number of projects, geographic diversity, industry diversity and equity concerns in general in light of the pressure to achieve the most cost-

### 3. Program Implementation Activities and Experiences

effective savings that meet aggressive program goals. These concerns are likely to affect the shape of future marketing plans.

#### Marketing via ATACs

The program was designed with the view that the ATACs as well as the PMCs would identify project opportunities. This design arose from the desire to take advantage of the ATACs' customer relationships and capacity to market the program along with marketing their services.

In the first six months of the program (in 2003), ATACs reported actively marketing the program. However, the process evaluation completed in early 2004 found that all ATACs that were not also PDCs reported having "lost" multiple energy study projects to either combination PDC/ATACs or to other ATACs. These alternative firms were recommended to conduct the study by the PDC in its scoping report to the PMC. Interviews with ATACs for the current evaluation found that most no longer market the program, but conduct studies solely for projects the PDCs scope. The studies conducted by non-ATAC vendors typically serve opportunities that the vendor had identified.

We spoke with representatives from six exclusively ATAC firms (that is, ATACs that did not also serve as PDCs) and one vendor who conducts technical studies for the program. Of these seven contacts, only one reported marketing the program. Three contacts stated they promoted the program to their customers when appropriate and the other three said that they did not market the program at all. ATACs who were also equipment vendors were more likely to report marketing or promoting the program than those with an engineering focus.

#### Energy Trust Marketing

In addition to the direct marketing conducted by the program implementers, the Energy Trust also markets the Production Efficiency program as part of its larger effort to inform the public about the organization generally and program opportunities specifically. Energy Trust communications staff members produce brochures, case studies and other collateral to support dissemination of program information. News releases and case studies related to Production Efficiency are posted on the Energy Trust website and are distributed by email newsletter.

Communication and marketing staff members at the Energy Trust identify opportunities to present information about the Energy Trust and its programs to audiences throughout the state. Each week, a schedule of activities is distributed to

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interested parties listing seminars, public meetings, conferences and other events that Energy Trust or program representatives plan to attend. Additionally, advertisements, articles and newsletters are identified so that those involved in program implementation and management know what information may be driving people to ask about a program.

These schedules reveal a high level of marketing and public speaking activities that include outreach to trade allies, participation in regional energy efficiency activities, representation at relevant conferences and leveraging utility forums. Throughout most of 2004, the Energy Trust ran an ad in the Associated Oregon Industries *Viewpoint* magazine describing commercial program opportunities, including the Production Efficiency program.

In addition to these activities, the Energy Trust's Executive Director has visited the facilities of a few large participants at the request of one of the PDCs. According to the PDC contact, the Executive Director deserves praise "for traveling down and personally connecting with these businesses, for being willing to learn about the details of their projects and what they are doing. She sticks her nose in. They love it. This is worth a lot. Relationship-building is one of her strengths."

#### Marketing to Specific Types of Firms

##### *Smaller Industrial Firms*

As stated, by all accounts, the PDCs have been highly successful in marketing the Production Efficiency program to large industrial firms. The PMC technical manager—in collaboration with the Energy Trust program manager and with input from the PDCs—is developing plans to serve small firms without overwhelming the program infrastructure. PDCs currently spend considerable time in all three phases of an efficiency project: 1) creating customer interest; 2) identifying a specific project; and 3) working with the participant through project completion. Program contacts universally noted that increasing the participation of small industrial firms would likely reduce the program's overall cost effectiveness, as the potential savings at a small facility is much less than at a large one, yet the administrative costs of marketing to and serving the facility are only somewhat lower than the administrative costs of serving a large facility.

The current study attempted to compare the size distribution of program participants with the size distribution of industrial firms served by the Energy Trust in order to gauge how successful the program has been to date in reaching firms of various sizes. We approached the investigation from two methods, neither of which was fruitful.



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First, we sought to obtain from the Energy Trust annual kWh consumption for the industrial firms served by PGE and PacifiCorp, including the program participants. The Energy Trust does not have consumption data on firms that are not program participants and the data for program participants was not available in time for the evaluation.

Second, we sought to approximate facilities' annual kWh consumption by using a multiplier of estimated kWh consumption per employee by industry. We obtained estimates of kWh consumption per employee by industry from the Northwest Energy Efficiency Alliance. We obtained a list of industrial facilities in Oregon that included for each facility its name, address, zip code, industrial classification code and number of employees.<sup>16</sup> We sought to match each program participant to the facilities on this list, but were successful for only about one-third of program participants.

Consequently, our evaluation does not shed light on the size distribution of facilities served by the Production Efficiency program. Chapter 2 presents information on project size, yet project size bears no strong relation to facility size.

#### **Semiconductor Firms**

One research question raised by Energy Trust staff at the outset of this evaluation concerned the extent to which firms in the semiconductor industry—which vies with the pulp and paper industry as one of the state's two largest employers—are participating in the Production Efficiency program. As of the end of 2004, firms designated as “High Tech” in the PMC's project database comprised 8% of all PE projects and 8% of estimated program savings.

Program contacts suggested semiconductor projects are underrepresented among program participants due to the characteristics of the facilities—they are relatively new and, as a consequence, have fewer efficiency opportunities than firms in other industries with much older facilities, like pulp and paper.

Research conducted by the Northwest Energy Efficiency Alliance (the Alliance) has found potential for electricity savings at every fabrication facility (fab) that has

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<sup>16</sup> This list was not purchased for the current evaluation, but rather had been purchased by one of the evaluation team members for a recent evaluation of another program.

### 3. Program Implementation Activities and Experiences

participated in their programs.<sup>17</sup> The potential lies in the chilled water and air distribution systems serving the clean rooms. In addition, the Alliance has determined that similar efficiency opportunities exist for other industries using clean rooms; these include biotech, pharmaceuticals and food processing.

The research conducted by Research Into Action for the Alliance suggests that currently there are no new fabs planned for Oregon other than a new R&D facility under consideration by Intel. However, it is likely that existing fabs will be renovated, as was Fab 2 by HP, a project that was included in Production Efficiency. There are likely to be upgrades at the Intel campus and others over the next few years.<sup>18</sup>

#### The Role of Incentives

The evaluation team asked contacts about the role of the project incentives and the non-energy benefits in participant decision-making. Contacts believe the incentives are critical to program acceptance, in contrast to functioning as an “attention grabber.” They expressed the view that, while the value of project non-energy benefits is often substantial and may even exceed the incentive amount, non-energy benefits are not able to trigger project commitment.

Contacts identified uncertainty surrounding non-energy benefits as the primary reasons they do not carry the weight of monetary incentives in participants’ decision making. As true for energy benefits, non-energy benefits associated with changes to the production process tend to be larger than those associated with equipment replacements. Often times, facility staff can only guess the extent to which the change in process will affect labor requirements or will reduce processing time, freeing up equipment for more through-put, or will reduce the proportion of poor quality output. Commonly, non-energy benefits that result from an efficiency project were not even anticipated by facility staff.

Facility management must allocate funds between numerous projects that compete, to greater or lesser extent, on the basis that the project is needed to improve facility operations. The monetary incentive associated with the efficiency measure makes the sale, in the opinion of contacts. Nor do contacts believe the program should

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<sup>17</sup> Peters, et al., 2001. [www.nwalliance.org/resources/evalreports.asp](http://www.nwalliance.org/resources/evalreports.asp), under evaluation reports for Industrial, Market Progress Evaluation Report, No. 1 (11/01), E01-089.

<sup>18</sup> Peters, et al., 2003. [www.nwalliance.org/resources/evalreports.asp](http://www.nwalliance.org/resources/evalreports.asp), under evaluation reports for Industrial, Market Progress Evaluation Report, No. 2 (6/03), E03-117.

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attempt to lower the financial incentive by quantifying for the participant monetary savings expected for non-energy benefits, as participants would have low confidence in the estimates of savings.

One observer thought perhaps the most useful role of non-energy benefits might be in eliciting facility interest in the PE program. Often, a facility manager seeks to reduce product losses, increase productivity or achieve some benefit. The discussion of non-energy benefits provides an opening for an exploration of process changes, and process changes often provide opportunities for efficiency improvements.

Contacts expressed the view that program participation might not be appreciably reduced were the Energy Trust to lower the incentive level somewhat, but they were reluctant to make a firm prediction. A few contacts said, “An incentive of 40% might work.” Contacts were in strong agreement that PE’s success is owed in large measure to the fact that industrial firms know what incentives they can count on from the program, being: 1) non-negotiated; and 2) stable over time. The Energy Trust should avoid frequent changes to the incentive level, sudden changes (i.e., without extensive advance notice), and program starts and stops as a means of managing annual program expenditures. Decision-making for complex industrial projects can be protracted and sometimes span several years; when project incentives change part-way through firms’ internal deliberations, efficiency projects often get scuttled.

In the latter half of 2004, the PE program added a two-cent per first year kilowatt hour savings for measures with paybacks less than 18 months. The PMC technical manager reported that, as of the end of the year, the program had conducted only two projects with paybacks less than 18 months. Nonetheless, contacts liked the incentive. One contact expressed the view that the two-cent incentive might “prime the pump” for participants, subsequently leading to longer payback projects. Another contact suggested that short payback, low-cost projects might be the only projects some smaller firms would be interested in. “The Energy Trust is buying two cents of goodwill,” this contact said approvingly.

## PROJECT DEVELOPMENT

### Project Identification and Scoping

Project identification typically is initiated by an interested facility. A PDC representative may also contact a facility with information about the program opportunity by using existing relationships in their service territory or market. Alternatively, a vendor (or less frequently, an ATAC) may identify a project after

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being contacted by a facility and completing a bid to replace or repair equipment in which they specialize (for example, compressed air or dust collection). A facility may also contact the program directly after hearing about the incentives in a public meeting, through an advertisement or through a friend or colleague. Electric utility account executives are also aware of the program and may occasionally bring customers to the PDC, introducing the parties and even participating in initial meetings.

Potential projects can be identified in a variety of ways, through the project phase known as *scoping*. Specific projects can be identified by the potential participant, who is often aware of the most energy-intensive processes on their site or of particular project opportunities that they've not been able to implement. Program representatives may also identify projects after meeting with the facility representative and/or by walking through the site. Occasionally, previous engineering studies will be available for review by program representatives and can be referred to during the identification or scoping period.

In the process of scoping for opportunities, the PDC will obtain a utility customer release (Form 400) that allows for access to previous utility-sponsored studies and to the customer's electricity billing history. The information gained through these initial conversations, the billing history and other scoping activities is used to create a scoping study, prepared by the PDC at no cost to the participant. On occasion, a large part of the information contained in the scoping study will have been gathered by a vendor who has referred a customer to the program after identifying a project that might qualify for incentives.

The program design team originally intended the scoping studies to initiate the program participation process and narrow the purview of subsequent technical studies to the qualifying measures of most interest to the facility representative. In practice, the scoping studies as originally conceived proved too limited. An initial energy savings analysis was added to the scoping document following requests from participants who desired the estimates to support their decision to move forward and because the Energy Trust desired early indicators of program savings and expenditures to assist in program tracking. Thus, rather than simply initiating a series of studies, the scoping study has evolved to be a "terminal" study in many cases; that is, the study that supports the Energy Trust's commitment of incentive money and the facility's commitment to proceed with the project.

## Technical Analysis

The scoping document is delivered to the PMC Program Technical Manager. The Program Technical Manager reviews the study and determines whether a more detailed analysis is warranted. If he determines that it is, he assigns an ATAC to perform the study and negotiates the scope and cost of the study with the ATAC. The level of detail and cost of the study depends upon the complexity of the project, but is also influenced by the fact that participants receive a technical analysis (TA) study without cost if they begin to install at least one measure (that either qualifies for an incentive or that has a payback of less than 18 months) within six months of study completion. To request a study, facilities must commit to paying 50% of the study cost should they choose not to install any of the recommended measures.

Being potentially liable for up to 50% of the cost of the technical study increases the likelihood that the industrial firms who sign up are serious about implementing their projects; it also creates pressure to do projects with the least amount of technical study possible. One ATAC commented on this pressure, noting that it was very hard to persuade participants to agree to a detailed study following completion of a shorter study, which typically costs about \$3,000. Yet this ATAC believes reliance on the short scoping studies may result in lost opportunities, as the short studies are best suited to equipment change outs and inadequate to identify opportunities for more comprehensive or systemic efficiency improvements. The issue of lost opportunities is discussed more fully below.

A second issue—in addition to that of potential lost opportunities—hinges on the level of detail in the studies that support participant and Energy Trust commitments to proceed. For the program to be successful, the technical analysis work needs to result in reasonably accurate estimates of energy savings that assure the program is paying incentives to projects that actually save energy at predicted levels. Therefore, the level of technical analysis and review ultimately conducted is a central issue for program managers and requires constant monitoring.

Balancing the certainty available in detailed engineering studies (and the budget required for such technical study) with the amount of funds left for project incentives will continue to be an issue for the program. The Energy Trust and the PMC describe wanting to keep the administrative costs associated with technical studies low to assure that the program is as cost effective as possible. However, everyone involved acknowledged the studies must be conducted at a level sufficient to accurately estimate energy savings.

This evaluation explores the issue of study technical reliability from two approaches. First, as described in this chapter, we asked program contacts several

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questions about the level of technical review they typically conduct, whether participants are well served by the studies, whether the studies are detailed enough for the program and whether the level of study is adequate for the program. Then, we assessed whether the technical studies and project documentation support the need of an impact evaluation. To do so, we developed, through onsite investigations, savings realization rates for the projects completed through September 20, 2004. This analysis is presented in chapter 7, with chapter 6 detailing the methodology used.

Contacts generally report that the studies provide information at a level that is adequate for Energy Trust decision-making, but were mixed in their opinions about whether or not participants were being well served by the studies. Several contacts noted they had seen examples of both excellent and poor studies and thought that in general the program seemed to be striking the right balance. Others voiced concerns about the actual margins of error contained in the studies and whether or not the assumptions embedded in the studies are valid. These contacts expressed concern that they had seen inconsistencies across studies in the estimation of both baseline consumption and measure savings.

At the same time, contacts stated they understood the dilemma faced by the program regarding the appropriate level of study. One contact said he knew the program wanted streamlined, barebones studies, so he created study budgets and scopes that would meet with program approval. Ultimately, the adequacy of the program technical studies is reflected in the realization rate, discussed in chapter 7.

Responses were similarly mixed when we asked contacts about whether the studies were detailed enough. Four contacts said that the studies were detailed enough to support decision-making. Contacts used various statements regarding the study precision, referring to the studies variously as accurate to within plus or minus 10% of costs, plus or minus 20%, and plus or minus 40%. Generally speaking, it appeared that contacts involved in detailed technical studies (as opposed to scoping studies) tended to speak of 10% and 20% bands. One contact emphasized that for complex projects, which are supported by detailed technical studies, it is standard business procedure for industrial firms to get a “second opinion” before pursuing the work. Thus, he believed the detailed studies are sufficient to support decision-making and that industrial firms are not naïve, but instead actively protect their own interests.

Six contacts were circumspect in their responses regarding the adequacy of study detail, noting that the level of detail required was unclear—due in part to the lack of formal requirements and because participants are asked to pay for 50% of detailed studies. According to one contact, “The cost share is an attempt to tell the

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customer: if you want a lot of engineering done, you'll have to pay for it." Another contact said he was "still wrestling with how much rigor is required for society."

We also asked ATAC contacts whether or not the compensation they receive for the studies is adequate. Responses were mixed. Several ATAC representatives—typically equipment vendors—described using the studies as a marketing tool, so the compensation for the studies is less important than the connection with the customer. Others, particularly consulting engineers not involved in selling products, said that it was occasionally difficult to fit all of the right information into a \$3,000 study. ATACs who are also PDCs have some ability to augment their ATAC work with their PDC budget for project review.

#### Technical Study Considerations

The program is implemented now without clear guidelines about several technical issues, including: measure life; conversion factors; motor efficiencies; contingencies for costs and savings (or derating savings); energy rates to use; role of peak demand (kW); and non-energy benefits. We asked ATACs about the level of technical guidance they received from the program. Several ATACs reported not needing technical guidance since they were regarded as experts in their field. Other contacts lamented the lack of a standardized process or a uniform toolkit for developing the studies. These contacts believe instituting a third-party review of studies could ensure that projects are not based on inconsistent approaches to calculating energy savings. Still others said that while the process was not standardized, they had determined their approach through trial and error, and were now comfortable with the expectations of the PMC technical manager.

#### Demand Savings and Non-Energy Benefits

We asked contacts specifically about the role of peak demand savings (kW) and non-energy benefits in their reports.

Technical studies may or may not include peak demand savings. As shown in chapter 7, 18 of the 30 largest projects completed by mid-September 2004 included kW savings estimates. These estimated energy savings reported in the program tracking database for these projects comprise 41% of the savings estimated for all 30 largest projects. Among the 24 smaller projects completed by September, about one-quarter directly provided kW savings estimates (primarily studies done by one ATAC) and another quarter provided kW estimates for various time periods or operating conditions before and after installation of the measure, from which a project kW savings estimate might be derived. According to Energy Trust contacts,

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on multiple occasions the Energy Trust has asked the PMC to report demand savings.

Contacts said they often do not include estimates of demand savings because such savings are generally not viewed as a high priority for energy projects in Oregon. According to the ATAC representatives, reporting anticipated demand savings is risky since it is often less predictable and can be easily misused. As one contact noted, “The PDCs ask us not to report kW. Not including demand results in a conservative estimate of project benefits. And it’s harder to predict.”

Contacts report they frequently discuss anticipated non-energy benefits with participants; these may or may not be reported in the studies and are seldom, if ever, quantified. Contacts believe non-energy benefits are an important part of the corporate decision-making process. Contacts said the program’s financial incentives serve to interest potential participants in the project and overcome financial barriers, but the final decision is often based on something other than energy savings (such as decreased maintenance, more uniform production conditions or improved staff utilization).

These contacts believe the program should continue to list non-energy benefits qualitatively, without quantifying them. The complication of negotiating a dollar value for non-energy benefits was viewed as likely to increase the complexity of the participation process. Increased complexity would undermine a major strength of the program—simplicity of participation. According to program contacts, quantifying non-energy benefits would also drive up the costs of study activities, leaving fewer dollars for project incentives. Several contacts noted that regardless of whether or not non-energy benefits are quantified, they often make the difference in whether or not projects go forward:

- *“Like any other project, non-energy benefits rule the day,”* said one contact.
- *“Larger corporations are hiring energy managers who know about decreased maintenance, increased production time, the benefits of expansion and reliability. These things are probably quantified internally.”*
- *“Customers are sophisticated; they know that there are multiple benefits. These are recognized, even if they are not always quantified.”*

#### **Lost Opportunities**

Some contacts expressed the opinion that the program delivery approach serves as a barrier to more comprehensive studies. The way the program is currently



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implemented, the PDC conducts all interactions with the industrial firm and the ATAC is relegated to the strictly technical role of delivering a study to the PDC and PMC. The study scope is generally focused on a single opportunity, as determined by the PDC.

In the process, the PDC is *de facto* the gate keeper. One ATAC in particular noted that based on his investigations for the short (e.g., \$3,000) studies, he many times is able to formulate a persuasive technical rationale for exploring additional efficiency improvements through a detailed study. But he has been unable to present such rationale to the participant, since he hands off his study to the PDC, who delivers it.

Although only one interviewed ATAC spontaneously elaborated on the barriers to detailed technical studies and the consequent greater potential for lost opportunities, this view was supported by the comments of most interviewed contacts. The PDCs and ATACs that specialize in engineering analyses all expressed frustration that the reliance on short studies limits the identification of comprehensive or systemic approaches to energy savings.

The PDCs that do not specialize in engineering analyses, and the PMC technical manager, agreed the program relies on short scoping studies, yet they view this too as a program strength. They note that the short studies contribute to low project administrative costs, facilitate short project turn-around times (by reducing both time spent in deliberation and project execution)—which benefits both participants and the program—and can serve as a foot-in-the-door that may lead in the future to more comprehensive projects. They also note the studies address items the participants have expressed interest in, and that other measures are suggested if they become apparent during scoping or through technical review.

One contact was firm in urging the program to “stay out of the customer’s head” and allow them to gain experience through successful projects that are straightforward and fulfill expectations. According to him, and other contacts, completing one project is the best way to prepare participants for additional projects and that for the large firms, it is acceptable to do one project at a time.

#### **Study Format**

The program operates without a uniform toolkit for technical studies. The contacts we spoke to described being confident in their own abilities to assess the technical details of a project, but several did note the lack of a standard format or clear expectations. Contacts were more likely to describe wanting clear expectations if they had been told their studies were problematic for some reason or if the relationship between themselves and a PDC or staff at Aspen Systems had become

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strained. The lack of a uniform toolkit, report standards or formatting requirements also poses a challenge to an evaluation of program impacts; inconsistent reporting approaches can make essential information difficult to identify. Chapter 7 addresses this issue in more detail.

## INTEGRATION OF MULTIPLE EFFICIENCY PROGRAMS

The industrial facilities served by the Energy Trust are potentially eligible for incentives through various Trust programs:

- *Production Efficiency Program*—industrial process equipment
- *Building Efficiency Program*—facility equipment, such as lighting, HVAC, motors
- *New Building Efficiency Program*—new construction or major renovations
- *Renewable Energy Program*—includes making use of industrial waste (e.g., heat, biofuel) to reduce demand on the electrical grid
- *Efficient Facility Operations Program*—commissioning of facility equipment (program coming online in 2005)

These programs are implemented through multiple PMCs and, in the case of industrial renewable projects, by Energy Trust staff.<sup>19</sup>

The facilities are also eligible for two programs offered by the State of Oregon’s Department of Energy:

- *Business Energy Tax Credits (BETC)*
- *Small-scale Energy Loan Program (SELP)*

Through 2004, facilities also could be served by the investor-owned utilities through the “transition programs”.

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<sup>19</sup> Aspen Systems is the PMC for both the Production Efficiency and Building Efficiency programs. SAIC is the PMC for the New Building Efficiency program. The implementation contractor for the Efficient Facilities Operations program has yet to be selected.

### 3. Program Implementation Activities and Experiences

Finally, the question arises as to how well these programs are integrated with respect to both marketing to potential participants and delivery of services to participants.

PDCs report they look for opportunities for projects to improve their customers' facility energy use and obtain incentives through the Building Efficiency program. One PDC, in particular, has a strong relationship with a large wood products firm that has conducted numerous projects through PE. This PDC also coordinates the firm's purchases of efficient motors through the Building Efficiency program. The Production Efficiency section of the Energy Trust website devotes a page to what it terms "standard incentives" (also known as prescriptive incentives) for motors and lighting equipment, as well as a page describing custom incentives. A firm accessing the website sees as a single program, incentives that are administered and tracked through separate programs (BE and PE).

The PMC and one PDC reported conducting pilot projects with the Renewable Energy program. Although the projects took several months to negotiate, as the Energy Trust's policy regarding such projects is not fully defined, both contacts reported the program staff were very open to their ideas and worked with them to bring the projects to fruition.

Contacts did not report experiences with New Efficiency program. Contacts did express some concern about the potential for participant confusion for firms that might want to pursue projects that are served by different programs. Potential for confusion begins with who to contact for the programs (simplified for Production Efficiency and Building Efficiency, which are currently implemented by a single PMC), to eligible measures, incentive amounts and participation procedures.

Regarding who to contact, the Energy Trust Director of Energy Efficiency noted the Trust has chosen to implement programs serving a single market sector (commercial/industrial) through several PMCs, since one of the Trust's goals is to develop Oregon's infrastructure (i.e., technical and market expertise) for delivering energy efficiency.

The Production Efficiency program appears to be well-integrated with the state's BETC (tax credit) program. The PDCs describe providing participants with assistance throughout the project implementation phase; some of this assistance takes the form of preparing, or helping to prepare, BETC application forms. According to surveys conducted with the participants completing the first 53 PE projects (see chapter 5), about two-thirds of participants submitted BETC applications. None of the participants submitted SELP applications, explaining they were not interested in loans.

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The current evaluation team member who conducted the project onsite investigations (described in chapter 7) also conducted an impact analysis of the Transition Program run by the utilities. The investigator estimates that roughly one out of five Transition Program participants was aware that efficiency incentives continued to be available through the Energy Trust.

#### SUMMARY

Program actors are proud of the accomplishments of the Production Efficiency program and see a continued need for the program to facilitate energy efficiency projects in the industrial sector. The simplicity of the program is appreciated by those who market it to industrial firms and appears to be a key factor driving customer acceptance.

The PMC reports that it has received additional, requested direction from the Energy Trust. The PMC and PDCs continue to report that the Energy Trust has not provided clear guidance on how to prioritize or accommodate potentially competing objectives, such as total savings obtained, cost of savings and who generates the savings (the issue of customer equity). However, PMC and PDC staff also say they are sensitive to all of the program objectives and direct efforts towards meeting each.

It appears that program processes are better understood by PDCs and ATACs than they were a year ago; however, there are still some areas of process confusion. Specifically, ATACs expressed continued confusion and dissatisfaction about the process of assigning projects to ATACs. ATACs also think participants may lose opportunities to learn more about their facility when the PDC delivers the technical study rather than the ATAC, as is standard practice. The role of the ATAC in marketing the program appears to have declined since last year, replaced by the PDC as the virtually sole marketing arm of the program.

The program relies primarily on short technical studies. Contacts expressed divergent viewpoints on this reliance. The short studies benefit the program by keeping administrative costs down and increasing the likelihood that total project turn-around time will be short (due to less time spent studying the project, deciding to commit and implementing the project). Other contacts argue the short studies may do a disservice to the program to the extent that a short study is unable to address participants' entire processes and thus may miss efficiency opportunities. Contacts believing the benefits outweigh potential losses point to the fact that participants are returning to the program for additional projects. The short studies thus become a "foot in the door," with a more comprehensive look at the facility

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possible subsequent to the establishment of a strong working relationship between the participant and the program.

The program operates with only very general guidelines for many of the inputs to technical studies—something perceived as both a strength and a weakness by key program contacts. On one hand, the lack of clear guidelines allows the program to stay flexible and reduces the administrative burden for those who would be required to comply with such rules. On the other hand, the lack of clear guidelines—essentially, a uniform toolkit—may increase the possibility of inconsistent estimates of baseline use between different ATACs. However, as the arbiter of these studies, the PMC technical manager is confident in the estimates he is receiving from program ATACs, even without a uniform toolkit to govern the technical study.

This chapter addresses some specific questions raised by Energy Trust staff at various times during the evaluation. Findings relating to these questions are briefly summarized here:

1. Project demand impacts (kW) are reported for a little over half of the largest 30 projects completed by September 20, 2004. (See chapter 7 for additional findings from the onsite review of these projects.) Program contacts report that estimates of demand impacts have much greater uncertainty than estimates of savings (kWh) and so can mislead the customer.
2. The PMC technical manager does not appear to need additional staffing assistance (in contrast to a finding from an evaluation of the program conducted one year ago).
3. A quantification of non-energy benefits will not enable the Energy Trust to reduce incentives in recognition of these additional project benefits, according to contacts.
4. The two-cent incentives for short-payback projects is anticipated by contacts to have minimal effect on total program savings or cost-effectiveness.
5. Coordination between the Production Efficiency, Building Efficiency and BETC programs is good. Coordination with other Energy Trust programs is still evolving; PE participants do not have an interest in the SELP program and coordination with the now-ended Transition Program was poor, according to contacts.

### 3. Program Implementation Activities and Experiences

6. Program staff are moving to garner the participation of smaller industrial firms without adversely affecting program cost-effectiveness. Analyses attempted for this evaluation to determine the size of existing participants were not fruitful.
7. The program has low penetration to date among firms in the semiconductor industry due to the recent vintage of their facilities, according to program contacts. Yet investigations conducted by the Northwest Energy Efficiency Alliance show significant opportunities for efficiency improvements in chilled water and air distribution systems serving clean rooms, which are also used by the biotech, pharmaceutical and food processing industries.

Chapter 4—*Program Changes Since the Last Evaluation*, and chapter 7—*Findings Concerning Impact Evaluability, Adjusted Savings and Free-rider/Spillover Effects* present additional findings directly bearing on questions posed by Energy Trust staff. Chapter 8—*Conclusions and Recommendations* draws on all of the research findings to reach conclusions on the Energy Trust’s more philosophical questions concerning how well the models are working of using a PMC and existing market actors for program delivery.

## 4. PROGRAM CHANGES SINCE THE LAST EVALUATION

This chapter discusses Energy Trust and PMC responses to the recommendations offered by the first process evaluation, conducted in early 2004 after the first six months of program operation.<sup>20</sup>

The chapter draws from the same information sources as chapter 3, namely in-depth interviews with the staff of the Energy Trust, the PMC, the four PDCs and ten ATACs (including three of the four PDCs).

Consistent with the Energy Trust's established procedure for addressing evaluation recommendations, the Energy Trust's Director of Energy Efficiency delivered a memo to the Energy Trust Board of Directors on September 8, 2004, detailing its response.

The Energy Trust and PMC staff stated they read the evaluation report; PDCs and ATACs said they had not been provided a copy of the report. Some PDCs said they had nonetheless seen and read the report, while others had not. All had at least a vague understanding of key findings and recommendations. None of the PDCs or ATACs knew the report was available on the Energy Trust's website.

PMC staff stated that no one from the Energy Trust talked with them about the evaluation findings as a whole, although the update on each recommendation that follows shows the Energy Trust did ask the PMC to take some specific actions. The PMC Technical Manager credited the evaluation report as bringing to his attention the need for a final form to record project completion, in response to which he created Form 430, *Project Review and Approval*. He retroactively completed Form 430s for projects already approved.

Disconcertingly, three of the four PDCs were reluctant to talk to the evaluation team for the current evaluation, explaining that they had experienced negative repercussions from PMC staff as a result of concerns they expressed about the program to evaluators during the first evaluation. The PDCs not only receive

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<sup>20</sup> The Energy Trust's website makes available this report, entitled: *Production Efficiency Program: End-of-First Year Progress Evaluation*. See: [Energytrust.org/Pages/about/library/reports/062204\\_PE\\_MPER1.pdf](http://Energytrust.org/Pages/about/library/reports/062204_PE_MPER1.pdf).

#### 4. Program Changes Since the Last Evaluation

direction from the PMC, but also are under contract to the PMC and accordingly stated they felt vulnerable candidly discussing the program.

### STATUS OF RECOMMENDATIONS

Along with recommending the Energy Trust congratulate program staff and contractors for a job well done, the first process evaluation offered six additional recommendations.

**Prior Evaluation Recommendation 2: Clarify for ATACs the current process for selecting an ATAC for a project. Continue to investigate the experiences of ATACs in marketing the program and bringing customers in.**

**Status:** The memo to the Energy Trust Board stated the PMC would clarify for the ATACs how projects are assigned and who to communicate with if they feel they have been treated unfairly. The current evaluation has found that ATACs still have some confusion about the selection process, with several firms requesting a clear procedure or information on types and numbers of jobs assigned to each ATAC. Nonetheless, ATACs said that they were currently more satisfied with the selection process than they were during the first six months of the program.

Although contacts are less concerned than previously with the issue of how studies are assigned, the current evaluation found virtually no marketing of the program by non-PDC ATACs that are consulting engineers. ATACs that are vendors continue to market the program. Consulting engineering ATACs that initially marketed the program to their customers said they no longer do so because of their early experiences bringing customers to the PDCs and having the technical study assigned to another firm. One consulting engineering firm that was particularly hard hit by this turn-about no longer participates in the program. The evaluation team reviewed a number of scoping studies for which the PDC indicated this firm had submitted a proposal to conduct the technical study, but for which the PDC recommended a different ATAC be assigned.

**Prior Evaluation Recommendation 3: Provide increased technical guidance for PDCs and ATACs.**

**Status:** The memo to the Energy Trust Board stated no action would be taken on this recommendation until program impacts were investigated, which is one of the subjects of the current evaluation; guided by the results of the impact investigation, the PMC would then prepare a plan to provide increased technical guidance.



#### 4. Program Changes Since the Last Evaluation

In April 2004, the PMC prepared a memo entitled *Technical Analysis Study, Assignment, Content and Review*. The evaluation team reviewed memo and found it to fall short of the addressing all the technical issues concerning project studies raised in the first report. The evaluation team provided its recommendations to the PMC. The PMC's memo was not revised.

The current evaluation found the PDCs had all seen the memo. Most of the PDCs expressed the opinion that the memo did not provide increased technical guidance; further, the PDCs varied in their understanding of whether the memo carried the weight of policy or was simply a sketch of how technical studies were to be handled.

The memo says the PDC will confirm that each study contains certain features and says the Technical Manager will conduct the project cost-effectiveness tests and give final approval to the study. As found by the first evaluation, PDCs again reported the Technical Manager, not the PDCs, are responsible for the quality of the technical studies. All PDCs reported they review all studies for their customers, occasionally ask the ATACs to make revisions and generally are comfortable providing their customers with the studies. When asked if they felt they could “vouch for” the accuracy or adequacy of the study, the PDCs typically avoided giving a direct answer.

Echoing the first evaluation, the ATACs reported they had not been provided with specific technical direction for the studies. Often they were either unfamiliar with the PDC's memo or did not find it useful. The consulting engineering ATACs consider themselves to be professionals and not in need of technical direction, yet they expressed concern about the quality of work done by other ATACs. The vendor ATACs did not express particular concern about technical issues; those who offered comments said the technical guidelines were not standardized or were “wishy-washy.” All types of ATACs (including PDCs) wanted the expectations made clear, rather than having explicit directions given.

ATACs were satisfied with their interactions with the Technical Manager regarding their studies. One noted the Technical Manager had caught “small mathematical errors in an appendix”; another described the Technical Manager as “straight forward.”

#### 4. Program Changes Since the Last Evaluation

**Prior Evaluation Recommendation 4: Conduct a preliminary investigation of program impacts to ensure the data necessary to support a comprehensive impact evaluation are available.**

**Status:** The memo to the Energy Trust Board said an evaluator had been hired; this statement refers to the current evaluation. (See chapter 7 for the findings from the investigation of program impacts and the evaluability assessment.)

**Prior Evaluation Recommendation 5: Seek ways to expedite contracts, communications with the market and program policy decisions.**

**Status:** The memo to the Energy Trust Board said “new resources are being deployed and will focus on streamlining program approval process. Procedures are in place to review documents for approval and respond within a timely fashion. Contract/program form templates are in place.”

The current Energy Trust program manager describes his intention to maintain program momentum by providing rapid decisions and rapidly approving and signing documents. The PMC was the party most affected by slow Energy Trust activities and its staff report being highly satisfied with the responsiveness of the program manager.

Contacts described a favorable change in Energy Trust contracting procedures and turn-around time, yet some contacts hoped for further improvements. Internal to the Energy Trust, the Director of Energy Efficiency described a significant, positive improvement in the organization’s contracting activities. (The program manager came on board after the changes were made.) The PMC recognized improvement in the Energy Trust’s contracting process; nonetheless, the PMC thought the Energy Trust bore most of the responsibility for the length of the contract renewal process (about four months). Both the PMC and the PDCs described the eleventh-hour timing of the contract extension (occurring within a few weeks of initial contract-end for the PMC, and within a few days of contract-end for the PDCs) as anxiety provoking.

**Prior Evaluation Recommendation 6: Prepare for potential participants written materials detailing steps for program participation.**

**Status:** The memo to the Energy Trust Board said, “Aspen will develop a program brochure and the information will be added to the website.”

#### 4. Program Changes Since the Last Evaluation

This action has been taken; the webpage for the PE program briefly describes the basic steps for program participation. PDC contacts thought neither they nor their clients would benefit from the preparation and dissemination of a written brochure with this information.

#### **Prior Evaluation Recommendation 7: Give clear guidance to contractors as to how to pursue conflicting objectives.**

**Status:** The memo to the Energy Trust Board said, “The results from the evaluator hired as a result of Recommendation 4 will form the basis of a dialogue between staff and PMC regarding the need for specific information, as well as analytical precision required in differing circumstances.”

As described above, the current evaluation has been undertaken in part to address Recommendation 4. The PMC, PDCs and ATACs report (as described in chapter 3) little change since the last evaluation in the amount of direction they have received from the Energy Trust nor, in the case of PDCs and ATACs, from the PMC, regarding how to pursue conflicting objectives or required analytical precision. Nor has the Energy Trust Board provided additional guidance to Energy Trust staff on prioritizing multiple objectives.

### SUMMARY

Most changes in program implementation have come from the Energy Trust’s responsiveness to recommendations made in the previous evaluation. Specifically, the Energy Trust has become much more responsive in day-to-day program management and decision-making. Its contracting processes are improved, according to both Energy Trust and PMC contacts, with Energy Trust contacts expressing high satisfaction with current contracting processes and PMC contacts continuing to see room for improvement. Most contacts feel the Energy Trust (more specifically, the Energy Trust Board of Directors) has yet to provide clear direction for addressing competing objectives with limited resources, yet all contacts report program activity is consciously directed to meeting the variety of Trust objectives.

The PMC activities reveal fewer changes in response to the evaluation recommendations. The PMC has articulated the program steps for prospective participants and this is posted on the website. Fewer ATACs currently report confusion with how projects are assigned than reported this a year ago. Yet the ATACs attribute their improved understanding to their experience gained over eighteen months working with the program and not to explicit memos from or meetings with the PMC. ATACs expressed ambivalence about how projects are



#### 4. Program Changes Since the Last Evaluation

assigned; most have settled into a satisfactory routine with the program, yet they would have hoped to have had a more prominent role.

Regarding the two remaining recommendations offered by the prior study, the memo of Energy Trust staff to the Board stated action would not be taken on these recommendations until the findings and conclusions of the current evaluation could be considered. Thus, the planned approach is being satisfied. Nonetheless, the Energy Trust and PMC program managers might have taken some action in the intervening year regarding the recommendation to provide increased technical guidance for PDCs and ATACs. Contacts report none was forthcoming.

## 5. PARTICIPATING INDUSTRIAL FIRMS' FEEDBACK

To obtain information from participating industrial firms for this evaluation, we sought to visit and interview firms with completed projects. We choose September 20, 2004, as the cut-off date for completed projects; the date was late in the year to allow for as many completed projects as possible, yet still provide enough time to complete the research.

From its inception in mid 2003 until September 20, 2004, the Production Efficiency program completed 53 energy efficiency projects conducted by 42 industrial facilities (see Table 5.1). Almost nine-tenths (89%) of the estimated energy savings garnered by the PE program in that period resulted from 30 projects conducted by 20 facilities, or fewer than half. The remaining 22 facilities conducted 23 projects that account for the rest (11%) of the program's estimated energy savings from completed projects.

**Table 5.1**  
**COMPLETED PROJECTS AND SAVINGS**

METRIC	TOTAL	LARGER PROJECTS (TOP ~90%)	SMALLER PROJECTS (BOTTOM ~10%)
Number of Projects	53	30	23
Number of Participants	42	20	22
Total Estimated Savings (kWh)	20,951,990	18,725,337	2,226,653
Percent of Estimated Savings (kWh)	100%	89%	11%

As described in the methods section of chapter 1, an engineer visited each of the 20 participating industrial firms with larger projects to verify that the completed project and operating parameters of affected equipment were consistent with what was specified in the project technical studies. While onsite, the engineer interviewed a member of facility staff most familiar with the project, often a plant manager. All 20 participants with larger projects were visited and interviewed in this manner; visits took place between August and December 2004.

## 5. Participating Industrial Firms' Feedback

Interview questions explored whether participants were likely to have undertaken their projects even without aid from the PE program (free-ridership) and whether participants may have taken additional energy saving measures as a result of their PE participation, but without receiving PE incentives (spillover). Additionally, interview questions explored participants' responses to their experiences and how well program processes worked for them.

The 22 participants with smaller projects did not receive visits from the engineer. Instead, we attempted to obtain comparable information through telephone interviews. These interviews served all three purposes described above: verifying that project descriptions and operating parameters conform to what was specified in the project technical studies, exploring free-ridership and spillover, and exploring how well program processes worked for the participants.

We completed interviews with 17 of the 22 participants with smaller projects between November 2004 and February 2005. Of the five participants with whom we did not complete interviews, two refused to be interviewed; we did not attempt to contact the remaining three participants with smaller projects because they were interviewed less than a year ago for the first PE program evaluation and we wanted to minimize the burden placed on participants.

In addition to the extra questions about operating parameters for participants with smaller projects, there were some other small differences between the onsite and telephone survey instruments because of the inherent differences in format and context between a site visit and a telephone interview. Both the telephone and onsite interviews (but not the onsite engineering investigation) took about 15 minutes. This chapter examines responses of participants with both larger and smaller projects to the survey questions.

The chapter is organized into five sections, in addition to a summary:

- *Awareness of Energy Trust, Other Assistance*
- *Initiating a Project*
- *Project Financing and Influence of Incentives*
- *Participant Experience with the Program*
- *Informal Feedback from Participants with Larger Projects*

## AWARENESS OF ENERGY TRUST, OTHER ASSISTANCE

With participants interviewed by phone, we explored the level of awareness of the Energy Trust of Oregon; onsite interviews excluded this line of questioning because any respondent not fully aware of the Energy Trust's role as program sponsor was fully apprised of this in the negotiations to accept a site visit.

First, the participants with smaller projects were asked whether they recalled the name of the organization sponsoring the PE program and, if so, who the sponsor was. Interviewers had just introduced themselves as representatives of the PE program for the Energy Trust. About three-fourths (77%) of these participants with smaller projects claimed to recall the name of the program's sponsor; however, only about half that many (41%) were able to name the Energy Trust as the sponsor.

Responses of those reporting the program sponsor was something other than the Energy Trust were also recorded, categorized and included in Table 5.2. The most common response other than the Energy Trust was a program ATAC or PDC.

**Table 5.2**

### WHO IS THE SPONSOR OF PROCESS EFFICIENCY (PARTICIPANTS WITH SMALLER PROJECTS ONLY)

RESPONSE	SMALLER (N=17)
Energy Trust	41%
Program ATAC/PDC	29%
Utility	6%
Don't Know	24%
<b>TOTAL</b>	<b>100%</b>

The ten participants with smaller projects (59%) who had not correctly named the Energy Trust as the program sponsor were asked if, before today, they had ever heard of the Energy Trust of Oregon. Nine of these ten participants reported that they had previously heard of the Energy Trust. Summing these nine participants with the seven others who had correctly named the Energy Trust as the program's

## 5. Participating Industrial Firms' Feedback

sponsor reveals the level of awareness of the Energy Trust among participants with smaller projects: 94%.

All 37 participants were asked whether they were aware of the Business Energy Tax Credit (BETC) offered by the state of Oregon. More than three-fourths (81%) reported being aware of the tax credit (see Table 5.3). Far fewer participants (35%) were aware of the Small-scale Energy Loan Program (SELP), also offered by the state. Both programs had a higher awareness among participants with smaller projects, though this difference is not statistically significant.

**Table 5.3**

### **AWARENESS OF AND PARTICIPATION IN BETC AND SELP BY PROJECT TYPE**

PROJECT TYPE	AWARE	CONTRACTOR MENTIONED	APPLIED FOR	RECEIVED*
<b>BUSINESS ENERGY TAX CREDIT (BETC)</b>				
Larger (n=20)	75%	20%	70%	25%
Smaller (n=17)	88%	71%	65%	35%
<b>TOTAL (n=37)</b>	<b>81%</b>	<b>43%</b>	<b>68%</b>	<b>30%</b>
<b>SMALL-SCALE ENERGY LOAN PROGRAM (SELP)</b>				
Larger (n=20)	25%	5%	0%	—
Smaller (n=17)	47%	29%	0%	—
<b>TOTAL (n=37)</b>	<b>35%</b>	<b>16%</b>	<b>0%</b>	<b>—</b>

\* A number of participants did not know if their company had actually received the BETC because they do not handle accounting and tax responsibilities, which are delegated to others.

More than two-thirds (71%) of participants with smaller projects say their contractor mentioned BETC to them, but just one-fifth (20%) of participants with larger projects say so (statistically significant,  $\chi^2, p < 0.05$ ). The remaining participants who knew of BETC learned about it from sources other than their contractors. Over one-fourth (29%) of participants with smaller projects reported the contractor mentioned SELP to them, while only 5% (one individual) of participants with larger projects said so (statistically significant,  $\chi^2, p < 0.05$ ).



While about two-thirds (68%) of participants applied for BETC and about one third- (30%) confirmed that that tax credit had been received, no participants reported applying for SELP.

### INITIATING A PROJECT

For nearly two-fifths (40%) of the larger projects, but only one smaller project (6%), participants had not even begun to think about installing any new equipment when they learned about the PE program (see Table 5.4). For participants with smaller projects, the majority (53% = 94% - 35% - 6%) learned about the program after beginning to consider equipment choices, but before deciding on equipment specifications.

Table 5.4

#### WHEN PARTICIPANTS FOUND OUT ABOUT PROGRAM INCENTIVES (CUMULATIVE)

PARTICIPANTS FOUND OUT ABOUT PROGRAM INCENTIVES...	LARGER N=20	SMALLER N=17	TOTAL N=37
...Before Beginning to Think About Installing New Equipment	40%	6%	24%
...Before Beginning to Consider Equipment Choices	55%	35%	46%
...Before Selecting/Deciding on Equipment Specifications	80%	94%	86%
...Before Ordering Equipment	95%	100%	97%
...Before Installing Equipment	100%	100%	100%

The difference between when larger and smaller projects were initiated is statistically significant ( $\chi^2, p < 0.05$ ) and likely reflect differences in how large and small projects are marketed. As described in chapter 3, PDCs (and, occasionally ATACs that are consulting engineering firms) contacted industrial firms to interest them in the program and scope out potential projects. As a second approach, ATACs that are equipment vendors, as well as non-ATAC vendors from whom the program accepts technical studies, talk about the program incentives in the course of discussing new equipment with their industrial customers. In the latter case, the industrial firm may have initiated the contact with the vendor. The former process

## 5. Participating Industrial Firms' Feedback

(marketing through PDCs) typically results in larger projects, while the latter process (marketing through vendors) typically results in smaller projects.

This interpretation of differences in when participants learned about the program is borne out by participants' responses to the question of from whom they learned about the program. The most common source among participants with larger projects was they learned of the program from PDCs, the Energy Trust or their utility (65%, see Table 5.5). Participants with smaller projects were almost equally likely to have heard of the program from their vendors or contractors (47%) as from PDCs (53%).

**Table 5.5**  
**HOW PARTICIPANTS LEARNED OF THE PROGRAM**  
**(MULTIPLE RESPONSES ALLOWED)**

<b>PARTICIPANT LEARNED OF PROGRAM FROM:</b>	<b>LARGER N=20</b>	<b>SMALLER N=17</b>	<b>TOTAL N=37</b>
<b>Vendor or Contractor</b>	25%	47%	35%
<b>PDC, Energy Trust, or Utility</b>	65%	53%	60%
<b>Colleague or Associate</b>	10%	0%	5%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

In the case of almost two-thirds (64%) of participants, project work was done by a contractor with whom the participant had worked in the past or had some other basis for an ongoing relationship (Table 5.6).

**Table 5.6**  
**HOW PARTICIPANTS SELECTED CONTRACTOR**

HOW CONTRACTOR WAS SELECTED	LARGER N=19	SMALLER N=17	TOTAL N=36
Participant Had Ongoing Relationship with Contractor	58%	70%	63%
From Search (competitive bid, Yellow Pages, etc.)	11%	12%	11%
PDC/ATAC Approached Participant	5%	6%	6%
Contractor Approached Participant	0%	6%	3%
Utility	0%	6%	3%
Did the Work Themselves	26%	0%	14%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Participants were asked what reasons their contractors cited in persuading them to install energy-efficient equipment; Table 5.7 gives their responses. The question was more easily answered by participants with smaller projects, where their decision-making process often involved discussing with the equipment contractor the advantages of replacing their existing piece of equipment with a high, rather than standard, efficiency unit. Participants with larger projects often did not work with equipment contractors until late in the project process, if at all.<sup>21</sup> Thus, the question was not relevant to 40% of these participants. The remaining participants most commonly mentioned that contractors told them the projects would save energy and money. Other commonly reported selling points were higher quality equipment or better performance and the availability of incentives or rebates.

<sup>21</sup> The participants with larger projects often acted as their own contractor for equipment specification and installation. Only a small portion of these large projects are equipment focused, where vendors would be influential.

## 5. Participating Industrial Firms' Feedback

Table 5.7

### REASONS CONTRACTORS ENCOURAGED INSTALLATION OF ENERGY-EFFICIENT EQUIPMENT (MULTIPLE RESPONSES ALLOWED)

REASON	LARGER N=20	SMALLER N=17	TOTAL N=37
Saving Energy, Saving Money	45%	82%	62%
Higher-Quality Equipment, Better Performance	25%	41%	32%
Incentives, Rebates	5%	53%	27%
Decreased Maintenance Cost/Effort	10%	24%	16%
Tax Credits	5%	12%	8%
Environmental Benefits	5%	6%	5%
Quick Payback	0%	6%	0%
System Needed Attention Anyway	5%	0%	3%
Not Applicable	40%	0%	22%

Only 10% of participants with larger projects and 6% of participants with smaller projects reported that they did not install all of the recommended energy-efficient items. One individual noted one of the recommended measures not installed had too long a payback and another individual noted one of the measures provided additional capacity that was unneeded. None of these individuals reported plans to install these measures at a later date.

## PROJECT FINANCING AND INFLUENCE OF INCENTIVES

Ninety-one percent of participants indicate using some type of financial analysis to help decide whether to go forward with equipment installations or modifications (see Table 5.8). A simple payback analysis is the dominant form of financial analysis, with more than two-thirds of all participants reporting they use it. Three participants with smaller projects indicated they did not do any financial analysis,

although two of these participants indicated they usually do so.<sup>22</sup> In both of these cases, the financial analyses were skipped because they already needed to replace equipment; one of these participants noted that the incremental cost of efficiency was being completely covered by program incentives.

**Table 5.8**  
**FINANCIAL ANALYSIS CONDUCTED**

SOURCE OF FUNDS	LARGER N=20	SMALLER N=16	TOTAL N=36
None	0%	19%	8%
Payback	70%	69%	69%
Return on Investment (ROI)	25%	6%	17%
Internal Rate of Return (IRR)	5%	6%	6%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Participants were asked what cutoff point a project's payback period must meet for their organization to consider the project (see Table 5.9). Cutoff points reported by almost two-thirds (64%) of participants were 18 months or less. (Participants with larger projects were significantly more likely than those with smaller projects to require a payback within 18 months—statistically significant,  $\chi^2, p < 0.05$ ). One-fourth of participants (25%) report their firm would go ahead with projects that have a payback of two years and 11% report their firm would go ahead with projects that have a payback of three years.

<sup>22</sup> These findings suggest, not surprisingly, that the simpler the project, the less likely a firm is to conduct a formal financial analysis. This result is consistent with findings from the 2004 Building Efficiency impact and process evaluation, conducted by the same evaluation team, which found that 31% of Building Efficiency participants (both lighting and mechanical projects equally) did not conduct a formal financial analysis of the project.

## 5. Participating Industrial Firms' Feedback

**Table 5.9**  
**MAXIMUM PAYBACK PERIODS THAT WILL BE CONSIDERED**

PAYBACK PERIOD LENGTH	LARGER N=17*	SMALLER N=11*	TOTAL N=28*
Beyond 3 Years	6%	0%	4%
3 Years or Less	6%	18%	11%
2 Years or Less	24%	27%	25%
18 Months or Less	76%	45%	64%
1 Year or Less	100%	91%	96%
Immediate	100%	100%	100%

\* Nine participants (three with larger projects, six with smaller) could not provide an answer.

As shown by Table 5.10, the most common source of project funds among participants with larger projects was the long-term capital budget or plan (45%).

**Table 5.10**  
**SOURCE OF FUNDS FOR PROJECT**

SOURCE OF FUNDS	LARGER N=20	SMALLER N=16*	TOTAL N=36*
Operating Budget	5%	25%	14%
Short-Term Capital Budget or Plan	25%	50%	36%
Long-Term Capital Budget or Plan	45%	19%	33%
Owner's Discretionary Funds	15%	0%	8%
Corporate Energy-Relief Fund	5%	0%	3%
Project Was "Capitalized"	0%	6%	3%
Not Applicable: Performance Contract	5%	0%	3%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

\* One industrial firm with a smaller project didn't know where project funds came from.

For participants with smaller projects, the most common source of funds was the short-term capital budget or plan, with half (50%) of these participants reporting their projects' funding came from this source.

All participants used an eleven-point scale (“0” to “10”) to indicate how much influence the incentives had on their decision install the equipment (see Table 5.11). Overall, about three-fourths of participants said the program had a strong influence (“7” to “10”).

**Table 5.11**  
**INFLUENCE OF INCENTIVES ON DECISION TO INSTALL**

PROJECT TYPE	“0” TO “3”	“4” TO “6”	“7” TO “10”
<b>REPORTED INFLUENCE OF PROGRAM ON DECISION TO INSTALL EQUIPMENT</b>			
<b>Larger (n=20)</b>	5%	15%	80%
<b>Smaller (n=17)</b>	12%	24%	65%
<b>TOTAL (n=37)</b>	<b>8%</b>	<b>19%</b>	<b>73%</b>
<b>REPORTED LIKELIHOOD EXACT SAME EQUIPMENT WOULD HAVE BEEN INSTALLED WITHOUT INCENTIVE</b>			
<b>Larger (n=18*)</b>	50%	11%	39%
<b>Smaller (n=17)</b>	41%	41%	18%
<b>TOTAL (n=35*)</b>	<b>46%</b>	<b>26%</b>	<b>29%</b>

\* Two participants with larger projects could not provide a response.

Participants used the same scale to describe the likelihood their organization would have installed exactly the same type of equipment, even if there had been no incentive. Almost half (46%) of participants said that they would have been very unlikely (“0” to “3”) to install the exact same type of equipment without an incentive.

With participants who reported they would likely have installed the exact same equipment without the incentive, we explored whether the incentive helped them install the equipment more quickly than they might otherwise have chosen to. If participants believed the project would have been postponed, interviewers explored how long the project would have been postponed. For participants with smaller

## 5. Participating Industrial Firms' Feedback

projects, most (five of seven) reported all the equipment would have been installed within six months of when it was actually installed (Table 5.12). For participants with larger projects, the most common response, given by 43%, was that the project would have been postponed three to five years.

**Table 5.12**  
**INFLUENCE OF PROGRAM ON PROJECT TIMING**

WITHOUT THE INCENTIVE, THE SAME EQUIPMENT WOULD PROBABLY HAVE BEEN...	LARGER N=14	SMALLER N=7	TOTAL N=21
...Installed within 6 Months	4	5	9
...Postponed 6 to 12 Months	2	0	2
...Postponed One to Two Years	0	1	1
...Postponed Three to Five Years	6	0	6
...Postponed More Than Five Years	2	1	3
<b>TOTAL</b>	<b>14</b>	<b>7</b>	<b>21</b>

Most (60%) participants with larger projects and almost half (47%) of participants with smaller projects had prior experience participating in utility energy efficiency programs. For participants who indicated having prior experience in past utility programs, we sought to assess to what extent their prior participation led them to look into options for energy-efficient equipment. Of those with prior utility program experience, all eight participants with smaller projects and six of ten participants with larger projects reported their experience had led them to look into energy-efficient equipment options for their current project.

Over two-thirds (70%) of participants with larger projects and almost half (44%) of participants with smaller projects reported having installed at least some energy efficient equipment—without getting any incentives—before participating in the program (see Table 5.13). Just over one-fourth (27%) of participants reported having installed additional energy-efficient equipment after their PE project.



**Table 5.13**  
**EFFICIENT EQUIPMENT INSTALLED WITHOUT INCENTIVES**

INSTALLED ENERGY EFFICIENT EQUIPMENT WITHOUT INCENTIVE...	LARGER N=20	SMALLER N=17	TOTAL N=37
...Before this Project	70%	44%	58%
...After this Project	25%	30%	27%

The ten participants who reported that after participating in the program, they installed additional energy-efficient equipment without getting an incentive were asked to say how much influence the program had on their decision to install this additional equipment, using an eleven-point scale (0 to 10). Table 5.14 shows that responses to this question were mixed, with participants with smaller PE projects reporting a greater influence than participants with larger PE projects.

**Table 5.14**  
**INFLUENCE OF PROGRAM ON ADDITIONAL INSTALLATIONS**

PARTICIPANT TYPE	"0" TO "3"	"4" TO "6"	"7" TO "10"
Larger (n=5)	3	1	1
Smaller (n=5)	1	2	2
TOTAL (n=10)	4	3	3

Most (55%) participants with larger projects and just over one-third (35%) of participants with smaller projects report they have a policy (formal or informal) about purchasing energy-efficient equipment (see Table 5.15).

## 5. Participating Industrial Firms' Feedback

Table 5.15

### POLICIES ABOUT PURCHASING ENERGY-EFFICIENT EQUIPMENT

PARTICIPANT TYPE	HAVE POLICY
Larger (n=20)	55%
Smaller (n=17)	35%
TOTAL (n=37)	46%

Four of the 17 participants that reported having such policies—two with larger projects and two with smaller—reported their organizations' policies regarding purchasing energy-efficient equipment were put in place after participating in the program. These individuals used an eleven-point scale to gauge the program's influence on the adoption of the policy. The two participants with smaller projects indicated that the program had a strong influence on their decision to institute the policy; one of the participants with larger projects acknowledged the program had a moderate influence, while the other indicated there was no program influence.

### PARTICIPANT EXPERIENCE WITH THE PROGRAM

When asked whether any step of their projects had been delayed or took longer than expected, few (19%) participants reported any delays (see Table 5.16).

Table 5.16

### OCCURRENCE OF DELAYS AT ANY STEP OF PROJECT

PARTICIPANT TYPE	EXPERIENCED DELAY
Larger (n=20)	15%
Smaller (n=17)	24%
TOTAL (n=37)	19%

Those who reported their project had been delayed were asked to describe what had been delayed and the length of the delay. The most common issue mentioned was

simply a generally slow process from start to finish, with five participants reporting this (see Table 5.17).

**Table 5.17**  
**DESCRIPTION OF PROJECT DELAYS**  
**(MULTIPLE RESPONSES ALLOWED)**

DESCRIPTION	LARGER N=3	SMALLER N=4	TOTAL N=7
General Unspecified Delays	3	2	5
Delays In Equipment Delivery, Broken Equipment	—	2	2
Delay In Receiving Incentive Payment	1	—	1
Problems Preparing Application Forms	—	1	1

Participants used a five-point scale, where “1” is “not at all satisfied”, and “5” is “very satisfied” to report how satisfied they were with various aspects of the program. Most (73% to 100%) participants expressed satisfaction (“4” or “5”) with all aspects of the program we asked about (see Table 5.18).

**Table 5.18**  
**PARTICIPANT SATISFACTION WITH ASPECTS OF PROGRAM**

PARTICIPANT SATISFACTION WITH...	PERCENT EXPRESSING SATISFACTION		
	LARGER	SMALLER	TOTAL
...the Rebate Amount (n=20, 15, 35)	100%	93%	97%
...the Quality of Contractor's Work (n=17, 16, 33)	100%	94%	97%
...Performance of Equipment Installed (n=20, 17, 37)	100%	88%	95%
...the Application Process (n=19, 17, 36)	95%	82%	89%
...Monthly Energy Savings (n=11)	—	73%	—
...the Program, Overall (n=19, 16, 35)	100%	100%	100%

## 5. Participating Industrial Firms' Feedback

Participants with smaller projects expressed high satisfaction at somewhat lower rates than participants with larger projects, yet the differences were not statistically significant. All participants, both larger and smaller, who were able to rate their satisfaction with the program overall, reported being satisfied (a rating of “4” or “5”).

As reported earlier, most (60%) participants with larger projects and almost half (47%) of participants with smaller projects had prior experience participating in utility energy efficiency programs. These participants were asked to compare their prior experience with the utility program to their current experience participating in the Production Efficiency program. They used an eleven-point scale, where “0” meant the PE program was much less satisfactory than the utility program, and “10” meant the PE program was much more satisfactory. Over 80% of participants described their experiences in the PE program as more favorable than in previous efficiency programs (see Table 5.19). No participants reported that PE program compares unfavorably (“0” to “3”).

**Table 5.19**

### SATISFACTION WITH PRODUCTION EFFICIENCY COMPARED TO UTILITY PROGRAMS

PARTICIPANT TYPE	LESS SATISFACTORY (“0” TO “3”)	COMPARABLE (“4” TO “6”)	MORE SATISFACTORY (“7” TO “10”)	TOTAL
Larger (n=10)	0%	20%	80%	100%
Smaller (n=7)	0%	14%	86%	100%
TOTAL (n=17)	0%	17%	83%	100%

Seventy percent of participants with larger projects (14 participants) and 53% of participants with smaller projects (9 participants) reported having some contact with the Energy Trust or the program management contractor (the PMC). Using a five-point scale, where “1” is “not at all satisfied” and “5” is “very satisfied,” participants reported how satisfied they were with this interaction. Participants with larger projects were simply asked their overall satisfaction with the contact, while participants with smaller projects reported their satisfaction with various

aspects of the experience. Responses indicate that most participants were very satisfied (see Table 5.20).

**Table 5.20**  
**SATISFACTION WITH ENERGY TRUST/PMC INTERACTIONS**

PARTICIPANT SATISFACTION WITH...	"1"	"2"	"3"	"4"	"5"
<b>LARGER (N=14)</b>					
... Contact with the Energy Trust or PMC	0	0	0	2	12
<b>SMALLER (N=9)</b>					
...the Energy Trust/PMC's Courtesy	0	0	0	1	8
...the Energy Trust/PMC's Knowledge of Program Services	0	0	0	3	5
...the Energy Trust/PMC's Helpfulness	0	0	0	1	8
...the Ease of Transactions (paperwork payments)	0	0	1	1	7

### INFORMAL FEEDBACK FROM PARTICIPANTS WITH LARGER PROJECTS

In addition to the formal survey of participating industrial firms, participants with larger projects informally shared their experiences with and opinions of the Production Efficiency program with the engineer who conducted the onsite investigations.

Commonly, participants with larger projects spontaneously emphasized how pleased they were with their program experiences. They described receiving a very high level of service from the PDCs. They reported the PDCs were flexible and worked with them to develop qualifying projects that met their needs. The PDCs took over much of the administrative burden of the program, freeing them to focus on their project and not the PE program.

### SUMMARY

Participants expressed high satisfaction with their experiences participating in the Production Efficiency program. They gave high marks to both the Energy Trust and

## 5. Participating Industrial Firms' Feedback

the program administrator on all measures of satisfaction. All but one participant was clearly aware of the Energy Trust as the program sponsor.

There were differences between how and when smaller projects were identified versus their larger counterparts. Smaller projects were typically identified later in the process than larger projects, most likely because they were identified by a vendor or ATAC contacted by the industrial facility after the facility had identified a replacement or upgrade opportunity. Participants with larger projects typically required a payback within 18 months, while smaller projects were likely to go forward without any payback calculation. A majority of both smaller and larger participants turned to contractors with whom they had an on-going relationship.

## 6. ANALYSIS METHODOLOGY

This chapter provides the methods we used to assess the impact evaluability of the Production Efficiency program, adjust project savings estimates and assess free-rider and spillover effects. Readers not interested in a detailed discussion of these methods should turn to the findings from the investigation, presented in chapter 7.

Our methods began with and rest on a foundation of participant site visits. The overall purpose of the site visits was to assess the evaluability of the first group of completed Production Efficiency projects. The sample of projects selected for site visits was drawn from the set of completed projects recorded in the program database as of September 20, 2004; the sample provides a snapshot of the program at that point in time, with 53 projects completed at 42 facilities.

As described in chapter 1, we conducted site visits for those participants whose projects comprise about 90% of the total kWh savings associated with projects completed through September 20, 2004. We conducted site visits for 20 facilities that had a total of 30 projects. A roughly equal number of facilities (22) had completed 23 projects, comprising the remaining 10% of total kWh savings; we contacted these participants by telephone.

The chapter is organized as follows:

- *Methodology For Impact Evaluability Assessment and Savings Adjustment*
- *Methodology For Free-Ridership and Spillover Analysis*

### METHODOLOGY FOR IMPACT EVALUABILITY ASSESSMENT AND SAVINGS ADJUSTMENT

Site visits were conducted in order to assess the evaluability of project kWh and kW savings based on the project documentation. This assessment was made by attempting to estimate the adjusted (or verified) program savings (kWh and kW) for each project. Thus, the evaluability assessment generated adjusted energy and demand savings estimates as a by-product.

We used three methods to adjust program-reported energy and demand savings, as shown in Table 6.1 and described below. For a small number of projects, the original savings estimate was used; Table 6.1 refers to these savings as deemed. We used

## 6. Analysis Methodology

the original savings estimates when the site visit was unable to generate data by which the savings could be adjusted, often because the project files lacked information to compare with site data.

**Table 6.1**  
**SAVINGS ADJUSTMENT APPROACH USED FOR PROJECTS**  
**ASSESSED THROUGH SITE VISITS**

SAVINGS ADJUSTMENT METHOD	NUMBER (N=30)	PERCENT (N=30)
Adjusted Savings	24	80%
...Adjusted with Metered Data	22	74%
...Adjusted with Participant Data	1	3%
...Adjusted by Site Observations	1	3%
Deemed (Not Adjusted)	6	20%

To adjust savings estimates, we applied engineering calculations to data obtained from the site. Site data took one of three forms (as shown in Table 6.1):

1. Short-term (typically one week) metering of installed equipment; this was the most-frequently used method.
2. Participant-provided data on the systems; such data are often better than data from short-term metering in cases where there are seasonal or production variations unlikely to be captured in one week of metering.
3. Site observations that were not from metering.

### Onsite Data Collection

The approach for gathering project data and verifying operating conditions through the site visits involved the following:

- Before conducting each site visit, the evaluators examined the available project documents, including the original energy analysis report, if provided, and any follow-up documents verifying savings. The project



reports reviewed included all of the documents retained by Aspen Systems in each of the project files. Other electronic or paper documents may exist in the records of the PDC, ATAC, or vendor; however, if these were not included in the Aspen project files, they were not reviewed.

- The evaluators arranged to meet in-person with facility staff familiar with the Production Efficiency project at their site. Most often, these were plant or operations managers, maintenance managers or supervisors, or facility engineers.
- The site visit typically included four elements: 1) a walk-through of the facility with the site contact, focusing on the installed energy efficiency measures; 2) an interview with the site contact and others as needed to understand plant and measure operation; 3) where possible, collection of data from the participants' own energy monitoring and control systems (for example, operating hours or detailed time-series system metrics); and 4) where appropriate and practical, installation of short-term metering of the project/system (usually for one week).

The evaluator gathered the following types of information through the site visits:

- Presence or absence of the installed efficiency measures as described in the project file.
- Any differences between the documented energy efficiency measures and those observed onsite.
- Any modifications to the production process or changes in production capacity that might impact the efficiency measures.
- Any differences between any described operating parameters for the energy efficiency measures (e.g., operating hours or equipment set points), and those observed onsite.
- Evidence of free-ridership. During the site visit, the participant was asked a series of questions about the likelihood that the firm would have installed the efficiency measures in the absence of the incentives.
- Evidence of spillover. During the site visit, the participant was asked whether the firm had installed any additional energy efficiency measures without incentives following participation in the program, and whether the program had influenced the decision to take this further action. This was rare, as most of the projects had only recently been installed, leaving

## 6. Analysis Methodology

little time to consider additional measures. While a very few participants described doing additional measures without incentives following the Process Efficiency project, they tended not to credit the program with influence on the decision. We did not attempt to quantify spillover; we simply briefly describe what occurred.

### Savings Adjustments

Following each site visit, the data and information gathered were used to make any necessary adjustments to the reported savings. The methodologies employed by the evaluators to make these adjustments varied depending on a number of different factors including: 1) the types of energy efficiency measures; 2) the data available from the project files and the participant; 3) the use of short-term metering; 4) the particular production equipment and process; and 5) other site-specific circumstances.

This analysis yielded two key results:

- An energy savings realization rate for each efficiency measure (or sometimes groups of similar measures, as appropriate) obtained by dividing the adjusted (verified) energy savings by the reported savings.
- A peak demand reduction realization rate for each measure (or sometimes groups of similar measures, as appropriate) obtained by dividing the adjusted (verified) peak demand reduction by the reported demand reduction. In a number of cases, there were no reported demand reductions; for these no realization rate could be determined.

Methodologies for saving adjustments varied according to the available data for energy usage (short-term or one-time metering, participant-supplied data, annual operating hours, etc.), the project technology and the information from the original energy studies. In the majority of cases, engineering analysis was used.

### Short-Term Metering Savings Adjustment

For many of the projects, savings were based on short-term metering the energy usage of air compressors, fans or pumps. Motor current was used to calculate total kWh energy use for the period that metering was installed, which was then prorated to a full year. This energy use was subtracted from the baseline to determine adjusted (verified) energy savings.

Adjusted peak demand was determined from short-term metering in similar fashion. The largest peak demand of a 15-minute rolling average was identified as the equipment peak. In circumstances where there were multiple pieces of equipment (such as air compressors), the coincident peak of all the motors was used. If the maximum value did not occur during the period of interest (NWPPC Bin 1<sup>23</sup>), the second maximum was identified.

### Project and Program Realization Rates

The estimated realization rate is given by the adjusted savings divided by the program-reported savings. Realization rates typically range between 0 and 1.5 or 2, although conceptually they can be greater than two, or even negative.

A zero realization rate means the project is credited with no savings. (A negative realization rate would signify the new equipment uses more electricity than the old equipment. Although the site review suggested this may have occurred for a few pieces of equipment, we established a lower limit for project realization rates at zero.)

Realization rates between zero and one indicate the project is credited with less savings than was reported in the program database. A realization rate of one indicates the project is credited with precisely the amount of savings given in the database. In practice, most if not all of projects with a 1.0 realization rate had their savings deemed. That is to say, there was not sufficient data available to generate a revised savings estimate and yet we did not have any information to suggest the savings estimate in the program database (and produced by program studies) was biased.

Realization rates greater than one indicate the project is credited with more savings than was reported in the program database.

The realization rate for the program as a whole is calculated by summing the adjusted savings for each project and dividing by the sum of program-reported savings estimates.

The reader should understand that the realization rate calculated for the program as a whole reflects only the earliest completed projects and primarily those

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<sup>23</sup> The time period of interest is Northwest Power Planning Council (NWPPC) Bin 1, 0800-1800 Monday through Friday.

## 6. Analysis Methodology

conducted for only 20 participants.<sup>24</sup> Consequently, the program-wide realization rate should be considered as an indication of whether the program is *on target* to deliver the savings it is promising. This initial program realization rate should not be used going forward to adjust program-reported savings.

### METHODOLOGY FOR FREE-RIDER AND SPILLOVER ANALYSIS

The approach used to estimate program free-ridership and spillover is based on participant self-reports using survey data. In 20 cases the survey questions were asked during the site visit and in 17 cases the questions were asked over the phone. The interviews were conducted within 18 months of the projects' initiation (typically) and within 13 months of project completion.<sup>25</sup> For all sites, the degree of free-ridership was calculated from the responses given to close-ended and open-ended questions asked of the person involved in the decision to install the efficient equipment. A determination of whether spillover occurred was based on responses from the same firm contact. No estimation of the magnitude of spillover was made, as is discussed below.

Interpretation of free-ridership and spillover claims by firm contacts is inherently subjective. The methodology described below includes components that are derived from calculations based on the contacts' numeric assessments of the influence of the program, as well as their comments on other factors. The calculations based on contacts' numeric estimates serve to rule out free-ridership (as warranted). For those cases where free-ridership was not ruled out, the other (nonnumeric) factors clarify whether indeed free-ridership likely occurred and, if so, to what degree. The other factors were reviewed and assessed by three analysts on the evaluation team, with the final determination a consensual process.

#### Free-Ridership

The central inputs to the calculation of free-ridership come from seven participant survey questions (see Figure 6.1). These questions are used to determine at what

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<sup>24</sup> More precisely, the rate also includes the experiences of an additional 22 very small participants that did not receive site visits; yet in practice, the results from these projects have little influence on the overall program realization rates.

<sup>25</sup> The completed projects were initiated between June 2003 and April 2004, with the exception of Transition Projects that were initiated with utility studies prior to the establishment of the Production Efficiency program. The projects were completed between October 22, 2003, and September 2, 2004. Interviews were conducted between August 2004 and February 2006.

point in its decision-making process the firm learned about the program and incentives, and to assess the importance of the incentives in the firm's decision to purchase the equipment. (Refer to the participant survey in appendix B for a fuller description.)

**Figure 6.1**

**QUESTIONS USED TO DETERMINE SELF-REPORT FREE-RIDERSHIP**

***When did you first hear about the Production Efficiency Program incentives, was it...***

- Q7 ...before you began to think about getting the new equipment, or after?
- Q8 ...before you began to consider your equipment choices, or after?
- Q9 ...before you selected or decided on the exact specification of the equipment, or after?
- Q10 ...before you ordered the equipment, or after?
- Q11 ...before you installed the equipment, or after?

***Using a scale of 0-10 with 0=zero influence and 10=a lot of influence.***

- Q12 How much influence did the incentive have on your decision to install the efficient equipment?
- Q13 Without the incentive, how likely is it that you would have installed exactly the same type and efficiency of equipment?

As a starting point for determining the degree of influence the program had, responses to Questions 12 and 13 were analyzed. The value for Q13 was subtracted from the value for Q12; values of -9 to 0 were considered to likely be free-riders. These values result when contacts replied the likelihood they would have installed the same equipment without the incentives was greater than or equal to their assessment of program influence on their decision.

Next, we considered the point in the firm's decision process where it learned of the program and available incentives, indicated by responses to Questions 7-11. Our focus was on whether they learned of the program before or after they specified or decided on the exact equipment for the project. If a participating firm reported they were familiar with the program at any time *after* they selected or decided on the exact specification for the equipment, we determined they had the potential to be at

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least a 50% free-rider, and perhaps as high as a 100% free-rider. If a participating firm’s “Q12 minus Q13” score was -9 to 0, and the firm became familiar with the program *before* deciding on the exact specifications, we assume the program requirements played a role in the specification decision. For these firms, we capped the free-ridership score at 40% and went on to consider whether additional factors might warrant a lower free-ridership score than that.

The scores are derived from Q12 and Q13, as shown in Table 6.2. Modifications to these scores occurred only in the case of other factors—discussed below—suggesting that the free-ridership score should be lessened. Figure 6.2 displays the decision model for determining free-ridership scores. This model, along with the scoring shown in the table, shows how free-ridership scores were assigned for each project.

**Table 6.2**  
**FREE-RIDERSHIP SCORE ASSIGNMENT**

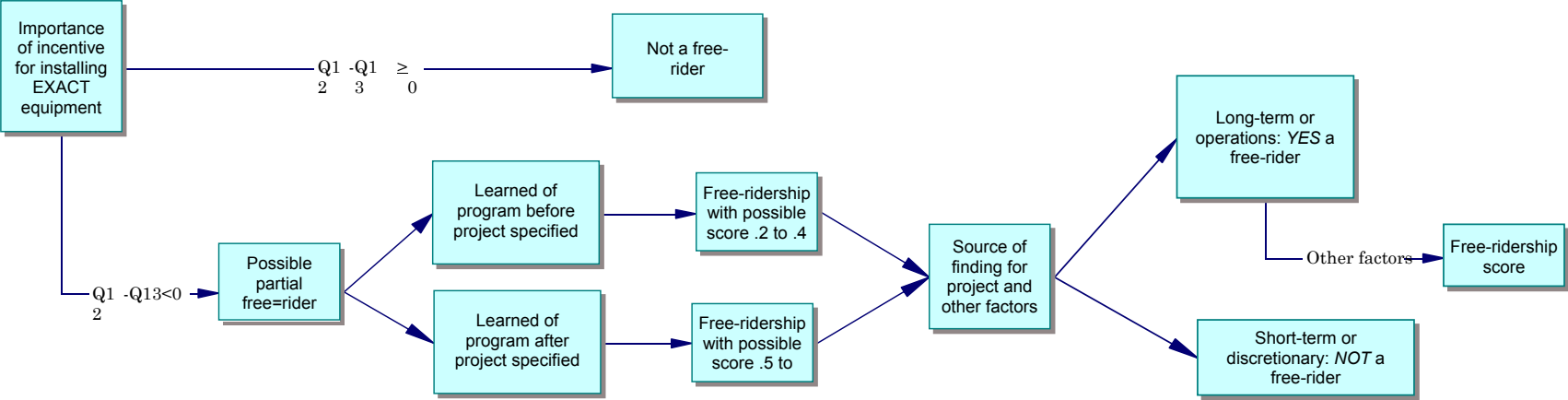
WHEN LEARNED OF PROGRAM:	(Q12) – (Q13) =				
	-9 TO -7	-6 TO -5	-4 TO -3	-2 TO 0	>0
FR Score If Learned of Program After Specification (and no extenuating factors)	1.0	0.8	0.6	0.5	0
FR Score If Learned of Program Before Specification (and no extenuating factors)	0.4	0.3	0.2	0.1	0

A free-ridership score of “1,” as shown in Table 6.2, indicates the project was fully a free-rider (100%); conversely, a free-ridership score of “0” indicates the project was not at all a free-rider (0%).

The free-ridership score is used to determine an energy savings estimate *net* of free-riders, also termed *net energy savings*, using the factor (1- FR Score). So a project free-rider score of 1 produces a multiplier for the savings estimate of 0, generating an estimate of 0 net energy savings for the project.

Free-ridership can be misdiagnosed if the determination is based solely on when a firm heard of the program and whether the respondent believed the incentive strongly influenced the firm’s decision. Therefore, we examined other questions about the decision process: source of funds for the project, acceleration of project timing, importance of the incentive in selling the project to management, etc.

Figure 6.2  
DECISION MODEL FOR FREE-RIDERSHIP DETERMINATION



## 6. Analysis Methodology

The first additional factor to be explored is funding source. Source of funding in industrial projects is key to understanding whether the project really was under consideration prior to program participation. If the funding comes from long-term capital funds or the operating budget, then it is highly likely the project was planned in advance of the program and the program incentive is mainly being used to help offset some of the costs. If the funds are from short-term capital or discretionary funds, then it is more likely that the project was accelerated because of the program.

Participant statements that they had already planned to do the exact project do not necessarily mean the project would have been done in the absence of the program. Projects are often “on the books” for long stretches of time while competing projects, both planned and unplanned, are implemented with the limited available funds. Some project contacts may go so far as to respond they feel certain the project would have gone ahead at that time without the incentive, and a few moments later lament how the project was one of several equipment purchases that had been planned for years and yet the other planned (non-efficiency) equipment still had not been purchased.<sup>26</sup>

Other project contacts may report they likely would not have undertaken the project until 12 months or more into the future. The program can accelerate the installation of a project through, for example, the encouragement and decision support provided by the PDC. Thus, if a contact indicates the measure was likely to have been installed earlier through the program than it would have been otherwise, the program likely had an influence and should be credited.

Other factors in addition to project timing can reduce the free-ridership score. For example, one project was clearly planned and scheduled and was using the incentive to decrease the net cost of the project. Its free-ridership score without considering other factors (i.e., based on Table 6.2) was 1.0. However, the firm had participated in a variety of energy efficiency efforts with the Northwest Energy Efficiency Alliance, which receives partially funding from public benefit funds administered by the Energy Trust. This project reflected efforts to improve the efficiency based on learning from those efforts. Additionally, the contact reported that the incentive made the project much more attractive for management, further indicating that the program had an influence. Based on these other factors, the free-ridership score for this project was lowered to 0.8.

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<sup>26</sup> One participant with a smaller project initially said the project would have been done anyway, as it and a new fork lift had been planned for years. Later in the interview, he made the off-hand remark, “We’re still waiting for the fork lift.”



## Spillover

After estimating the magnitude of any free-ridership, we assessed the issue of spillover to determine whether any other information in the survey or program database suggested that the program effect was under- or over-estimated. Spillover is defined as:

Reductions in energy consumption and/or demand in a utility's service area caused by the presence of the DSM [efficiency] program, beyond program-related gross savings of participants. These effects could result from: (a) additional energy efficiency actions that program participants take outside the program as a result of having participated; (b) changes in the array of energy-using equipment that manufacturers, dealers, and contractors offer all customers as a result of program availability; and (c) changes in the energy use of non-participants as a result of utility programs, whether direct (e.g., utility program advertising) or indirect (e.g., stocking practices such as (b) above, or changes in consumer buying habits).<sup>27</sup>

Part “a” of above definition is referred to as *participant spillover*, which we attempted to assess in this study.

For example, consider a participating firm that received financial assistance from Production Efficiency to install a Variable Speed Drive (VSD). After experiencing and documenting to their own satisfaction the energy efficiency and other benefits of the retrofit, this participant proceeds to install VSDs on several other motor systems at their own expense. These additional installations would be considered benefits that *spilled over* from the original program experience. When taken into account, such spillover should be credited to the program and increase program savings.

The survey had three questions for estimating energy and demand spillover (Q31, Q31a, and Q31b, as shown in Figure 6.3). One specific constraint on this issue for the Production Efficiency program was that nearly every project was considered by the firm to be too recent for the firm to have even considered further energy efficiency investments.

Five of the 37 participants reported that some measures had been installed as a result of their experience in the program. No other cases of measures being installed in the Energy Trust territory because of the program were reported. All five of these situations appear to be on a much smaller scale than the project funded

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<sup>27</sup> *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs*, page A-9.

## 6. Analysis Methodology

by the program. Furthermore, there were no savings or consumption data available to estimate the value of the spillover from the program.

**Figure 6.3**  
**QUESTIONS USED TO DETERMINE SPILLOVER**

Q31	Since participating in the program, have you installed any <i>additional</i> energy efficient equipment without any incentives from the Energy Trust's Production Efficiency Program?  {If yes:}
Q31a	Please describe the type and quantity of the efficient equipment or measures?
Q31b	Overall, how influential would you say the program was in your decision to install additional efficient equipment? (0 to 10 scale, with a 0 indicating not at all influential and a 10 indicating very influential.)

Therefore the data from the survey only support an estimate of the rate of spillover at this early stage of program implementation. Fundamentally, as an evaluability assessment, the major learning about spillover is that it will be very difficult to estimate without obtaining more detailed information about the measures implemented. Such findings were also evident in the report on Transition Projects prepared for the Energy Trust, with spillover determined not to be a factor. While some participants described doing additional projects without incentives following the utility efforts, attribution to the transition program was weak and they could not quantify the savings.<sup>28</sup>

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<sup>28</sup> *Impact Evaluation of Oregon Industrial Transition Projects*, MetaResource Group, January 2005, page 29.

## 7. FINDINGS CONCERNING IMPACT EVALUABILITY, ADJUSTED SAVINGS AND FREE-RIDER/SPILLOVER EFFECTS

This chapter presents findings from our investigation of the first 53 projects completed through the Production Efficiency program. The methods used in our investigations are described in the preceding chapter.

The chapter is organized into four sections:

- *Definitions*—defines key concepts and explains terms and symbols used in the subsequent tables of findings
- *Findings Concerning Impact Evaluability*—discusses the completeness and ease of use of the project files with respect to the task of estimating project impacts
- *Findings Concerning Adjusted Savings*—presents adjusted energy (kWh) and demand (kW) savings and corresponding realization rates for the investigated projects
- *Findings Concerning Free-Rider and Spillover Effects and Non-Energy Benefits* Associated with the Projects

Within each chapter section on findings, tables present project-specific information. Because of the large number of projects for which the evaluation team conducted onsite investigations (30 projects), they are organized into four groups—presented in four tables in each section. These four groups are: 1) projects with realization rates greater than one (11 projects); 2) projects with realization rates equal to one—deemed savings (6 projects); 3) projects with realization rates less than one (9 projects); and 4) projects with realization rates equal to zero (4 projects). All tables discussing a given project group list the projects in the same order, to facilitate comparison across projects.

### DEFINITIONS

The following are definitions of terminology used throughout the tables following:

- *Energy Savings*—first-year kilowatt hours (kWh) saved by the project

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

- *Demand Savings*—kilowatts (kW) saved by the project
- *Estimated Savings*—project savings estimated by program staff prior to project implementation, as reported in project studies and the project tracking database
- *PMC-Audited Savings*—project savings as determined by program staff subsequent to project implementation, as reported in the project tracking database
- *Adjusted Savings*—project savings estimated by the evaluation team (methods discussed in chapter 6; findings reported in this chapter and appendix A)
- *Deemed Savings*—adjusted savings estimates that equal the estimated savings because the evaluation team was unable to improve upon the original estimation method and originally assumed equipment operating parameters

This outcome results from one or more of the following conditions: 1) the original estimation method is sound; 2) the original estimation method is not available and an alternative method is not feasible within the constraints of the evaluation; 3) the originally assumed equipment operating parameters have not changed; 4) the originally assumed equipment operating parameters are not available; and 5) the current equipment operating parameters are not available within the constraints of the evaluation. Thus, in some cases original project savings estimates may be deemed through an investigation that confirms their reliability, while in other cases savings may be deemed because insufficient information exists (from the study, subsequently, or both) to adjust the original estimates.

- *Realization Rate (RR)*—ratio of adjusted savings to estimated savings (reported in this chapter and appendix A)

A realization rate can be calculated for energy and demand savings. In addition, we calculate a realization rate for PMC-audited savings, when available. (Chapter 6 provides a fuller explanation.)

- *Free-Rider Estimates*—estimated extent to which the same project would have been implemented at the same time in the absence of the program (For a fuller explanation and discussion of method, see chapter 6.)

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

- *Spillover Assessment*—energy efficiency activities taken by participant subsequent to the program, without receiving an incentive  
(For a fuller explanation and discussion of method, see chapter 6.)

- *Non-Energy Benefits*—benefits resulting from an efficiency project in addition to energy savings, such as improved labor productivity and reduced emissions

These benefits are as reported by the participant and were not independently verified or quantified by the evaluation team.

- *NA (Not Available)*—data expected to be available are not available

The tables also use dashes (—) in cells for which data are not expected to be available, such as PMC-audited project savings, and demand savings realization rates when demand savings estimates were not available.

### FINDINGS CONCERNING IMPACT EVALUABILITY

Table 7.1 summarizes our findings on the source of data used by the evaluation team to estimate savings realization rates, while Table 7.2 through Table 7.5 provide the detailed findings by project group. The team sought information on baseline electricity consumption and demand for the affected equipment, as well as projected consumption and demand after project completion, along with an explicit statement of expected project energy savings (the difference between baseline and after-installation consumption).

#### Reliability of Data Sources

Table 7.1 provides a summary of data sources used by the evaluation team to develop adjusted savings estimates. Between 50% and 60% of project files explicitly stated the affected equipment's pre- or post-kWh consumption. About one-quarter of the files explicitly stated pre- and post-equipment demand; 30% explicitly identified demand savings. (Note that demand savings are not included in project cost-effectiveness calculations; however, the Trust has requested that information on demand reductions or significant non-energy benefits be described when known.)

The tables in this section are unable to convey the challenges faced by the evaluation team to determine what data were explicitly stated, not to mention what data could be inferred from other information included; this is because the project studies do not include a summary statement clearly identifying the projects' consumption and demand figures.

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**Table 7.1**  
**SUMMARY OF DATA SOURCES**

DATA SOURCE	PRE-ECM		POST-ECM			OVERALL
	kWh	kW	kWh	kW	kW SAVINGS	
<b>Available</b>	57%	27%	53%	27%	30%	39%
<b>Calculated by Evaluator</b>	43%	33%	47%	33%	33%	38%
<b>Not Available</b>	0%	40%	0%	40%	37%	23%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

As indicated in Table 7.1, some of the projects were not even supported by studies; some were supported by letter proposals and one was supported simply by a worksheet. The evaluation team found the data used in the savings adjustment by scouring the reports, papers, handwritten notes, applications, letter proposals and faxes (sometimes of poor legibility) to either find the values in question or to determine what information was available to calculate them.

Sometimes the project files did not clearly identify the implemented equipment, such as when multiple options for air compressors had been proposed. Often the method the ATAC or vendor used to estimate projected savings was not stated and so the evaluation team was unable to confirm whether its approach to estimating adjusted savings was consistent with the approach previously used, or whether the prior approach is well founded.

In addition to these findings, the evaluation team found one project (PE0013) for which information in the project tracking database is inconsistent with that given in the project files. The database reports project savings in excess of both baseline consumption and project savings as reported in the project study.

Table 7.2 through Table 7.5 provide project-specific findings on data availability for projects grouped by energy savings realization rates (greater than one, equal to one, less than one, and zero). Note that even among projects with high realization rates (those in Table 7.2), some were missing an explicit statement of pre- and post-energy consumption for the affected equipment.

### Terms Used in Table 7.2 through Table 7.5

In addition to the terms defined in the preceding section, Table 7.2 through Table 7.5 use a number of terms to succinctly convey a large amount of information:

- *Study*—the energy analysis results and project description available from the project files
  - *Y*—the project files contained a final Technical Analysis Study
  - *Draft*—the files contained a draft Technical Analysis Study
  - *Letter*—the files contained a letter proposal or similar brief description of the energy savings project rather than a Technical Analysis Study
  - *Worksheet*—the files contained worksheets with project details, but no Technical Analysis Study
  - *N*—the files contained none of the above

- *Pre-ECM (Energy Conservation Measure)*—estimates of equipment consumption and load prior to project installation (i.e., baseline data)

The data in the columns indicate the source of estimates for pre-ECM equipment consumption and loads used by the evaluation team:

- *Y*—the project files identified the data element
  - *EC (Engineering Calculations)*—the project files did not identify the data element, yet provided other project descriptors from which the evaluator was able to calculate an estimate of the data element
  - *N*—the project files neither contained the data element nor contained sufficient information from which the data element could be derived
- *Post-ECM*—estimates of equipment consumption, load and project savings subsequent to project installation, as estimated or projected by the ATAC/ vendor

The data in the columns indicate the source of estimates for post-ECM equipment consumption, loads and project savings used by the evaluation team:

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

- $Y$ —as defined above for Pre-ECM
- $EC$ —as defined above for Pre-ECM
- $N$ —as defined above for Pre-ECM



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**Table 7.2**  
**DATA AVAILABILITY—PROJECTS WITH REALIZATION RATES > 1**

ID	PROCESS	PDC	ATAC	STUDY	PRE-ECM		POST-ECM		
					kWh	kW	kWh	kW	kW SAVINGS
PE0211	Secondary Proc.	RHT	Compression	Y	Y	Y	Y	Y	Y
PE0367	Compressed Air	ESG	Rogers Machinery	Y	Y	N	Y	N	N
PE0206	Primary Process	RHT	Harris Group	Y	EC	EC	EC	EC	EC
PE0099	Air Abatement	RHT	QEI	Draft	Y	Y	Y	Y	Y
PE0002	Air Abatement	RHT	Vendor	Letter	EC	EC	EC	EC	EC
PE0003	Air Abatement	RHT	CEE	Letter	EC	EC	EC	EC	EC
PE0363	Compressed Air	ESG	CEE	N	Y	N	Y	N	N
PE0158	Compressed Air	CEE	Compression	Y	Y	Y	Y	Y	Y
PE0164	Secondary Proc.	RHT	Compression	Y	Y	Y	Y	Y	Y
PE0099A	Air Abatement	RHT	QEI	Draft	Y	Y	Y	Y	Y
PE0047	Compressed Air	ESG	Rogers Machinery	Y	Y	N	Y	N	N



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**Table 7.3**  
**DATA AVAILABILITY—PROJECTS WITH REALIZATION RATES = 1 (DEEMED)**

ID	PROCESS	PDC	ATAC	STUDY	PRE-ECM		POST-ECM		
					kWh	kW	kWh	kW	kW SAVINGS
PE0009	Hydraulics	RHT	CEE	N	Y	N	Y	N	N
PE0141	Refrigeration	RHT	CEE	Y	Y	N	Y	N	Y
PE0175	Primary Process	RHT	Compression	N	Y	N	Y	N	N
PE0182	HVAC	ESG	Other	BETC Application	EC	EC	EC	EC	EC
PE0199	Secondary Proc.	RHT	Vendor	Letter	Y	N	Y	N	N
PE0205	Primary Process	RHT	Harris Group	Y	Y	Y	Y	Y	Y

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**Table 7.4**  
**DATA AVAILABILITY—PROJECTS WITH REALIZATION RATES < 1**

ID	PROCESS	PDC	ATAC	STUDY	PRE-ECM		POST-ECM		
					kWh	kW	kWh	kW	kW SAVINGS
PE0185	Air Abatement	RHT	Vendor	N	EC	N	EC	N	N
PE0181	Primary Process	RHT	Vendor	Worksheet	EC	N	EC	N	N
PE0248	Air Abatement	Harris Group	Vendor	Y	EC	EC	EC	EC	EC
PE0117	Compressed Air	RHT	Rogers Machinery	N	EC	EC	EC	EC	EC
PE0001	Compressed Air	RHT	Compression	Y	Y	Y	Y	Y	Y
PE0132	Compressed Air	ESG	Rogers Machinery	Y	Y	N	Y	N	N
PE0188	Primary Process	RHT	Other	Letter	EC	EC	EC	EC	EC
PE0005	Air Abatement	ESG	Vendor	Letter	EC	N	EC	N	N
PE0013	Wastewater	Aspen (PMC)	BacGen	Y	Y	EC	EC	EC	EC



7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**Table 7.5**  
**DATA AVAILABILITY—PROJECTS WITH REALIZATION RATES = 0**

ID	PROCESS	PDC	ATAC	STUDY	PRE-ECM		POST-ECM		
					kWh	kW	kWh	kW	kW SAVINGS
PE0014	Compressed Air	ESG	Vendor	N	Y	N	EC	N	N
PE0142	Refrigeration	RHT	CEE	Y	EC	Y	EC	Y	Y
PE0166	Compressed Air	RHT	Comp Eng	Y	EC	EC	Y	EC	EC
PE0167	Air Abatement	RHT	Vendor	Y	EC	EC	EC	EC	EC

## FINDINGS CONCERNING ADJUSTED SAVINGS

Table 7.6 through Table 7.9 (grouped by energy savings realization rate) identify the project-specific adjusted savings determined by the evaluation team. For projects with realization rates of one or less, the tables provide a comment on the adjusted savings estimates.

Among projects with realization rates greater than one are six projects for which the PMC audited the project savings after installation. Table 7.6, which discusses these projects, includes the PMC-audited savings and a savings-adjusted realization rate for the PMC-audited estimates. In addition, PMC-audited savings estimates were available for two projects with energy realization rates less than one. The table discussing these projects (Table 7.8) was too large to accommodate information on the audited savings estimates and so these details are given in the text that discusses the table, below.

### Projects with Deemed Adjusted Savings

Savings for six of the thirty projects were deemed (see Table 7.7). That is, in lieu of no information or reasonable approach for determining the savings, the evaluation team assumed the actual project savings were the same as projected.

Two of the deemed projects were for refrigeration and cooling loads with seasonal variation; without a full season of operating information, even short-term metering would not have been useful for estimating savings. For these projects, the participant offered the evaluation team data it had metered or collected; yet these data were, ultimately, never provided. Savings verification approaches that may have yielded a more attractive result than deeming would include:

- Long-term metering or telemetry by customer, vendor or the Energy Trust
- Commitment by the customer to regularly document measure operation
- Energy simulation modeling based on engineering, architectural, weather and some operations parameters

A third project involved turning off a large motor where there was a measured baseline. Two more projects installed controls; these projects were simple operational changes and there was no expectation that savings would be different than predicted.

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

The remaining project among the six with deemed savings involved what the participant considered to be a proprietary change to a cleanroom HVAC system. This project had the largest savings of any evaluated projects, about one-third of total estimated savings, yet documentation provided in the project file was scanty and far from adequate. Fortunately from the standpoint of the program's integrity, this project had been designed in collaboration with the Alliance. Thus, the evaluation staff have some confidence in the estimated project savings in spite of the dearth of documentation.

### Projects with Realization Rates Less than One

Table 7.8 provides project-specific information for projects with realization rates less than one, but greater than zero. The size of the table did not accommodate columns to report PMC-audited savings estimates and energy savings realization rates based on the PMC-audited estimates. Two of the nine projects had PMC-audited savings estimates, as follows:

- PE0001 has PMC-audited savings of 529,305, for an audited realization rate of 0.98. The PMC-audited savings estimate is closer to the adjusted savings estimate than the originally projected savings, which have a realization rate of 0.90.
- PE0005 has PMC-audited savings of 488,750, for an audited realization rate of 0.86. The PMC-audited savings estimate is closer to the adjusted savings estimate than the originally projected savings, which have a realization rate of 0.69.

### Projects with Zero Adjusted Savings

Four of the thirty projects had zero adjusted savings (see Table 7.9). Two of the energy savings estimates for these projects were from vendor proposals and two were by ATACs that are generally highly regarded for the quality of their work (see Table 7.5). Two of the projects were compressed air, one an upgrade dust collection system and the fourth was a refrigeration compressor VFD. Each has a different rationale for the zero savings found.

For the two compressed air projects, it appears that controls to ensure that air compressors turn off when not needed may no longer have been operating properly. An alternate hypothesis is that air demands had increased substantially. For the dust collection project, it appears that the vendor-provided baseline and savings estimates were inappropriate. And for the refrigeration project, it is possible that

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

production increases had led to the impression of zero savings. For the latter, production information was requested from the customer, but was not provided.

The estimation of zero adjusted savings was based, for all four projects, on some detailed data on measure performance: three projects had short-term metering (about one week each) installed as part of this evaluation and one project had long-term customer data (two years). Because metering data were available to estimate savings, we have reasonable confidence that zero savings is appropriate in each case.

These projects with zero adjusted savings were cases where the actual energy use observed for the affected equipment was greater than the baseline estimate of equipment energy use prior to the project.<sup>29</sup> It is likely the project documents overstate baseline energy consumption. Were it possible to develop more accurate estimates of baseline energy consumption for these projects, it may be possible to discern project savings. The projects appear to the evaluation team to be good ideas that should save energy, yet lacking accurate baseline estimates, no energy savings could be calculated.

### Overall Realization Rate

The overall realization rate for the 30 projects for which the evaluation team conducted on-site investigations is 1.03 for energy savings (19,622,951 adjusted kWh versus 18,962,903 reported kWh; these values can be obtained by summing the “total” line in Tables 7.6 – 7.9). Due to missing demand values for some projects, no realization rate for demand savings was calculated.

The PMC had audited the energy savings of eight projects subsequent to installation. For seven of the eight projects, the PMC-audited estimate was closer to

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<sup>29</sup> These four (of 30) projects were found to have negative savings. For the Industrial Transition program, one project out of 58 visited sites was found to have negative savings, which the evaluator attributed to lack of proper operations and maintenance for the measure. This Industrial Transition project installed compressed air controls, as did two of the four Production Efficiency projects to which the evaluator assigned zero savings. *Impact Evaluation of Oregon Industrial Transition Projects*, for Energy Trust of Oregon by MetaResource Group, January 2005.

## **7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect**

the adjusted savings than were the initial savings projections contained in the project files. For five cases, the adjusted savings exceeded the PMC-audited savings estimate; for three cases, the adjusted savings were less than the PMC-audited estimates, ranging from 2% less to 27% less.



7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**Table 7.6**  
**ESTIMATED AND ADJUSTED SAVINGS—PROJECTS WITH REALIZATION RATES > 1**

ID	ESTIMATED KWH SAVINGS	ADJUSTED KWH SAVINGS	KWH REALIZATION RATE	PMC-AUDITED KWH SAVINGS	AUDITED KWH REALIZATION RATE	ESTIMATED KW SAVINGS	ADJUSTED KW SAVINGS	REALIZATION RATE FOR KW
PE0211	119,460	302,186	2.53	—	—	NA	—	—
PE0367	290,000	597,148	2.06	—	—	56.5	56.5	1.00
PE0206	711,360	1,221,938	1.72	—	—	14.2	7	0.49
PE0099	258,804	442,268	1.71	601,848	0.73	62	73	1.18
PE0002	386,458	544,271	1.41	506,845	1.07	NA	—	—
PE0003	835,000	1,162,265	1.39	700,757	1.66	104.4	145	1.39
PE0363	322,183	431,150	1.34	—	—	56.4	59	1.05
PE0158	1,689,977	2,157,134	1.28	2,025,073	1.07	55.3	116	2.10
PE0164	372,350	454,646	1.22	—	—	95	118	1.24
PE0099A	263,016	312,191	1.19	260,676	1.20	NA	—	—
PE0047	180,359	200,071	1.11	184,512	1.08	44.3	18	0.41
<b>TOTAL</b>	<b>5,428,967</b>	<b>7,825,268</b>	<b>1.44</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**Table 7.7**  
**ESTIMATED AND ADJUSTED SAVINGS—PROJECTS WITH REALIZATION RATES = 1 (DEEMED)**

ID	ESTIMATED KWH SAVINGS	KWH REALIZATION RATE	COMMENT	PMC-AUDITED KWH	ESTIMATED KW SAVINGS	REALIZATION RATE FOR KW
PE0009	1,017,474	1.0	Actual operation unchanged from study; customer had performed metering and confirmed savings	—	6	1.0
PE0141	72,770	1.0	Modeling approach used in estimation appears reasonable	—	70	1.0
PE0175	258,711	1.0	Actual operation unchanged from study	—	NA	—
PE0182	5,760,682	1.0	Very little documentation available for this confidential project; limited time available with respondent; equipment not observed nor metered	—	NA	—
PE0199	491,175	1.0	VFD chiller in use; controlled manually with no detailed records, precluding modeling	—	NA	—
PE0205	524,160	1.0	Savings accrue from turning off back-up motor; confirmed motor off; usage measured by study	—	657	1.0
<b>TOTAL</b>	8,124,972	1.0	—	—	NA	NA

7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**Table 7.8**  
**ESTIMATED AND ADJUSTED SAVINGS—PROJECTS WITH REALIZATION RATES < 1**

ID	ESTIMATED KWH SAVINGS	ADJUSTED KWH SAVINGS	KWH REALIZATION RATE	COMMENT	ESTIMATED KW SAVINGS	ADJUSTED KW SAVINGS	REALIZATION RATE FOR KW
PE0185	544,431	531,908	0.98	Only engineering calculations available for pre- and post-kWh	NA	—	—
PE0181	1,049,962	1,014,863	0.97	Only engineering calculations available for pre- and post-kWh	154	NA	—
PE0248	186,575	177,326	0.95	Operating hours may have increased slightly from baseline	22.8	13.7	0.60
PE0117	164,796	152,796	0.93	Increased demand for compressed air	5	1	0.20
PE0001	578,170	518,853	0.90	Increased demand for compressed air	12	63	5.25
PE0132	318,587	278,376	0.87	Increased production and demand for compressed air	NA	—	—
PE0188	272,392	196,619	0.72	Results are within reasonable range of expected performance	30	19	0.63
PE0005	608,813	419,508	0.69	Increased equipment use	0	NA	—
PE0013	826,330	382,462	0.46	Assumed project would replace 13 aerators; 5 are still running, 2 of which may be retired at a later date	83	44	0.53
<b>TOTAL</b>	4,550,056	3,672,711	0.81	—	NA	NA	NA



7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**Table 7.9**  
**ESTIMATED AND ADJUSTED SAVINGS—PROJECTS WITH REALIZATION RATES = 0**

ID	ESTIMATED KWH SAVINGS	COMMENT	KWH REALIZATION RATE	PMC-AUDITED KWH SAVINGS	ESTIMATED KW SAVINGS	ADJUSTED KW SAVINGS	REALIZATION RATE FOR KW
PE0142	215,583	Assumption that only efficient, larger compressor would run, yet that unit plus two existing units are running; controls may not be working properly; air demands may have increased	0	—	NA	—	—
PE0166	132,645	Likely significant changes occurred in production and system operation; possible increase in output	0	—	NA	—	—
PE0014	320,891	Project installed controls, yet metering determined unit runs almost constantly; possible increase in air demands	0	—	-13	0	0
PE0167	189,789	Hours of operation significantly understated; baseline fan power overestimated at full loading; baseline energy unknown, yet if known, some savings might be discernable	0	—	73	54	.74
<b>TOTAL</b>	858,908	—	0	—	NA	NA	NA

## FINDINGS ON FREE-RIDER AND SPILLOVER EFFECTS AND NON-ENERGY BENEFITS

Table 7.10 through Table 7.13 present project-specific free-rider estimates, spillover effects and non-energy benefits. The free-rider estimates are calculated as described in chapter 6. The spillover effects and non-energy benefits were identified by the participants.

7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

Table 7.10

FREE-RIDER, SPILLOVER AND NON-ENERGY BENEFITS—PROJECTS WITH REALIZATION RATES > 1

ID	INDUSTRY	PROCESS	FREE-RIDER ESTIMATE	SPILLOVER REPORTED	NON-ENERGY BENEFITS REPORTED
PE0047	Food Processing	Compressed Air	0%	Some lighting projects	Increased reliability; ease of use
PE0099A	Wood Products	Air Abatement	0%	None	Improved labor use; less maintenance
PE0164	Wood Products	Secondary Proc.	0%	None	Decreased emissions
PE0158	Wood Products	Compressed Air	0%	A few small projects	Increased reliability
PE0363	General Mfg.	Compressed Air	0%	None	Improved production; less maintenance
PE0003	Wood Products	Air Abatement	0%	None	Decreased emissions
PE0002	Wood Products	Air Abatement	0%	None	Eliminated dust emissions
PE0099	Wood Products	Air Abatement	0%	None	Improved labor use; less maintenance
PE0206	Wood Products	Primary Process	0%	None	Better output
PE0367	Food Processing	Compressed Air	0%	None	Reliability; less waste
PE0211	Wood Products	Secondary Proc.	0%	None	Decreased emissions; improved labor use; better output; fewer problems; shorter run time

7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

Table 7.11

FREE-RIDER, SPILLOVER AND NON-ENERGY BENEFITS—PROJECTS WITH REALIZATION RATES = 1 (DEEMED)

ID	INDUSTRY	PROCESS	FREE-RIDER ESTIMATE	SPILLOVER REPORTED	NON-ENERGY BENEFITS REPORTED
PE0009	Wood Products	Hydraulics	0%	None	Lower oil temperature
PE0141	Food Processing	Refrigeration	50%	None	Less equipment wear and easier compressors start-up
PE0175	Wood Products	Primary Process	0%	None	Less noise and vibration
PE0182	High Tech	HVAC	80%	Delamping	More reliable in an environment where downtime is very costly
PE0199	High Tech	Secondary Proc.	0%	None	Increased flexibility
PE0205	Wood Products	Primary Process	0%	None	Improved labor use



## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**Table 7.12**

**FREE-RIDER, SPILLOVER AND NON-ENERGY BENEFITS—PROJECTS WITH REALIZATION RATES < 1**

ID	INDUSTRY	PROCESS	FREE-RIDER ESTIMATE	SPILLOVER REPORTED	NON-ENERGY BENEFITS REPORTED
PE0185	Wood Products	Air Abatement	0%	None	Better air distribution; improved handling and maintenance
PE0181	Wood Products	Primary Process	0%	None	More efficient; more exact; slightly faster (increased output)
PE0248	Wood Products	Air Abatement	0%	None	Decreased down time
PE0117*	General Mfg.	Compressed Air	0%	Some lighting projects	Improved production (adequate air supply); less noise
PE0001*	General Mfg.	Compressed Air	0%	—	—
PE0132	General Mfg.	Compressed Air	0%	None	Improved production (adequate and proper air pressure)
PE0188	Wood Products	Primary Process	0%	None	None reported
PE0005	Wood Products	Air Abatement	80%	None	None reported
PE0013	Municipal	Wastewater	0%	None	Improved performance; potential reduction in chemical costs = \$96k/yr

\* A single participant conducted both these projects, which installed two different sized units of the same technology; thus spillover and non-energy benefits are given jointly for the two projects.



7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

Table 7.13

FREE-RIDER, SPILLOVER AND NON-ENERGY BENEFITS—PROJECTS WITH REALIZATION RATES = 0

ID	INDUSTRY	PROCESS	FREE-RIDER ESTIMATE	SPILLOVER REPORTED	NON-ENERGY BENEFITS REPORTED
PE0014	Food Processing	Compressed Air	0%	None	No increased air demand, despite increased total compressor HP
PE0142	Food Processing	Refrigeration	0%	None	Helps level out production
PE0166	Wood Products	Compressed Air	0%	None	Better pressure; easier to manage system; reduced compressor run time
PE0167	Wood Products	Air Abatement	50%	Some Motors	Reduced discharge to nearly zero



7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**FINDINGS FROM PHONE INTERVIEWS OF SMALLER PROJECTS**

The above sections discuss the 30 larger projects comprising 89% of total savings from projects completed as of September 20, 2004. This section discusses the 23 smaller projects comprising 11% of total completed savings. The evaluation team phoned the contacts for these projects and, as described in chapter 6, completed interviews investigating 17 of these projects.

All of the interviewed project contacts reported the efficiency equipment is in place and operating as expected. None of the contacts reported any changes in the operating parameters of their affected equipment.

The evaluation team asked project contacts about the annual hours of operation for the equipment, and whether the hours had changed since the project was proposed. We then compared their responses with the hours of operation reported in the project files. The files of 8 of the 17 phone-surveyed projects lacked any mention of operating hours. Table 7.13 provides the information for these projects that was obtained from the phone survey and the evaluation team’s assessment of whether project operating hours have changed since the project was proposed.

**Table 7.14**  
**SURVEYED PROJECTS LACKING OPERATING HOURS IN PROJECT FILES**

ID	EVALUATOR'S ASSESSMENT OF OPERATING HOURS CHANGE	PARTICIPANT SURVEY RESPONSE	
		APPROXIMATE HOURS PER YEAR (CALCULATED)	HAS THIS CHANGED?
PE0122	No change	2,500	No change
PE0125	No change	6,500	No change
PE0133	Don't know	5,500	Not asked
PE0207	No change	6,000	No change
PE0243	No change	6,000	No change
PE0247	Don't know	4,000	Don't know
PE0272	No change	2,500	No change
PE0298	No change	90 to 100 days a season	No change

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

Table 7.15 provides the data for the nine projects whose files contained operating hours. The table compares the information from the files with the information obtained during the phone surveys and includes the evaluation team's assessment of whether operating hours have changed.

**Table 7.15**  
**SURVEYED PROJECTS WITH OPERATING HOURS IN PROJECT FILES**

ID	EVALUATOR'S ASSESSMENT OF OPERATING HOURS CHANGE	FROM PROJECT FILES	PARTICIPANT SURVEY RESPONSE	
		APPROXIMATE HOURS PER YEAR (CALCULATED)	APPROXIMATE HOURS PER YEAR (CALCULATED)	HAS THIS CHANGED?
PE0016	Increased	2,500	3,500	Yes, increased
PE0028	No change	4,500	4,500	No change
PE0049	Decreased	6,000	4,000	Yes, ramping up
PE0128	Increased	2,200	5,000	Yes, increased
PE0136	No change	8,760	8,760	No change
PE0251	No change	7,000	7,000	No change
PE0287	No change	Changes seasonally, details elaborated in files	Not asked	No change
PE0371	Increase	2,000	8,760	No change
PE0379	No change	3,000	3,000	No change

The projects in the preceding two tables fall into five groups relative to our assessment of whether operating hours have changed: 1) assumption of no change, yet unable to confirm due to lack of operating hours in project files; 2) no change, as confirmed by phone interviews; 3) unable to determine from comparison of available phone and file data; 4) hours increased, based on a comparison of phone and file data; and 5) hours decreased, based on a comparison of phone and file data. These project groups and the projected energy savings associated with each group are given in Table 7.16.

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

**Table 7.16**  
**SURVEYED PROJECTS' REALIZATION RATES**

OCCURRENCE	PROJECTED SAVINGS		ESTIMATE OF REALIZED SAVINGS		REALIZATION RATE
	KWH	PERCENT	KWH	PERCENT	
No change (unconfirmed)	432,810	33%	432,810	25%	100%
No change (confirmed)	433,172	33%	433,172	25%	100%
Unable to determine, no change assumed	159,017	12%	159,017	9%	100%
Increased	248,626	19%	696,006	40%	280%
Decreased	42,080	3%	28,053	2%	67%
<b>TOTAL</b>	<b>1,315,705</b>	<b>100%</b>	<b>1,749,058</b>	<b>100%</b>	<b>133%</b>

For each project whose operating hours have increased or decreased according to the phone survey responses, we calculated the ratio of hours reported in the phone survey to the hours reported in the project files. We then multiplied the savings for each project by the project-specific ratio of percentage increase or decrease. We then summed the multiplied savings for each group, as reported in Table 7.16 in the column “estimate of realized savings”. (The multiplier for the savings in the groups with no changes is “1.”)

Finally, Table 7.16 shows the realization rate for each group of surveyed projects and for the surveyed projects overall. The results are strongly affected by a single project (PE0371), for which the project file indicated 2,000 hours of operation and the interviewed contact indicated constant operation (8,760 hours). The results are also strongly influenced by the 45% of projects whose operating hours could not be confirmed and were assumed unchanged.

In addition to exploring changes in operating hours and equipment operation parameters, we asked phone survey respondents questions to support assessment of free-ridership and spillover. Contacts for four of the 17 projects reported some spillover. For 12 of the 17 projects, we estimated no free-ridership occurred. For five projects, we estimated free-ridership rates between 30% and 60%. These estimated free-rider rates would reduce the savings projections given in the project files by 12% (i.e., a net-to-gross ratio for projected savings of 88%).

## 7. Findings Concerning Impact Evaluability, Adjusted Savings and Free-Rider/Spillover Effect

## 8. CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSIONS

The Production Efficiency program is successful from a number of perspectives. Industrial participants are happy with the program, especially with the services they receive from program staff (principally, the PDCs). Eighteen months after its launch (i.e., the end of 2004), the program had completed 132 projects, estimated to have saved over 100,000,000 first-year kilowatt hours of electricity. In addition to those completed, close to 400 projects are currently underway. The completed projects were attained by providing total participant incentives (direct incentives plus study costs) averaging 14¢ per first-year kWh.

On the whole, program implementation activities are occurring smoothly, although we will elaborate on this topic subsequently.<sup>30</sup> The various program implementation parties (staff of the Energy Trust, the PMC, the PDCs and the ATACs) for the most part have forged effective working relationships and together are meeting program goals.

This research has assessed the evaluability of the Production Efficiency program, but was conducted early in the program and thus investigated too few projects to provide a reliable estimate of the impact realization rate (percent of estimated savings actually achieved) and of the freerider rate. Even for the projects investigated, time and resource constraints precluded thorough investigations of some sites.

We offer specific conclusions on research issues raised by Energy Trust staff concerning the Production Efficiency program.

#### 1. Are the Production Efficiency projects sound?

**Yes, the projects appear to be sound.** Overall, the evaluation team judged the 30 site-investigated projects as attaining 103% of the energy savings ascribed to them in the program database. This study was conducted early in the program and

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<sup>30</sup> See issues #5 and #6, below.

thus investigated too few projects to provide estimates of the realization and free-rider rates suitable to extrapolation to future program accomplishments. Even for the projects investigated, time and resource constraints precluded thorough investigations of some sites.

### 2. Are any changes needed in project documentation to better support an impact evaluation?

**Yes, project documentation needs to be improved to better support an impact evaluation.** The evaluation team found that roughly 45% of the 30 projects comprising about 90% of program savings lacked a clear statement of the estimated energy consumption of the affected equipment before and/or after the energy efficiency action. For 6 of the 30 projects, the evaluation team deemed the savings; and for another 4, the team assigned zero savings. The decisions to deem savings or assign zero savings for these ten cases were made, in most cases, because of inadequate analyses or documentation. Had baseline data been available, the team would have been able to ascribe some savings to the four projects assigned zero savings, even if not the full expected savings reported in the project files. More than two-thirds of files lacked estimates of demand savings. About 40% of the smaller projects which the evaluation team investigated through phone surveys lacked data on operating hours. Nonetheless, the projects appear to be sound. Overall, the evaluation team judged the 30 site-investigated projects as attaining 103% of the energy savings ascribed to them in the program database.

In investigating the realized impacts of the 30 largest projects, the evaluation team faced significant challenges to determine exactly what data were explicitly contained in the project files, not to mention what data could be inferred, because the project studies do not include a summary statement clearly identifying the projects' consumption and demand figures, or key assumptions such as operating hours. Some of the projects were not even supported by studies; some were supported by letter proposals and one was supported simply by a worksheet.

On a positive note, the PMC-audited savings estimates are closer than the original estimates to the adjusted savings for seven of eight PMC-audited projects. However, as a group, the PMC audit results suggest the original project estimates are typically conservative—which they are not—because, by chance, more than half of the PMC-audited projects were judged by the evaluation team to have greater-than-expected savings, compared with one-third of projects investigated on-site by the evaluation team.

## 8. Conclusions and Recommendations

### 3. How are industrial firms responding to the program?

**Industrial firms are participating in large numbers (as evidenced by the number of projects) and participants span all ten of the industry-type categories tracked by the program.** Of the first 53 projects completed, approximately 10 improved the overall efficiency of the systems serving the facilities' production; the remaining projects improved the efficiency of specific components or auxiliary equipment, such as air compressors. The evaluation team was not successful in comparing the distribution of participants' facilities to the distribution by size of all industrial facilities eligible for the program, so no conclusions can be drawn concerning the program's reach into the submarket of smaller firms.

The microelectronics industry is underrepresented among program participants in comparison with its size as one of the two largest industrial loads in the state. Program contacts explained this was owing to the industry's relatively new facilities, yet research conducted by the Northwest Energy Efficiency Alliance has concluded there is an opportunity for efficiency improvements to cleanrooms in virtually all of the state's semi-conductor fabrication facilities. These opportunities extend to other industries with cleanrooms, including biotech, pharmaceuticals and even some food processing.

Program staff have successfully coordinated the marketing and delivery of the Production Efficiency program with that of the Energy Trust's Building Efficiency program and the state's BETC and SELP programs. Industrial firms are also eligible for three additional programs the Energy Trust offers or has plans to offer. It is too soon to judge the level of coordination among all of these Energy Trust efforts and participants' ease of access with an array of programs.

### 4. What are the roles that incentives and project non-energy benefits play in the decisions of industrial firms to participate in the program?

**Program contacts speculated that the magnitude of program participation might not be adversely affected by reducing the incentive somewhat** (say, to 40% of project costs from the current 50%), but added that, of course, they cannot predict this with certainty. Contacts did not believe non-energy benefits substitute for direct program incentives in customer decision-making. Non-energy benefits cannot be known with the confidence of energy benefits—neither in type nor magnitude—and non-energy benefits are equally present for all capital expenditures with which efficiency investments compete. Contacts suggested non-energy benefits can best be used to leverage energy savings during the initial



project identification phase by asking facility staff about their hopes for improving their facilities and assessing whether any of their objectives might be met by creative, energy-efficient solutions.

Contacts emphasized the importance of a simple, non-negotiated incentive structure—a strength of the current program—and incentives that change only slowly and after ample warning has been given to the market. The latter characteristic includes avoiding having to suspend program incentives for any period as a means of controlling program volume.

Finally, program contacts thought the two-cent per kWh incentive offered to quick payback projects was appropriate from a marketing perspective; as a practical matter, as of the end of 2004, only two projects had received that incentive.

### **5. Have there been any changes in the program in response to the findings and recommendations of the first process evaluation?**

**Most changes in program implementation have come from the Energy Trust's responsiveness to recommendations made in the previous evaluation.** Specifically, the Energy Trust has become much more responsive in day-to-day program management and decision-making, and its contracting processes are improved. However, most contacts feel the Energy Trust (more specifically, its Board of Directors) has yet to provide a clear direction for addressing competing objectives with limited resources, yet all contacts report program activities are consciously directed towards meeting the variety of Trust objectives.

PMC staff report modest changes undertaken in response to program evaluation findings: an additional program form was created to track a key juncture (approval of the technical study); information for potential participants was added to the website; and small efforts were made to ensure that technical studies conform to a few basic requirements. ATACs reported less confusion about their role, yet this improvement is owed to their experiences gained over the past year and not to explicit activities conducted by the PMC.

### **6. How well is the model working of relying principally on market actors for program delivery and secondarily on program staff?**

**Changes since program inception have increased reliance on contracted Production Efficiency staff for program delivery, away from market actors**

## 8. Conclusions and Recommendations

**(i.e., established firms that provide services to the market); however, planned changes would reverse this trend.**

To understand this issue and the significance of some of the past and planned program changes, some background information is presented.

To further its goal of market transformation—increasing the energy efficiency of industrial firms by increasing the energy efficiency of the solutions offered by their consulting engineers and equipment vendors—the Energy Trust designed the Production Efficiency program to involve consulting engineers and equipment vendors in program delivery. The program is also delivered by program staff—professionals who, in the absence of the program likely would not have a relationship with industrial firms. For Production Efficiency, the Energy Trust and the PMC are program staff, as well as two of the PDCs that are not consulting engineering firms and that owe their existence to efficiency programs. The program employs market actors (existing consulting engineers and equipment vendors) as two of the PDCs, as well employing them in the role of ATACs.

The Energy Trust originally conceived that Production Efficiency would rely on marketing by ATACs, as well as by PDCs. Thus, the consulting engineers and vendors that serve as ATACs would gain additional expertise and confidence in energy efficiency; to a lesser extent, so would the engineers and vendors that are not employed by the program, but who work with participating industrial firms. At the outset of Production Efficiency, interviews conducted by the evaluation team confirmed that the ATACs were marketing the program. However, the ATACs reported losing customers they had brought to the program. A year later, this current evaluation has found very little marketing by ATACs. Thus, this intended use by the program of established market players has decreased. In addition, for 2005 activities, the allocation of funds among the PDCs has shifted to provide a greater proportion to the two non-engineering firms (essentially, extensions of program staff) and away from the two consulting engineering firms (market actors).

Looking forward, the PMC is developing plans to deliver the program to smaller industrial firms that will likely depend heavily on equipment vendors. The PMC anticipates developing software to enable various types of equipment vendors (such as for compressed air equipment) to specify program-qualifying equipment and production solutions. The PMC anticipates the program will only be able to cost-effectively serve smaller firms if it enables vendors to readily propose energy-efficient equipment.

### 7. How well is the model working of using a PMC for program delivery?

**The current PMC model in many respects serves the program very well, yet has limitations that could be reduced were the Energy Trust to modify the PMC's role.** The use of a PMC for program delivery has, as the Energy Trust anticipated when it created the role, enabled the program to launch quickly and effectively, without adding to Energy Trust staff at a time when the organization was still “feeling its way” and focusing on the development of programs, policies and internal capabilities. Regarding the specific firm serving as program PMC, it has, by all accounts, hired capable staff and program contractors (PDCs and ATACs). The PMC technical manager has, by all accounts, an excellent understanding of industrial processes and marketing to industrial firms, and has been a tireless worker. The program achievements after 18 months of implementation—achievements in terms of energy savings and number and variety of projects—speak to the success of program delivery by the PMC.

Nonetheless, the evaluation has found two areas of significant weakness for program. The team believes these weaknesses owe more to the structure of the PMC's role than to the specific characteristics of the current PMC.

One, the evaluation has found the quality of documentation of project analyses increases the difficulty and cost of an impact evaluation and results in uncertainty to the extent that the evaluators are unable to adjust program estimates based on field observations. Further, the quality of documentation has the ultimate effect of reducing savings that evaluators can attribute to the program. Program contacts agree project analysis costs must be balanced by the need to move forward with projects and to deliver a cost-effective program. In the absence of these constraints, projects could be studied indefinitely with few ever implemented and with high program administrative costs. The current PMC's role includes deciding what constitutes adequate analysis and documentation; yet the PMC's performance, according to the terms of its contract, is judged based on the quantity of cost-effective savings it delivers. Under the contract terms, it poses a conflict for the PMC to also determine the required degree of analysis and documentation, which drives up program costs.

Two, the evaluation has found several problems that stem from the role of the PMC as client of the PDCs and ATACs, with whom the PMC has contracted for program delivery services. The most striking problem: multiple program contacts expressed a reluctance to talk with team members because they said they had suffered negative repercussions after freely sharing their opinions during the first program evaluation a year earlier.

## 8. Conclusions and Recommendations

Thinking this situation may have arisen as an outcome of the contracting arrangements—reluctance of contractors to express potentially critical views about the firm that has hired them—the evaluation team informally contacted process evaluators around the country that are well-esteemed for their work. Essentially, other than the Energy Trust and recently WECC for the Focus on Energy efforts in Wisconsin, no sponsoring agency has organized its program management contracts like the Energy Trust does. Other agencies either directly contract with a program implementation contractor and with each of the supporting contractors, or contracts with a prime implementation contractor who has, prior to contracting, assembled a team of firms with agreed upon relationships. Further, none of these other evaluators had experienced program contacts that were reluctant to speak as an outcome of negative repercussions for having previously spoken candidly.

The program evaluation team has come to suspect that the hesitancy of the program contacts to speak freely is nearly inevitable because of the contracting system used by the Energy Trust. The current system opens the door to conflict among the parties because it imposes a hierarchy on firms that are competitors. Any of the PDCs could potentially be hired by the Energy Trust to serve as a PMC. Likewise, any of the ATACs could potentially be PDCs, or even the PMC. Thus, firms that compete with each other for consulting work are expected by the program to subordinate their individual interests when they make program-related decisions. Yet the competition among these firms is a market reality that has preceded and will outlive the program, and it complicates communication and decision-making among the parties.

The system of having the PMC contract with the PDCs and ATACs also complicates contracting, as described in detail in the first evaluation of the Production Efficiency program. The first evaluation observed that the Energy Trust required that the RFPs for PDCs and ATACs, and all contracts with selected firms, be approved by the Energy Trust. Contract negotiations included the Energy Trust as well as the two parties to the contract (the PMC and the particular PDC or ATAC). All parties described the contracting process as protracted and problematic.

Finally, the current system, whereby the PMC contracts with the PDCs and ATACs, makes the Energy Trust twice removed from the industrial firms it serves. The Energy Trust interacts with the contractor that interacts with the contractors that have relationships with potential and actual participants. The PMC operates the program in a turn-key manner for the Energy Trust—the Energy Trust pays the bill and the contractor delivers the energy savings. Although the Energy Trust is informed about PMC decisions, and in some cases collaborates in making these decisions, it does so relying on information the PMC presents. The Energy Trust lacks an independent source of information about the market, and about the

performance of PDCs and ATACs. Consequently, the Energy Trust's evolution of the program and its oversight of the PMC primarily rest on information the PMC has provided it.

### RECOMMENDATIONS

- 1. The Energy Trust should ensure the adoption of procedures, formats or standards that will improve the quality of project analyses and documentation.**

The Energy Trust should build on the findings of the current impact evaluability assessment and of the first process evaluation and take steps to ensure that project analyses and documentation can support a future full-scale program impact evaluation. Taking these steps will also ensure that Oregon ratepayers receive consistently excellent information on the energy savings benefits of Trust-recommended efficiency projects.

- 2. The Energy Trust should conduct a full-scale program impact evaluation of the Production Efficiency program after December 31, 2005.**

The full-scale program impact evaluation should examine projects completed after those examined for the current impact evaluability assessment, namely those completed between September 21, 2004, and December 31, 2005.

- 3. Energy Trust staff should meet more frequently with program participants and with PDCs.**

Energy Trust staff should meet more frequently with program participants to further build relationships with customers—which contacts agree contribute greatly to the success of the program—and to obtain direct feedback from participants, unmediated by program contractors.

In addition, the Energy Trust should hold periodic meetings (e.g., quarterly or bi-annually) to bring the PDCs together to share lessons they have learned in program marketing and to identify efficiency opportunities.

- 4. The Energy Trust should consider contracting directly with each of the firms involved in program delivery, contracting with the PDCs to attain energy**

## 8. Conclusions and Recommendations

### **savings goals and with the PMC to provide program support services to the Trust and to the PDCs and ATACs.**

The Energy Trust should consider contracting directly with the PMC, with each PDC, and with each ATAC. Such contracting will bring the Energy Trust closer to the industrial market and into direct contact with the firms delivering the program to that market. It will simplify the program contracting processes by removing the Energy Trust from contracts to which it is not a party, and it will enable existing conflicts of interest to be untangled.

Each PDC would be assigned energy goals and a specific, unique market. The contract terms should be crafted so that it is in the interest of PDCs to have ATACs market the program to industrial firms in their assigned markets. The Energy Trust should consider contracting with the PMC to conduct most of the program support services currently performed by the PMC. These activities include, at a minimum: developing marketing strategies and approaches, assisting the PDCs in marketing, and program tracking. As well, the PMC would continue to assign and review technical studies to a level of quality defined by the Energy Trust, since study review would not pull the PMC in two directions once the PMC is no longer responsible for cost-effectively meeting an energy savings goal.

# APPENDICES

Appendices



# APPENDIX A

## Project Evaluation Summaries

Appendix A

## PROJECT EVALUATION SUMMARIES

### PROJECT EVALUATION SUMMARY – FOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
VFD air compressor, cycling air dryer	Food Processing	311411	PE0047
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
180,359	200,071	111%	Conservative analysis approach
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Better control of air pressure			Yes

### Customer Description

This facility manufactures and packages snack foods.

### Efficiency Project

#### ➤ Compressed Air System

- Variable speed air compressor with variable speed cooling fan, cycling refrigerated air dryer, and increased receiver capacity.

### Projected Energy Savings and Peak Demand Reduction

Projected compressed air energy savings was 180,359 kWh annually, as reported in the project database. Total annual PMC-audited savings was 184,512 kWh.

No information on projected peak demand reduction was available.

### Other Project Benefits

For the compressed air control upgrade, plant staff feel this upgrade has real production value in that they can count on uniform pressure in the plant, even during clean-up periods. The system is completely automatic now, whereas before it was manually operated.

### Factors Attributing to Variance

The analysis of metered information suggests savings are slightly greater than predicted. The following points support this conclusion:

1. There have been no significant changes in compressed air demand.
2. The ATAC for this project typically downgrades savings potential in order to be conservative.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- Thirty-second interval motor current data for the variable speed compressor were gathered over about one week.

#### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

#### ➤ Spillover

- Some lighting projects have been done with their own funding.

➤ **Measures Not Implemented**

- All measures recommended were implemented by the customer.

**Summary of Project Savings**

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Variable Speed Air Compressor, Cycling Refrigerated Dryer	180,359 kW not available	200,071 kW not available	111% kW not available

## PROJECT EVALUATION SUMMARY – CEMENT PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Air compressor controls, air dryer	Lime Manufacturing	327410	PE0363
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
322,183	431,150	134%	Possible conservative analysis
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Dry air, no more compressed air-related problems, much less maintenance			Unknown

### Customer Description

This facility manufactures lime for cement products.

### Efficiency Project

#### ➤ Compressed Air System

- Compressed air controls, piping changes, additional storage and new refrigerated air dryer.

### Projected Energy Savings and Peak Demand Reduction

Projected compressed air energy savings was 322,183 kWh annually, as reported in the project database.

No information on projected peak demand reduction was available.

## Other Project Benefits

For the compressed air control upgrade, plant staff described they now have dry air and no longer have compressed air-related problems. They also report spending less time on compressor maintenance.

## Factors Attributing to Variance

The analysis of metered information suggests savings are greater than predicted. The following points support this conclusion:

1. There have been no significant changes in compressed air demand.
2. The study used was an update of an earlier study rather than a comprehensive look at the compressed air system as it was being operated at the time of the project. It is possible this cursory look did not fully consider how the system would actually operate.

## Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

### ➤ Metering

- One-minute interval motor current data for the main compressor were gathered over about one week.

### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

### ➤ Spillover

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure has been installed.

### ➤ Measures Not Implemented

- All measures recommended were implemented by the customer.

Appendix A

Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Air Compressor Controls and Air Dryer	322,183 kW not available	431,150 kW not available	134% kW not available



## PROJECT EVALUATION SUMMARY – TRANSPORTATION MANUFACTURING

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Variable speed air compressor	Truck Trailer Manufacturing	336212	PE0132
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
318,587	278,376	87%	Possible increased air demands
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Now have adequate air and proper air pressure at all times			Yes

### Customer Description

This facility manufactures truck trailers and accessories.

### Efficiency Project

#### ➤ Compressed Air System

- Variable speed air compressor.

### Projected Energy Savings and Peak Demand Reduction

Projected compressed air energy savings was 318,587 kWh annually, as reported in the project database.

No information on projected peak demand reduction was available.

### Other Project Benefits

With the compressed air control upgrade, plant staff described they now have adequate air and proper air pressure at all times, even when the bead blaster is operating.

### Factors Attributing to Variance

The analysis of metered information suggests savings are less than predicted. The following points support this conclusion:

1. There have been increases in production and compressed air demand.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- One minute interval motor current data for the main compressor were gathered over about one week.

#### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

#### ➤ Spillover

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure has been installed. However, they have become more aware of their ability to change their energy use since participation.

#### ➤ Measures Not Implemented

- All measures recommended were implemented by the customer.

Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Variable Speed Air Compressor	318,587 kW not available	278,376 kW not available	87% kW not available

## PROJECT EVALUATION SUMMARY – FOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
VFD refrigeration compressors, efficient ice cream freezer	Ice Cream and Frozen Dessert Manufacturing	311520	PE0142, PE0141
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
VFD Comp: 215,583 Ice Cream Freezer: 72,770	0 72,770	0% 100%	Possible production dif. Deemed
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Less equipment wear and easier start-up for screw compressors			Yes

### Customer Description

This facility is a dairy and manufactures ice cream.

### Efficiency Project

#### ➤ Refrigeration System Upgrade

- Controls and variable speed drives for three compressors.

### Projected Energy Savings and Peak Demand Reduction

Projected compressed air energy savings was 215,538 kWh annually, as reported in the project database for the variable speed drive retrofit; and 72,770 kWh annually, as reported in the project database for the upgrade for the ice cream freezer.

No information on projected peak demand reduction was available.

### **Other Project Benefits**

For the variable speed drive upgrade, plant staff mentioned they expected less equipment wear and easier start-up for the screw compressors. No specific benefits were mentioned for the new ice cream freezer, except to help level out production requirements at the main plant.

### **Factors Attributing to Variance**

An analysis of several years of system performance data provided for the main plant compressors where variable speed drives were installed indicate there are zero savings for this measure. The following points should be considered:

1. There were likely significant changes in production and system operation.
2. The customer implied product demand had been growing over time; if so, this would increase total energy consumption. Evaluation staff requested production data from the customer, but the request was declined, possibly because the data were considered proprietary.

For the ice cream freezer, the energy savings were deemed. The following points should be considered for that project:

1. This project has relatively small savings and would not have been discussed with the owners except as a side conversation to the main plant variable speed compressor project.
2. The refrigeration system is straightforward and the loads are relatively uniform throughout the year (except for ambient condition loads). Because of this, the modeling approach for predicting the savings is expected to be accurate.

### **Site Visit Description and Findings**

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

## Appendix A

### ➤ Customer Data

- Fifteen-minute interval compressor motor current data for each of the main refrigeration compressors were provided over a period of about two and one-half years.

### ➤ Free-Ridership

- No full or partial free-ridership was observed for the VFD refrigeration compressors: 0% score.
- The ice cream freezer project would have been done anyway, as it was a necessary new project for their process: 50% score.

### ➤ Spillover

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure has been installed.

### ➤ Measures Not Implemented

- A VFD evaporator fan retrofit was recommended but not pursued by the customer because the fan motor manufacturer refused to warrant their motors for this change.

## Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Variable Speed Refrigeration Compressors	215,583 kW not available	0 kW not available	0% kW not available
Ice Cream Storage Freezer	72,770 kW not available	72,770 kW not available	100% kW not available

## PROJECT EVALUATION SUMMARY – TRANSPORTATION MANUFACTURING

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Variable speed air compressors & dryers	Aircraft Manufacturing	336411	PE0001, PE0117
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
150 HP: 578,170 75 HP: 164,796	518,853 152,796	90% 93%	Possible increased air demands
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
150 HP: 12 75 HP: 5	63 1	525% 20%	Observations of metered data
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Adequate air supply and quieter operation			Yes

### Customer Description

This facility manufactures and repairs aircraft.

### Efficiency Project

#### ➤ Compressed Air System

- 150 HP variable speed air compressor and cycling refrigerated air dryer.
- 75 HP variable speed air compressor and cycling refrigerated air dryer.

(The compressors serve two separate locations at the facility.)

### Projected Energy Savings and Peak Demand Reduction

Projected compressed air energy savings for the 150 HP compressor was 578,170 kWh annually, as reported in the project database. Total annual PMC-audited savings for this project was 529,305 kWh. Projected compressed air energy savings for the 75 HP compressor was 164,796 kWh annually.

Projected peak demand reduction for the 150 HP compressor was 12 kW and for the 75 HP compressor was 5 kW.

### Other Project Benefits

For both these compressed air upgrades, plant staff described the benefit of finally having adequate air supply. They also reported having a more pleasant work environment, since the compressors are very quiet compared to the former equipment.

### Factors Attributing to Variance

The analysis of metered information suggests savings are slightly less than predicted. The following points support this conclusion:

1. There have been increases in compressed air demand.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- One-minute interval motor current data for each main compressor motor were gathered over about one week.

#### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.



➤ **Spillover**

- Some lighting projects have been implemented with their own funding. It has been a relatively short time since these funded compressed air measures have been installed.

➤ **Measures Not Implemented**

- All measures recommended were implemented by the customer.

### Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
150 HP Variable Speed Air Compressor	578,170 12	518,853 63	90% 525%
75 HP Variable Speed Air Compressor	164,796 5	152,796 1	93% 20%

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
VFD air compressor	Dimensional Lumber Sawmill	321113	PE0158
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
1,689,977	2,157,134	128%	Conservative analysis approach
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
62	73	118%	Observations of metered data
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
A more reliable compressed air system with dryer and centralized controls			Yes

### Customer Description

This facility is a dimensional lumber sawmill.

### Efficiency Project

➤ **Compressed Air System**

- Variable speed air compressor and new heated regenerative air dryer.

### Projected Energy Savings and Peak Demand Reduction

Projected compressed air energy savings was 1,689,977 kWh annually, as reported in the project database. Total annual PMC-audited savings were 2,025,073 kWh.

Projected peak demand reduction was 62 kW.

### Other Project Benefits

For the compressed air upgrade, including the variable speed compressor, plant staff feels this upgrade has resulted in a more reliable compressed air system with centralized controls providing for better operations capabilities. The new air dryers have eliminated problems with moisture in the compressed air.

### Factors Attributing to Variance

The analysis of metered information suggests savings are slightly greater than predicted. The following points support this conclusion:

1. There have been no significant changes in compressed air demand.
2. It is possible the compressed air energy analysis was somewhat conservative.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- One-minute interval motor current for the variable speed compressor and the other operating air compressors was gathered over about one week.

#### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

#### ➤ Spillover

- A few small projects have been done with their own funding.

#### ➤ Measures Not Implemented

- All measures recommended were implemented by the customer.

## Appendix A

### Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Variable Speed Air Compressor, Air Dryer	1,689,977 62	2,157,134 73	128% 118%

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Baghouse and Blower	Reconstituted Wood Product Manufacturing	321219	PE0248
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
186,575	177,326	95%	Possible small operational differences
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
23	14	60%	Observations of metered data
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Improvement to plant up-time			Yes

### Customer Description

This facility manufactures reconstituted wood panels.

### Efficiency Project

#### ➤ Production Silo Baghouse and Blower

- New silo, baghouse and blower.

### Projected Energy Savings and Peak Demand Reduction

Projected compressed air energy savings was 186,575 kWh annually, as reported in the project database.

## Appendix A

Projected peak demand reduction for this project was 23 kW.

### Other Project Benefits

Plant staff report plant down-time has decreased with the new production silo blower and baghouse.

### Factors Attributing to Variance

The analysis of metered information suggests savings are slightly lower than predicted. The following points support this conclusion:

1. There have been no significant changes to production.
2. The additional up-time due to installation of this new baghouse system may have increased operating hours slightly.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- One-minute interval motor current for the main baghouse blower was gathered over about one week.

#### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

#### ➤ Spillover

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure has been installed.

#### ➤ Measures Not Implemented

- All measures recommended were implemented by the customer.

Summary of Project Savings Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Baghouse and Blower	186,575 29	177,326 14	95% 60%

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Dust collection consolidation, grinder	Cut Stock, Resawing Lumber and Planing	321912	PE0099, PE0099A
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
Dust System: 258,804 Grinder: 263,016	442,268 312,191	171% 119%	Lower loads Unaccounted grinder controls
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Dust System: 55 Grinder: 57	116 57	210% 100%	Observed from meter Deemed
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Simplified dust collection system, improved labor utilization with grinder			Yes

### Customer Description

This facility produces millwork.

### Efficiency Project

#### ➤ Dust System Consolidation

- This project involved the consolidation of five dust collection (blower) systems that had a total of 700 HP into three systems totaling 340 HP.

#### ➤ Replace Hog

- Replace existing hog with a grinder with lower connected load and automatic shut-down controls.



## Projected Energy Savings and Peak Demand Reduction

For the dust collection consolidation, the projected energy savings was 258,804 kWh annually, as reported in the project database. Total annual PMC-audited savings for this project were 601,848 kWh. For the hog replacement with the grinder, the projected energy savings was 263,016 kWh annually, as reported in the project database. The PMC-audited savings for the grinder was 260,676 kWh.

Projected peak demand reduction for the dust system consolidation was 55 kW. Projected peak demand reduction for the hog replacement was 57 kW.

## Other Project Benefits

Plant staff feels the consolidation of the dust collection system is a simplification that improves maintenance. They also report improved labor utilization with the new grinder because of its location.

## Factors Attributing to Variance

Analyzing the metering data for both the dust collection consolidation and the hog replacement shows savings in excess of expectations. The following points should be considered:

1. The savings determined from the metered data are higher than the original projections and lower than the PMC-audited results. Since peak demand reduction is much larger than predicted, it appears the actual loads on the blower motors are less than assumed in the energy study, which would result in more savings than predicted.
2. The grinder has automatic controls that turn the motor off when the feed belt is empty. This had lead to substantially reduced run-time compared to the original analysis, reducing energy use below predicted levels.

## Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

## Appendix A

### ➤ Metering

- One-minute interval motor current for each blower motor was gathered over about one week.
- The off/on status for the grinder motor was gathered. Due to a large number of very short cycles, the metering occurred over about two shifts only.

### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

### ➤ Spillover

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure has been installed.

### ➤ Measures Not Implemented

- All recommended measures were implemented by the customer.

## Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Dust System Consolidation	258,804 55	442,268 116	171% 210%
Hog Replacement	263,016 57	312,191 57	119% 100%

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Replacement cyclone	Dimensional Lumber Sawmill	321113	PE0167
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
189,789	0	0%	Incorrect baseline assumptions
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
73	54	74%	Observations of metered data
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Better design and much reduced dust discharge			No

### Customer Description

This facility is a dimensional lumber sawmill.

### Efficiency Project

#### ➤ Cyclone Upgrade

- Replace existing undersized planer cyclone with larger-sized cyclone featuring lower pressure drop.

### Projected Energy Savings and Peak Demand Reduction

Projected blower energy savings was 189,789 kWh annually, as reported in the project database.

## Appendix A

Projected peak demand reduction was 73 kW.

### Other Project Benefits

For the planer cyclone upgrade, plant staff feels this upgrade features a much better design and has reduced discharge to almost zero, even when they are cutting dry cedar.

### Factors Attributing to Variance

The analysis of the metering data for the cyclone blower indicates the savings are zero for this measure. The following points should be considered:

1. If more accurate project baseline energy could be known, the resulting realization rate may be greater than zero.
2. The baseline for this project was too low due to incorrectly assumed hours of operation, which was partially offset by incorrect assumptions about fan power.
3. The hours of operation assumed by the vendor at 2,600 per year are much less than what was measured at 4,730 hours per year, and much less than what was stated by plant staff at about 8,100 hours per year.
4. The baseline fan power was estimated to be 200 BHP, which is the same as the installed motor size. It is likely the baseline fan power was much lower.
5. This project and the associated energy savings were determined by the equipment vendor. As this was one of the first projects undertaken by the program and the PDC, it is likely that subsequent vendor proposals received more scrutiny.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

➤ **Metering**

- Thirty-second interval motor current for the blower motor was gathered over about one week.

➤ **Free-Ridership**

- Partial free-ridership was observed in that they were planning on installing this equipment and it had already been specified by the vendor and the proposal accepted by the customer: 50% score.

➤ **Spillover**

- Some energy-efficient motors have been installed with their own funding.

➤ **Measures Not Implemented**

- All measures recommended were implemented by the customer.

**Summary of Project Savings**

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Replacement Cyclone	189,789 73	0 54	0% 74%

## PROJECT EVALUATION SUMMARY – WASTEWATER TREATMENT

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Sewage treatment and monitoring	Sewage Treatment Facilities	221320	PE0013
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
826,330	382,462	46%	Inappropriate baseline; savings based on actual operation
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
83	44	53%	Connected load change
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Better mixing and steady DO levels; approach may also eventually reduce need for chemical additives			Not applicable

### Customer Description

This facility is a wastewater treatment plant.

### Efficiency Project

- **Energy-Efficient Sewage Treatment and Monitoring System**
  - The 15 installed aerators (13 of which were operating) using 7.5 HP motors in this treatment lagoon have been replaced by low-energy mixers and diffused air units powered by solar panels. Remote dissolved oxygen monitoring instruments ensure the facility operates properly with the new equipment.

## Projected Energy Savings and Peak Demand Reduction

For replacing the aerators, the projected energy savings was 826,330 kWh annually, as reported in the project database. Note that the ATAC report claims a baseline consumption of 779,640 kWh and savings of 724,115 kWh.

Projected peak demand reduction was 83 kW.

## Other Project Benefits

Plant staff members report there is better turnover (mixing) in the pond and dissolved oxygen levels have not changed.

Plant staff members hope they will at some point be able to operate only three aerators instead of the five now running. They will confirm the feasibility of three aerators by long-term monitoring of pond conditions over the winter of 2005 and beyond. Staff also plan to move a solar unit to the storage pond, which could reduce the need for chemical additives that now cost approximately \$8,000 per month.

## Factors Attributing to Variance

The analysis of the sewage treatment system change has lower than expected savings. The following points should be considered:

1. Note that the ATAC report claims a baseline consumption of 779,640 kWh and savings of 724,115 kWh; both are less than the savings reported in the project database.
2. The project report assumed none of the standard aerators would continue to operate. However, currently five of the standard aerators are being operated to maintain proper pond conditions. Ongoing experimentation over the winter of 2005 may lead to running three aerators, but no fewer. Until this is proved, it was assumed that five units will run.

## Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

## Appendix A

### ➤ Metering

- No metering was performed. The ATAC report clearly stated run times and measured power input to the aerators.

### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

### ➤ Spillover

- No other energy-related projects have been done with their own funding. This project is essentially the entire plant load at the time of the report.

### ➤ Measures Not Implemented

- All recommended measures were implemented by the customer.

## Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Sewage Treatment and Monitoring	826,330	382,462	46%
	83	44	53%



## PROJECT EVALUATION SUMMARY – FOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
VFD air compressor	Commercial Bakery	311812	PE0367
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
290,000	597,148	206%	Possible conservative analysis; very effective system changes
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
No longer have any issues with compressed air			Yes

### Customer Description

This facility is a commercial bakery.

### Efficiency Project

#### ➤ Compressed Air System

- Installation of a variable speed drive on one air compressor along with piping upgrades, controls and additional receiver capacity.

### Projected Energy Savings and Peak Demand Reduction

For the VFD compressor and related projects, the projected energy savings was 290,000 kWh annually, as reported in the project database.

## Appendix A

Projected peak demand reduction for the project was not available.

### Other Project Benefits

Plant staff members are very satisfied with the change and report no longer having issues or concerns with compressed air. Previous problems with the video jet product marking system are gone and they have experienced a 1% increase in process reliability and a 2-4% waste reduction that they attribute to the compressed air improvements.

### Factors Contributing to Variance

The analysis of the metered data indicated greater than expected savings. The following points should be considered:

1. There are three compressors onsite: one VFD running constantly, one compressor that never operates (acting as backup) and one compressor that runs only occasionally. The later compressor was metered as well as the VFD unit. However it appears the controls were not set properly during the metering period and the 'never runs' compressor actually did operate some of the time. Thus the savings and realization rate are possibly somewhat lower than reported.
2. A note in the project files by the utility engineer indicates 'actual' savings were 389,952 kWh annually. If this value had been used instead of 290,000 kWh/year, the realization rate would equal 153%.
3. There were related system changes (including the addition of controls) to resolve excessive pressure drop occurring in the distribution piping and low pressure problems in remote areas of the plant. Some of the additional unmodeled savings are likely attributable to these other improvements.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

➤ **Metering**

- As mentioned above, one-minute metering was gathered from the VFD compressor and the primary lead compressor.

➤ **Free-Ridership**

- No full or partial free-ridership was observed: 0% score.

➤ **Spillover**

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure was installed.

➤ **Measures Not Implemented**

- All recommended measures were implemented by the customer.

### Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
VFD Air Compressor	290,000 kW not available	597,148 kW not available	206% kW not available

## PROJECT EVALUATION SUMMARY – MICROELECTRONICS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Efficient cleanroom filtration system	Computer Peripheral Manufacturing	334119	PE0182
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
5,760,682	5,760,682	100%	Deemed
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
657	657	100%	Deemed
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Units are low-profile and fit well in space and seem to be reliable			Yes

### Customer Description

This facility produces integrated circuits.

### Efficiency Project

#### ➤ Efficient Cleanroom Filtration System

- The existing Building 3 cleanroom was remodeled into a Class 10 (very high standards) cleanroom. The baseline equipment assumed for Building 2 consisted of 107 8.5 kW recirculating air handlers. The efficient measures consist of 962 fan filter units at 0.184 kW each and 156 fan coil boxes at 0.480 kW each.

### Projected Energy Savings and Peak Demand Reduction

The projected energy savings was 5,760,682 kWh annually, as reported in the project database.

Projected peak demand reduction was 657 kW.

### **Other Project Benefits**

Plant staff observed the units are low-profile and fit well in the space available (other options considered were more obtrusive). Staff report the units are more reliable than the previous equipment and downtime/repair is a serious issue in a cleanroom environment.

### **Factors Attributing to Variance**

There was no potential for metering and few documents were provided. One of the documents was lab test information on the load for the fan filter units. The savings were accepted as stated.

### **Site Visit Description and Findings**

A brief site visit was performed and information was gathered from interviews. Because of the sensitive nature of the facility and the limited time available with the respondent, the measure installations were not observed.

#### ➤ **Metering**

- No metering was performed.

#### ➤ **Free-Ridership**

- This was not an energy project for the company. It was a required change to meet new process requirements that would have been done under any circumstances: 80% score.

#### ➤ **Spillover**

- Some delamping projects have been done with their own funding.

#### ➤ **Measures Not Implemented**

- All recommended measures were implemented by the customer.

## Appendix A

### Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Efficient Cleanroom Filtration System	5,760,682 657	5,760,682 657	100% 100%

## PROJECT EVALUATION SUMMARY – CHEMICAL PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Variable speed chiller retrofit	Photographic Film and Chemical Manufacturing	325992	PE0199
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
491,175	491,175	100%	Deemed
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Provides more flexibility in sequencing chillers			Yes

### Customer Description

This facility produces medical imaging film and chemicals.

### Efficiency Project

#### ➤ Chilled Water System

- This project involved the retrofit of a second water chiller with a variable speed capacity control instead of an inlet vane control. The facility has process space cooling loads in addition to office type loads.

### Projected Energy Savings and Peak Demand Reduction

The projected energy savings was 491,175 kWh annually, as reported in the project database.

## Appendix A

Projected peak demand reduction for the project was not available.

### Other Project Benefits

Plant staff contacts note the variable speed drive provides for more flexibility in sequencing chillers.

### Factors Attributing to Variance

The review of savings calculations suggest that this chiller is used and that actual savings are likely similar to expected savings; therefore, the savings are deemed. The following points should also be considered:

1. The VFD chiller is operational and it is used as an efficient part-load control for their chilled water plant on a regular basis.
2. All chillers are controlled manually with no detailed records available, so review of weather or other patterns could not allow a model of chiller sequencing to be created.
3. Customer data was provided on daily average chilled water load for the entire building, but individual equipment operation data to confirm the operation and thus the energy use of this new VFD chiller were not available.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- The customer provided daily average chilled water load for the entire building.

#### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.



➤ **Spillover**

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure was installed.

➤ **Measures Not Implemented**

- All recommended measures were implemented by the customer.

### Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Variable Speed Chiller Retrofit	491,175 kW not available	491,175 kW not available	100% kW not available

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Dust collection system controls	Wood Cabinet Manufacturing	337110	PE0005
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
Original: 608,813 Revised: 488,750	419,508 419,508	69% 86%	Liberal original analysis
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
0	0	Not applicable	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
None mentioned			Yes

### Customer Description

This facility produces cabinet doors.

### Efficiency Project

#### ➤ Dust Collection System

- Automatic controls to adjust the fan system, depending on which woodworking tools are in use.

### Projected Energy Savings and Peak Demand Reduction

The projected energy savings was 608,813 kWh annually, as reported in the project database. Total annual PMC-audited savings for this project were 488,750 kWh.

There was no peak demand reductions projected for this project.

## Other Project Benefits

Plant staff did not mention any other project benefits besides energy savings.

## Factors Attributing to Variance

The analysis of the metered data showed less than expected savings. The following points should be considered:

1. There have been major changes to the total number of tool ‘drops’ in the plant since the original installation. The area (as opposed to diameter) has increased 29%. The savings figure reflects this factor.
2. The original vendor analysis appears to be liberal in estimating the energy savings. The PMC-audited value is much closer to what was actually observed.

## Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

### ➤ Metering

- One-minute interval motor current for the main blower motor was gathered over about one and one-half weeks.

### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

### ➤ Spillover

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure was installed.

### ➤ Measures Not Implemented

- All recommended measures were implemented by the customer.

Appendix A

Summary of Project Savings Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Dust Collection System Controls	608,813 0	419,508 0	69% Not applicable

## PROJECT EVALUATION SUMMARY – FOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
VFD air compressor	Perishable Prepared Food Manufacturing	311991	PE0014
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
320,891	0	0%	Liberal vendor analysis
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
No increased air demand, despite increased total compressor HP			Yes

### Customer Description

This facility produces chilled food products.

### Efficiency Project

#### ➤ Compressed Air

- Installation of a 100 HP VFD air compressor to replace a 30 HP fixed-speed compressor. A 75 HP and a 50 HP compressor were left in place.

### Projected Energy Savings and Peak Demand Reduction

The projected energy savings for installation of the VFD air compressor was 320,891 kWh annually, as reported in the project database.

## Appendix A

No information on projected peak demand reduction was available for this project.

### Other Project Benefits

Plant staff mentioned there has been no increased air demand, despite increased total compressor HP. (This contradicts observations below regarding the number of compressors running.)

### Factors Attributing to Variance

The analysis of the entire compressed air system showed zero savings. The following points should be considered:

1. The original vendor analysis showed three compressors operating in the baseline condition and just one, the VFD unit, operating in the post condition. Actual conditions as evidenced from metering have all three running.
2. Average kW load of the compressors during the post-install test performed by the vendor that was included in the project documentation was about one-half of the values found during the evaluation metering.
3. The vendor analysis appears to have been liberal in determination of savings.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- One-minute interval motor current for all three air compressors was gathered over about one week.

#### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.

➤ **Spillover**

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure has been installed.

➤ **Measures Not Implemented**

- All recommended measures were implemented by the customer.

**Summary of Project Savings Summary of Project Savings**

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Variable Speed Air Compressor	320,891 kW not available	0 kW not available	0% kW not available

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Various measures outlined below	Softwood Veneer and Plywood Manufacturing	321212	PE0164, PE0166, PE0205, PE0206, PE0211
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
VFD ID Fan: 372,350 Air Comp. Ctrls: 132,645 200hp Chipper: 524,160 300hp Chipper: 711,360 VFD FD Fan: 119,460	454,646 0 524,160 1,221,938 302,186	122% 0% 100% 172% 253%	Various, see below
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
VFD ID Fan: 14 Air Comp. Controls:-13 200hp Chipper: 70 300hp Chipper: 95 VFD FD Fan: 44	7 0 70 118 18	49% 0% 100% 124% 41%	Observations of metered data & deemed
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Variety of benefits outlined below			Yes

### Customer Description

This facility manufactures plywood.

### Efficiency Projects

#### ➤ Boiler VFD Inlet Draft Fan

- VFD control of the boiler inlet draft fan in lieu of inlet dampers.



➤ **Air Compressor Controls**

- PLC-based controls for lead-lag and pressure control of three plant air compressors.

➤ **200 HP Veneer Chipper**

- Install a new chipper feedworks to reduce plugging so that a 200 HP chipper running in parallel could be shut down.

➤ **300 HP Core Chipper**

- Replace a very old 300 HP motor with a new 200 HP motor and belt drive.

➤ **Boiler VFD Forced Draft Fan**

- VFD control of the boiler forced draft fan in lieu of inlet dampers.

### **Projected Energy Savings and Peak Demand Reduction**

Projected energy savings reported in the project database are given in the table above. None of the projects have PMC-audited savings figures.

Projected peak demand reduction for the various projects are indicated in the table above.

### **Other Project Benefits**

➤ **Boiler VFD Inlet Draft Fan and Boiler VFD Forced Draft Fan**

- Decreased emissions from boiler; more responsive to load change.

➤ **Air Compressor Controls**

- Reduced compressor run time; less problems with low pressure; easier management of the system.

➤ **200 HP Veneer Chipper**

- Improved labor utilization; less plugging.

## Appendix A

### ➤ 300 HP Core Chipper

- Removed a very old motor from service; better chips.

## Factors Attributing to Variance

The analysis of savings is discussed below:

1. Both of the Boiler Fan VFD projects have higher than expected savings. These results suggest the original analysis for both projects was conservative and could not account for all the efficiencies obtained from eliminating the original inlet damper systems.
2. For the air compressor controls there are zero savings. The primary compressors were metered and found to run loaded almost constantly. Air demands are likely higher than when the original analysis was performed.
3. For the core chipper, the savings are greater than expected. The original analysis may have been conservative.
4. The savings for the veneer chipper feedworks were deemed, as the measure savings were from simply turning a backup motor off. It was measured at the time of the analysis and remains off all of the time while the new feedworks chipper is used.

## Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

### ➤ Metering

- One-minute interval meter data for about one week each were collected from air compressors #1 and #3, the boiler ID and FD fans, and the core chipper.

### ➤ Free-Ridership

- No full or partial free-ridership was observed for any of the installed projects: 0% score.

➤ **Spillover**

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure was installed.

➤ **Measures Not Implemented**

- All recommended measures were implemented by the customer.

### Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
VFD ID Fan	372,350 14	454,646 7	122% 49%
Air Compressor Controls	132,645 -13	0 0	0% 0%
200hp Chipper	524,160 70	524,160 70	100% 100%
300hp Chipper	711,360 95	1,221,938 118	172% 124%
VFD FD Fan	119,460 44	302,186 18	253% 41%

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Efficient chip fines blower	Dimensional Lumber Sawmill	321113	PE0188
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
272,392	196,619	72%	Possible liberal analysis
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
30	19	62%	Observations of metered data
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
None mentioned			Yes

### Customer Description

This facility produces dimensional lumber.

### Efficiency Project

#### ➤ Chip Fines Blower Project

- Replacement of a system with a 100 HP blower and 10 HP conveyor with a 30 HP blower and a 5 HP feeder.

### Projected Energy Savings and Peak Demand Reduction

For the blower project, the projected energy savings was 272,392 kWh annually, as reported in the project database.

Projected peak demand reduction for the blower change was 30 kW.

### Other Project Benefits

Plant staff mentioned no additional benefits beyond energy savings.

### Factors Attributing to Variance

The analysis of the project showed somewhat less than expected savings. The following points should be considered:

1. The results are within a reasonable range of expected performance. It is possible the analysis was somewhat liberal in its assumptions for motor loading.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- One-minute interval meter data for about one week were collected for the blower motor. On-off status was collected over one week for the feeder motor.

#### ➤ Free-Ridership

- The contact stated the incentives were weakly influential (4 on a 0-10 point scale) and that the organization was very likely to have installed the same type and efficiency of equipment without the incentive (10 on a 0-10 point scale): 80% free-rider

#### ➤ Spillover

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure was installed.

## Appendix A

### ➤ Measures Not Implemented

- All recommended measures were implemented by the customer.

### Summary of Project Savings Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Chip Fines Blower	272,392 30	196,619 19	72% 62%

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
VFD for stacker fans and dust collection upgrades	Softwood Veneer and Plywood Manufacturing	321212	PE0181, PE0185
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
Stacker Fans: 1,049,962 Dust Collection: 544,431	1,014,863 531,908	97% 98%	Possible conservative analysis
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not Available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
Stacker shows increased productivity and better air distribution for the dust collection system			Don't know

### Customer Description

This facility manufactures plywood.

### Efficiency Project

#### ➤ Stacker Fan VFD

- Two stacker fans of 150 and 250 HP with damper controls were replaced with 50 and 100 HP blower motors with VFD controls.

#### ➤ Dust Collection System Upgrade

- The vortex breaker was removed, the tubeguard enlarged and the tangential inlet replaced with a 90-degree involute. The blower motor was re-sheaved for the lower load.

### Projected Energy Savings and Peak Demand Reduction

For the stacker fan VFD project, the projected energy savings were 1,049,962 kWh annually, as reported in the project database. For the dust collection system upgrade, the projected energy savings were 544,431 kWh annually, as reported in the project database.

No information on projected peak demand reduction was available.

### Other Project Benefits

Plant staff members report stacking works better with the VFD control: it is more efficient and more exact. With this change they can run the stacker slightly faster, increasing productivity. For the change to the dust collection system, there is better air distribution, with two pipes for each sander instead of one. The bags pack uniformly and last longer also.

### Factors Attributing to Variance

The analysis of the project shows expected savings for the stacker project and better than expected savings for the dust collection system upgrade. The following points should be considered:

1. There was no baseline information for either project provided in the files, requiring the baselines to be estimated in order to calculate savings.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

#### ➤ Metering

- One-minute interval meter data were collected for about two weeks for the dust collection blower motor and for each of the two stacker fan VFD.

#### ➤ Free-Ridership

- No full or partial free-ridership was observed: 0% score.



➤ **Spillover**

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure was installed.

➤ **Measures Not Implemented**

- All recommended measures were implemented by the customer.

**Summary of Project Savings Summary of Project Savings**

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Stacker Fans	1,049,962 kW not available	1,014,863 kW not available	97% kW not available
Dust Collection	544,431 kW not available	531,908 kW not available	98% kW not available

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
Hydraulic pump controls and hog control	Reconstituted Wood Product Manufacturing	321219	PE0009, PE0175
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
Pumping: 1,017,474 Hog: 258,711	1,017,474 258,711	100% 100%	Deemed Deemed
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Not available	Not available	Not available	
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
The pump controls have resulted in a lower hydraulic oil temperature; before the controls, the hog would run empty for hours			Unknown

### Customer Description

This facility manufactures fiberboard.

### Efficiency Project

#### ➤ Hydraulic Pump Controls

- The hydraulic pump system cycles the fiberboard presses periodically and not all pump capacity is needed the entire time. A new control system and soft-starts turns nine pumps off for about one-half the press cycle time, whereas before they ran constantly.

### ➤ Hog Control

- Controls to turn the hog and conveyor off when the bin is empty were added, whereas before it ran constantly.

### Projected Energy Savings and Peak Demand Reduction

For the hydraulic pump controls, the projected energy savings were 1,017,474 kWh annually, as reported in the project database. For the hog controls, the projected energy savings were 258,711 kWh annually, as reported in the project database.

No information on projected peak demand reductions was available.

### Other Project Benefits

Plant staff members observed the pump motor controls have resulted in the hydraulic system operating at a lower oil temperature. The controls have had no effect on production.

The hog would run empty for hours before its controls were installed and it now creates less vibration and noise in the area when it is shut down.

### Factors Attributing to Variance

Review of the energy savings calculations determined the actual operation was unchanged from that observed at the time of the *Final Project Summary* by the PDC. The customer has performed their own metering in order to confirm savings for themselves.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

### ➤ Metering

- Customer data for the hydraulic pumping controls were provided.

## Appendix A

- Customer data for the hog control project were initially offered by the customer, but it was never provided.
- **Free-Ridership**
- No full or partial free-ridership was observed: 0% score.
- **Spillover**
- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure was installed.
- **Measures Not Implemented**
- All recommended measures were implemented by the customer.

### Summary of Project Savings Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
Hydraulic Pump Controls	1,017,474 kW not available	1,017,474 kW not available	100% kW not available
Hog Control	258,711 kW not available	258,711 kW not available	100%kW not available

## PROJECT EVALUATION SUMMARY – WOOD PRODUCTS

DESCRIPTION OF ENERGY EFFICIENCY MEASURE(S)	INDUSTRY	NAICS CODE	PE PROJECT NUMBER(S)
New baghouse and replace scrubber	Reconstituted Wood Product Manufacturing	321219	PE0002, PE0003
TOTAL ANNUAL SAVINGS REPORTED (KWH)	TOTAL SAVINGS CONFIRMED (KWH)	REALIZATION RATE	FACTORS ATTRIBUTING TO VARIANCE
Baghouse: 386,458 Scrubber: 835,000	544,271 1,162,265	141% 139%	Lower hours of operation and lower loads
PEAK DEMAND REDUCTION REPORTED (KW)	PEAK DEMAND REDUCTION CONFIRMED (KW)	REALIZATION RATE	DEMAND REDUCTION APPROACH
Baghouse: 56 Scrubber: 104	59 145	105% 139%	Calculated from one time measurements
DESCRIBED NON-ENERGY BENEFITS			PARTICIPATION IN BETC
The scrubber reduced emissions and requires less maintenance; the baghouse was required to be installed for emissions compliance			Yes

### Customer Description

This facility manufactures particleboard.

### Efficiency Project

#### ➤ Baghouse

- This baghouse was required to be installed for emissions compliance. Previously the dust was vented to atmosphere.

### ➤ Replacement Scrubber

- A sand cell scrubber was replaced with a wet electrostatic precipitator. Connected load was reduced from 355 HP to 215 HP.

### Projected Energy Savings and Peak Demand Reduction

For the baghouse, the projected energy savings was 386,458 kWh annually, as reported in the project database. The PMC-audited savings for this project were 506,845 kWh. For the replacement scrubber, the projected energy savings were 835,000 kWh annually, as reported in the project database and the PMC-audited savings for this project were 700,757 kWh.

Projected peak demand reduction for the baghouse was 56 kW and for the replacement scrubber, 104 kW.

### Other Project Benefits

Project files mention the electrostatic precipitator scrubber reduces emissions and had reduced maintenance and clean up requirements compared to the old equipment. The baghouse replaces dust venting to atmosphere, which is no longer permitted by Oregon DEQ.

### Factors Attributing to Variance

The analysis of the projects confirmed savings are generally greater than expected for each project. The following points should be considered:

1. The savings for the replacement scrubber appear to reflect lower connected loads than are actually present.
2. The PMC-audited savings for the baghouse are closer to the adjusted savings than the originally predicted savings value.

### Site Visit Description and Findings

A brief site visit was performed. During the limited time onsite, the measure installations were confirmed by inspection, but no operating parameters were collected.

➤ **Metering**

- One-minute interval metering was collected for the main fan motor on the electrostatic precipitator scrubber. One-time measurements were made for the recycle pump and flush pump, and a panel reading was taken from the precipitator power supply.
- For the baghouse, a one-time clamp-on ammeter current measurement was made of the fan.

➤ **Free-Ridership**

- **Baghouse** – the baghouse was required for emissions compliance; the participant said the equipment was all but ordered before the program was involved and the same specification of equipment would have been ordered without the incentive: 100% score
- **Scrubber** – no free-ridership was observed: 0% score.

➤ **Spillover**

- No other energy-related projects have been done with their own funding. It has been a relatively short time since the measure was installed.

➤ **Measures Not Implemented**

- All recommended measures were implemented by the customer.

### Summary of Project Savings Summary of Project Savings

MEASURE	REPORTED SAVINGS (KWH/KW)	INSTALLED SAVINGS (KWH/KW)	REALIZATION RATE (KWH/KW)
<b>Baghouse</b>	386,458 56	544,271 59	141% 105%
<b>Replacement Scrubber</b>	835,000 104	1,162,265 145	139% 139%

Appendix A



# APPENDIX B

## Guides and Survey Instruments

Appendix B

## DISCUSSION GUIDE FOR PDC, PMC AND ENERGY TRUST STAFF

### Program Accomplishments in 2004

1. What are the program's successes? Any features that compare favorably with other programs?
  
2. Were you given a copy of the process evaluation, or did you see it?
  - a. Have there been any changes that can be attributed to the report? The recommendations were: (and feel free to comment if you think the recommendation was not worth pursuing)
    - i. (ETO to) Congratulate staff for job well done
  
    - ii. (ETO to) Expedite contracting, communicating with the market, policy decisions
  
    - iii. (ETO to) Give clear guidance to contractors for pursuing conflicting objectives. E.g.: what customers (hard to reach are more costly to serve); technical rigor (again, costly); very large customers okay?
  
    - iv. (Aspen to) Clarify for ATACs the current process for selecting an ATAC for a project.
  
    - v. (Aspen to) Provide PDCs and ATACs with increased technical guidance: on (1) measure life, (2) conversion factors, (3) motor efficiencies, (4) contingencies for costs and savings (or derating savings), (5) energy rate to use, (6) role of kW, (7) non energy benefits

## Appendix B

1. How is KW used? Non-energy benefits?
2. ETO Board was told “Aspen will prepare a plan...It will include face to face meetings with PDCs and ATACs together, so everyone hears the same procedures and rules, and everyone has an opportunity to get clarification and voice concerns.”
  - vi. (Aspen to) Prepare for potential participants written steps for participating
- b. Did you experience any negative repercussions as a result of the evaluation? What?
3. Other program changes in 2004? (probes: policy, marketing, organizationally, administratively)
4. What changes are you expecting in 2005?

## Marketing

5. Any changes in your scope of work?
  - a. I understand the Energy Trust added \$1 million to the PDCs contracts to expanding into Klamath Falls irrigation, food processing, CHP, wood products. Was your budget expanded? How has this worked out? How have your activities expanded? Have you added staff?
  - b. How are the geographic boundaries and industry type boundaries working out?

6. How do you market?
  - a. Are you targeting hard-to-reach customers? How?
  - b. Have all of the transition projects been handed over to the Energy Trust?
  - c. Do you market to participants (PE and transitional) additional projects they might do?
  - d. Do PDCs and ATACs look for potential facility projects and refer customers to BE?
  - e. What do you do when you talk with a customer that has a project already in the pipeline? To your knowledge, is that what the other PDCs and ATACs do?
7. Why isn't the semi-conductor industry participating?
8. Do you conduct all of the scoping studies for the projects you work on? Are ATACs bringing in projects? What proportion?
  - a. In 2003, most of the ATACs reported they had lost one or more projects they brought into the program. Have you heard of such complaints in 2004? What's your take on this issue? Do the ATACs have a legitimate complaint or are they just trying to get more work for themselves? How can the situation be improved?

## Appendix B

9. Do all customers come through PDCs, or does Aspen still serve as the PDC for vendor projects?
10. How do non-energy benefits figure into customers' decisions? What amount of emphasis do you place on them while marketing? Why don't customers act on these on their own? Are non-energy benefits more influential when recommended by a consultant, when clustered together in a cohesive argument?
11. How low can the incentive go and not lose participation? 40%? Lower?
  - a. What if non-energy benefits were quantified—through a negotiation process—and coupled with an incentive payment to lower the payback. Would customers be responsive to this? Would marketing costs go up? How would marketing need to change, by all the players?
  - b. Can non-energy benefits be used to bring in less cost-effective projects, increasing project comprehensiveness?

## Program Financials

12. How can program cost-effectiveness be improved?
13. Are there any ways that the program's long-term goals being sacrificed to short-term goals?
14. A program metric is "cents per first year kWh"; "cents per levelized costs" would reflect measure/useful lives. How reliable is the information ATACs are able to estimate for measure/useful lives? Should measure life be capped at 10 years, e.g.?

15. Now that the kicker is over, are Technical Studies identifying measures with paybacks less than 18 months? Are customers installing them on their own? What are the barriers—lack of a study? The capital?
16. Were average costs lower with the kicker (due to measures w paybacks less than 18 months), or after the kicker?

### Technical Studies

17. In January 2004, Aspen produced a protocol for “Technical Analysis Study Assignment, Content, and Review”. Are you instructed to follow it? How is that working?
  - a. The protocol says the PDCs will confirm delineated aspects of the Technical Study. Does this mean the PDCs are responsible for ensuring the quality of the ATAC’s work; that PDCs are willing to vouch to their customers about the quality of the Technical Studies they didn’t do?
18. Do you ever ask questions of the ATAC or ask them to revise something in the report? How often (what proportion)?
  - a. Does it work out okay for the PDCs to ask ATACs to revise their work, when the PDCs don’t pay for the studies or have contracts with the ATACs?
19. Does Aspen ever provide you with comments on the Technical Studies assigned to you? What proportion?

## Appendix B

20. Program like this must trade off administrative costs spent on studies with the reliability of the savings estimates. Is PE striking a good balance?
21. What proportion of projects requires engineering designs subsequent to the Technical Studies? Some industrial programs elsewhere create a statement of Functional Design Intent for each project. Would this be useful for governing the work of designers, vendors, and contractors executing the project or for helping the customer to oversee the project?
22. As of the end of 2003, the program did not require energy efficiency commissioning or final savings-verification audits. Has this changed? Do you think these should be required?
23. Are there any additional technical specifications would you like to see put in place? Are there any program changes that could be made that would encourage more comprehensive savings?
24. Are there rules for what happens when a project goes over budget?
25. Are the technical studies sufficient to meet BETC and SELP requirements?
26. Do you help customers apply to BETC and SELP?
  - a. How is this working? It seems it could potentially take a lot of time to satisfy the BETC requirements.



## Communication

27. Interactions with the other players? (Probes: PDCs, ATACs, Aspen, Energy Trust? In-person, as a group, email, phone?)
28. What additional interactions would be helpful? (with who, venue)
29. Does Aspen welcome or discourage comments? Act on concerns? Provide requested guidance? Update you on program status, budget? Do you get consistent information from different staff?
30. Is there a standard status report format? Invoice format?
31. Energy Trust interactions: Have you met Andy Saleh? How often? Does ETO welcome comments? Act on concerns? Provide requested guidance? Provide updates? Do you get consistent information from different staff?
32. Any Energy Trust processes impede desirable changes? Are Energy Trust staffing resources sufficient?
33. Any Aspen processes impede desirable changes? Are Aspen staffing resources sufficient?

## DISCUSSION GUIDE FOR ATACS THAT SERVE THE PE PROGRAM ONLY

### Program Accomplishments in 2004

1. What do you feel are the program's most notable successes—what is working well? Are there features of this program that compare favorably with other programs?
  
2. Did you hear anything about the evaluation completed last year? What?
  - a. Have there been any changes resulting from the report? The recommendations were: (and feel free to comment if you think the recommendation was not worth pursuing)
  
  - b. There were several recommendations that dealt with ATACs directly – including:
    - i. (ETO to) Congratulate staff for job well done
  
    - ii. (ETO to) Expedite contracting, communicating with the market, policy decisions
  
    - iii. (ETO to) Give clear guidance to contractors for pursuing conflicting objectives. E.g.: what customers (hard to reach are more costly to serve); technical rigor (again, costly); very large customers okay?
  
    - iv. (Aspen to) Clarify for ATACs the current process for selecting an ATAC for a project.

- v. *(Aspen to)* Provide PDCs and ATACs with increased technical guidance: on (1) measure life, (2) conversion factors, (3) motor efficiencies, (4) contingencies for costs and savings (or derating savings), (5) energy rate to use, (6) role of kW, (7) non energy benefits
  - 1. Do you report anticipated KW savings? Do you quantify non-energy benefits?
  - 2. *Have you had any opportunity to participate in meetings with PDCs and ATACs together—so everyone hears the same procedures and rules, and everyone has an opportunity to get clarification and voice concerns?*
- 3. Were there other program changes in 2004? (probes: policy, marketing, organizationally, administratively)
- 4. Are you expecting any changes 2005?

## Marketing

- 5. Do you market the program or simply get referrals from the PDCs
- 6. Do you ever conduct scoping studies, or is that the PDC's role exclusively?
- 7. In 2003, it was common for ATACs to report that they had lost one or more of the projects they brought into the program. Do you perceive this to be a continuing issue? Why/Why Not? Was this satisfactorily resolved? How?

## Appendix B

8. The program design indicates that projects will be supported by an increasing level of technical study, based on the requirements of that project, starting with a scoping study, followed by a short study and a more detailed study (if necessary)...
  - a. Are your customers being well served by the study process? Is the program?
  - b. Are the studies detailed enough?
  - c. Is the level of study that's funded adequate for a given project? Can you get additional studies funded if it appears needed? How often do you feel that the level of study is adequate/inadequate?
  - d. Is your compensation adequate for the time required to complete the studies? What is the fee structure (we can probably get this, don't need to ask?)?
  - e. Are there opportunities left unexplored at a given site? Why does this happen? Are there any program changes that could be made that would encourage more comprehensive savings?
9. What do you do when you talk with a customer that has a project already in the pipeline? To your knowledge, is that what the other PDCs and ATACs do?
10. Do you conduct all of the scoping studies for the projects you work on?
11. How do non-energy benefits figure into customers' decisions?

12. How do you feel about the current incentive levels? Could they be reduced? How low can the incentive go and not lose participation? 40%? Lower?
  - a. What if non-energy benefits were quantified—through a negotiation process—and coupled with an incentive payment to lower the payback. Would customers be responsive to this? Would marketing costs go up? How would marketing need to change, by all the players?
  - b. Can non-energy benefits be used to bring in less cost-effective projects, increasing project comprehensiveness?

### Technical Studies

13. In January 2004, Aspen produced a protocol for “Technical Analysis Study Assignment, Content, and Review”. Have you seen this?
14. How is the relationship between ATACs and PDCs? Do PDCs question your studies or ask you to revise something in the report? How often does this happen (what proportion)?
  - a. How do you feel about PDCs also serving as ATACs?
  - b. How do you feel about utility staff serving as PDC?
15. Does Aspen ever comment on your Technical Studies? Is there a typical reason for comment? How often does this happen?

## Appendix B

16. Have any issues emerged between you and the PDCs regarding studies or other aspects of the program? How are issues between you and the PDC resolved? Are there any issues that emerge in technical studies? What is Aspen's role in this?
17. Is PE striking a good balance? Are the studies a reliable estimate of energy savings? Is additional study required?
18. Some projects require engineering designs subsequent to the Technical Studies. Industrial programs elsewhere create a statement of Functional Design Intent for each project. Would this be useful for governing the work of designers, vendors, and contractors executing the project or for helping the customer to oversee the project?
19. The program does not require energy efficiency commissioning or final savings-verification audits. Should this be required?
20. Are there any additional technical specifications would you like to see put in place?

## Communication

21. How would you characterize your interactions with the other players in the program? (Probes: PDCs, ATACs, Aspen, Energy Trust? In-person, as a group, email, phone?)
22. Are there additional interactions that would be helpful? (with who, venue)

23. How does Aspen respond to comments or issues raised by you? Have you requested more work from Aspen? How were those requests received? Have you seen any action on concerns or guidance provided when requested?
  
24. Have you met Andy Saleh (New program staff at ETO)? How often? What has been your interaction with the Energy Trust? (probes: *Does ETO welcome comments? Act on concerns? Provide requested guidance? Provide updates? Do you get consistent information from different staff?*)

## DISCUSSION GUIDE FOR ATACS THAT SUPPORT BOTH BE & PE PROGRAMS

### Marketing

1. Does the number of studies you've conducted under the program compare with your expectations? BE? PE?
2. Have you brought any customers to the program? [If yes] About what proportion of the studies that you've done have been for customers you've brought in? Is this different between the two programs?
3. Prior to the program (or to areas outside the program, like Washington), did you actively sell your analytical services?
4. What proportion of your customers appear to be aware that the Building Efficiency program is being offered by Energy Trust? What about aware of the Production Efficiency program?
5. What proportion of your customers appear to be aware that Aspen Systems is implementing the Building Efficiency program for Energy Trust?

### Customer Response to Studies

6. How are the programs integrated for your customers? Do you refer them to someone else?



7. After you've completed the study, can you tell me what happens? [open]  
Is it different for PE/BE?

Probes:

8. Who delivers the report to the customer? How? (Any in-person or by phone conversation about the report?) [If more than one approach:] How do you decide which approach to use with a customer? [open]
9. Do you know who, if anyone, from the Building Efficiency program follows up with customers as they decide about implementing the recommendations and taking the next steps? What about PE?
10. Do you ever receive any feedback from customers on the studies? [If yes:] What feedback have you received? [open]
11. Do the customers typically decide to install all of the recommended measures? (or most? Or some? Or don't know?)
12. Do customers give you any reasons for not installing measures you recommend? [If yes:] What reasons have you heard? [open]

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### Direction from the PMC

13. Has Aspen Systems been clear in its expectations for the studies?  
Is the level of clarity or direction different between the two programs—if so, how?
14. Have you ever been asked to revise any of the studies? (N/Y)
15. [If yes:] What types of revisions have you been asked to make? [open]  
[Probe:] Anything else?
16. Is there a set price for the studies, or do you negotiate each one?  
Is the process of setting a price for studies different in PE/BE?
17. [If yes] Have you had any difficulty negotiating with Aspen Systems regarding the fee you will charge them for the study? (N/Y)
18. [If yes:] What has been your experience? Is there a difference in the way these things are handled between BE/PE?
19. Has the fee been generally appropriate to the needs of the study?  
[If no:] What has been your experience?
20. What meetings or training have you had with Aspen?

Probes: BE? PE?

- 21. Have you received any instruction or direction from Aspen Systems on methods to use in the audits, or to convey the findings? Different level of instruction/direction/feedback for one program or another?
- 22. Would you like to receive additional direction from Aspen? [If yes:] What would you like? [Probe: PE/BE difference?]
- 23. Regarding the forms required for either program, do you have any concerns or feedback about them?

**Overall Assessment**

- 24. Has your involvement in the programs met your expectations?  
[y n dk]
- 25. [If not:] In what way? [open] Different experience/expectation between BE/PE?
- 26. Overall, how satisfied are you with your involvement in Building Efficiency? Please use a 1 to 5 scale, where 1 is not at all satisfied and 5 is highly satisfied. Open:  
RATE: 1 2 3 4 5

## Appendix B

27. PE? [open] RATE
28. Do you have any concerns about either program, or about your participation in either program? [y n dk]
29. [If yes:] What are they? [open] Anything else? [open]
30. Do you think these concerns will have any ongoing effect on your experience participating in the program? [y n dk]
31. [If yes:] What? [open]
32. Do you think these concerns will have any effect on your customers? [y n dk]
33. [If yes:] What? [open]
34. Final Questions
35. What do you believe are the current strengths of the Building Efficiency program? [open] PE?
36. What are its current weaknesses? PE?

37. Are there any changes you would like to see made in either program?  
(N/Y)
38. [if yes:] What?
39. Thinking about the other utility incentive programs you've participated in, how satisfied are you with the BEP compared to those programs? Please use a 5-point scale in which 5 means "much more satisfied" and 1 means "much less satisfied." 1 much less satisfied 2 3 4 5 much more satisfied NA  
(no utility experience) What about PE, how would you rate that?
40. Why do you say that? [Probe for specific practices or lessons learned for either program]

May we call you another time in the course of this evaluation?

## SURVEY OF PRODUCTION EFFICIENCY PARTICIPATING FIRMS

Hi, I am \_\_\_\_\_ with Research into Action. I'm calling on behalf of the Production Efficiency Program that we understand you've participated in during the last year or so. I would like to ask you a few questions about your experience with this program. Is this a convenient time for you? This is not a solicitation: we are simply trying to gather some information that will help the Energy Trust of Oregon to improve its energy efficiency program planning efforts and services. None of this information will be used to recalculate incentives or tax credits you've already received. Your answers will be kept confidential by the researchers and the Energy Trust of Oregon.

Date

ID

Name

Organization

### **Confirming Decision Maker**

1. Do you recall installing equipment through the Production Efficiency Program in \_\_ (month/year) \_\_ at \_\_ (location of project) \_\_?

yes       no

If Q1=no, identify who. (get contact info):

2. Are you the person at your organization who was most involved in making the decision to install equipment through the Program?

yes       no

If Q2=no, identify who... (get contact info):

**Program Awareness**

3. Do you recall what organization is sponsoring the Production Efficiency Program and providing the incentives?

- yes
- no

3A (if Q3=yes) Who?

Energy Trust (SKIP to Q5)

Utility

Other (record below)

3A Other:

4. Before today, had you heard of the Energy Trust of Oregon?

- yes
- no
- Don't Know
- Refused

5. Can you tell me how you first learned about the Production Efficiency Program incentives for energy-efficient equipment projects? [Open-ended. Probe to code.]

vendor or contractor

PDC (Cascade Engineering, ESG, Harris, RHT), PMC (Aspen), Energy Trust

utility or power company rep told me

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- friend or colleague told me
- other (record below)
- don't know
- refused

Q5 Other

6. Can you tell me how you came to be working with the contractor or vendor you worked with? (open. do not read, prompt if needed)

- had worked with contractor in the past
- got name from Energy Trust
- selected from yellow pages, colleagues, ect.
- other
- contractor approached respondent
- don't know

Q6 Specify Other



**When Heard About Program (Timing)**

Regarding the timing of when you first heard about the Production Efficiency Program incentives: Was it...

7. before you began to think about getting new equipment, or after?

Before  After  Don't Know  Refused

8. before you began to consider your equipment choices, or after?

Before  After  Don't Know  Refused

9. before you selected or decided on the exact specifications of the equipment, or after?

Before  After  Don't Know  Refused

10. before you ordered the equipment, or after?

Before  After  Don't Know  Refused

11. before you installed the equipment, or after?

Before  After  Don't Know  Refused

**Program Influence**

According to our records, the total cost for all of the production efficiency project you installed was about \_\_\_\_\_. The Energy Trust paid about \_\_\_\_\_% of the total cost of this equipment, or about \$\_\_\_\_\_.

Appendix B

12. Please rate how much influence the incentive had on your decision to install the efficient equipment. Please use a scale from 0-10, with 0 being no influence at all and 10 being a lot of influence.

(Record Answer# 0-10), Use 88=don't know, 99=refused

13. Please rate how likely it is that you would have installed *\*exactly\** the same type and efficiency of equipment, *without* the incentive (again, 0 to 10, with 10 meaning very likely).

(Record Answer# 0-10), Use 88=don't know, 99=refused

13A. *Answers appear inconsistent: probe, describe situation below.*

14. What type of equipment do you think you might have purchased instead?

15. Before your interactions with the Production Efficiency Program, was your company planning to replace (or add) production equipment?

yes  no  Don't Know  Refused

Now some questions about the *timing* of your project. *Without* the incentive from the Program, when would you have installed the energy efficient equipment?

16. within 6 months of when you actually installed (%s should add to 100, use 888 here for don't know, 999 for refused)

within 6 to 12 months

within one or two years

within three to five years

more than five years

16(a) Why do you say that?

17. Did the money for the project come from your organization's ..... (READ)

- operating budget
- short-term capital budget or plan
- long-term capital budget or plan
- other (record below)
- Don't Know
- Refused

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Q17 record other:

Please indicate the how much you agree or disagree with the following three statements. For these questions, A 0 indicates that you strongly disagree with the statement, a 10 indicates that you strongly agree with the statement.

18. The incentive made this equipment made it an "easier sell" to management.

*(Record Answer# 0-10), Use 88=don't know, 99=refused*

19. The incentive helped the equipment meet our investment criteria.

*(Record Answer# 0-10), Use 88=don't know, 99=refused*

20. The savings estimated for this equipment helped convince me to install the measures.

*(Record Answer# 0-10), Use 88=don't know, 99=refused*

21. Does your organization do any financial analyses to help you decide whether to do projects like equipment installations or modifications, e.g., payback, return on investment or break-even analysis? (Do not read)

None

Other (record below)

Payback

- Don't Know
- Return on Investment (ROI)
- Refused
- Break-even Analysis

Q21 Specify Other:

22. What is the cut-off point that your organization uses to decide to go ahead?

*(Record Answer payback: maximum years, ROI: minimum %), Use 88=don't know, 99=refused*

23. Before the project, had your organization previously installed any energy efficient equipment, without any incentive?

- yes, without an incentive
- installed, but got an incentive
- Refused
- no
- Don't Know

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24. Is all of the equipment that you installed through the program still in place and in use?  Yes  No

open:

25. Is the equipment operating as you expected?  Yes  No

open:

26. What are the operating hours for the equipment?

27. Are the operating hours different than what you expected at the time the project was planned?  Yes  No

open:

28. Do you know if any of the operating parameters are different now than what you expected when the project was planned (air pressure, temperature, static pressure, dissolved oxygen)?  Yes  No  Don't Know open:

29. Have you experienced any other benefits as a result of the project in addition to energy savings (reliability, better system control, production, product quality, safety, happy staff, improved regulation for compressed air)?

**Past Program Influence**

30. Did your organization participate in any \*utility\* energy efficiency programs, before this project?  yes  Don't Know  no  Refused

(a) How would you rate the Production Efficiency Program as compared with the utility program you participated in previously? Again, please use a 0 to 10 scale, where 10 indicates the Production Efficiency Program compares very favorably with the previous program.

*(Record Answer# 0-10), Use 88=don't know, 99=refused*

Q24(a)(1) Why do you say that?

Q24(b) Did your experience with the utility program(s) lead you to look into energy efficient options for equipment?  yes  Don't Know  no  Refused

**Spillover**

31. Since participating in the Production Efficiency program, have you installed any additional energy efficient equipment without any incentives?

- yes  Don't Know  no
- Refused  installed or planning to, with an incentive

(a) What type of equipment was that? (e.g. lights, motors)

(b) Please rate how influential the program was in your decision to install additional energy efficient equipment. Again, please use a 0 to 10 scale where 10 indicates the program was very influential.

*(Record Answer# 0-10), Use 88=don't know, 99=refused*

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**Energy-Related Decision Making**

32. Does your organization have any policies (either written or informal) about purchasing energy efficient equipment?  yes  Don't Know

no  Refused Q26(a) Please describe policy

(b) And were these policies put in place BEFORE or AFTER you began participating in the Energy Trust's Production Efficiency Program?

Before  Don't Know  After  Refused

26(b)(1) How much was the decision to adopt these policies influenced by your participation in the Production Efficiency Program? Again, use a 0 to 10 scale, where 10 means the Program had a very strong influence on your decision to adopt the policy.

*(Record Answer# 0-10), Use 88=don't know, 99=refused*

**Process Questions**

Now I want to ask you about your experience participating in the Production Efficiency Program...

33. Do you recall any phone conversations or other interactions with the Energy Trust of Oregon or its program administrator (Aspen Systems) concerning the Production Efficiency Program? (...or did you just work with your contractor/supplier/utility)

yes  don't know  no  refused



(a) Do you recall which one?

- The Energy Trust
- both
- the program administrator (Aspen)
- don't know

34. Have you experienced any delays in any step of the project or has it taken longer for something to happen than you expected?

- yes
- don't know
- no
- refused

(a) Describe (probe: reason for delay, length of delay)

(b) What in your view would have been a reasonable turn-around time?

35. What reasons were you given for proceeding with your project? (Probe each, record all mentions)

- environmental benefits
- decreased energy use or electricity bill
- other (record below)
- incentive, rebate (lowers the first cost of equip)

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- don't know
- decreased maintenance costs
- tax credits

Specify Other:

36. Did you decide to install all of the energy efficient items your contractor recommended?  yes  don't know  no  refused

(a) What did you decide not to install, and why?

37. Do you have any plans to install this equipment at a later date?

- don't know
- yes
- no
- refused

(a) What do you plan to install, and when?

**Satisfaction**

We'd like to get a sense of your satisfaction with the program. Use a one-to-five scale where 1 means not at all satisfied and 5 means completely satisfied. (88 = Don't Know, 99 = Refused.)

38. How satisfied are you with the performance of the equipment you installed.

*(Record Answer# 1-5), Use 88=don't know, 99=refused*

39. How satisfied are you with the application process?

*(Record Answer# 1-5), Use 88=don't know, 99=refused*

... the savings on your monthly energy bill?

*(Record Answer# 1-5), Use 88=don't know, 99=refused*

40. the rebate amount?

*(Record Answer# 1-5), Use 88=don't know, 99=refused*

41. your satisfaction with the quality of work conducted by your contractor/vendor.

*(Record Answer# 0-10), Use 88=don't know, 99=refused*

[if less than 5] Why did you say that?

42. .... your overall satisfaction with your program experience..

*(Record Answer# 1-5), Use 88=don't know, 99=refused*

### **Satisfaction with the Energy Trust**

I want to ask a similar set of questions about your interactions with the Energy Trust. (These are additional questions we ask only of participants who had experiences with the Trust). Again, please use a 1 to 5 scale, where 1 is extremely unsatisfactory and 5 indicates extremely satisfactory. Please rate ... (For Questions 50-54 key in 88 for Don't Know or 99 for Refused.)

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43. the Energy Trust's courtesy

*[record response value 1-5, use 8 for don't know and 9 for refused]*

44. the Energy Trust's helpfulness

*[record response value 1-5, use 8 for don't know and 9 for refused]*

45. the Energy Trust's knowledge of program services:

*[record response value 1-5, use 8 for don't know and 9 for refused]*

46. the ease of your transactions (paperwork/payments):

*[record response value 1-5, use 8 for don't know and 9 for refused]*

47. Did you ever have any issues that needed resolution? If so, how satisfied are you with how it was resolved?

*[record response value 1-5, use 8 for don't know and 9 for refused - record 77=no issues needed resolution]*

48. [If any satisfaction responses were "1" or "2"...] Can you describe the factors contributing to your lack of satisfaction?

**BETC and SELP**

Are you aware that the State of Oregon offers a tax credit for qualifying energy-efficient investments, called the Business Energy Tax Credit, or BETC?

49.  yes  no  don't know  refused

**If yes....**

(a) Did your contractor mention the tax credit program to you?

- yes     no     don't know     refused

(b) Did your organization apply to receive a tax credit?

- yes     no     don't know     refused

**If yes....**

(b)(i) Did your organization receive a tax credit from the State?

- yes     no     don't know     refused

**If no....**

Probe: why not?

50. Are you aware that the State of Oregon offers loans for qualifying energy-efficient investments through the Small Scale Energy Loan Program, or SELP?

- yes     no     don't know     refused

**If yes....**

(a) Did your contractor mention the loan program to you?

- yes     no     don't know     refused

(b) Did your organization apply to receive a loan?

- yes     no     don't know     refused

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If yes....

(b)(i) Was your organization approved to receive a loan from the state?

yes       no       awaiting approval

don't know       refused

Allow verbatim if needed

### ***Firmographics***

51. What is the primary activity that occurs at this facility? (Do Not Read)

office

food service

retail

hotel

warehouse/wholesale

manufacturing

other

52. Approximately how many full-time equivalent (FTE) employees work at this facility?

*(record number. use 888 for DK and 999 for refused)*

A. How many other sites does your organization operate?

53. How many years has your organization been in business at this site?

*[record number of years, use 888 for don't know and 999 for refused]*

54. Approximately how many square feet of lighted area are in your business?

*[record square footage value, use 8 for don't know and 9 for refused]*

55. Of this square footage, how much is conditioned?

*[record square footage value, use 8 for don't know and 9 for refused]*

### **Conclusion**

56. In conclusion, are there any other comments you would like to make about the incentive program, or any feedback you would like program managers to hear?

May we call you another time in the course of this evaluation?

yes       no.







**research/into/action** inc

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