

Energy Trust of Oregon

Production Efficiency Program 2003-2005

Impact Evaluation

Final Report

Funded By



Prepared For

Philipp Degens
Energy Trust of Oregon, Inc.

Prepared By

Steven Scott, PE
Brian Crumrine

STRATEGIC ENERGY GROUP
Providing business energy solutions

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Executive Summary

Energy Trust of Oregon, Inc. (Energy Trust) is an independent nonprofit 501(c)(3) corporation dedicated to energy efficiency and renewable energy development in Oregon. Under an agreement established with the Oregon Public Utility Commission in January 2002, Energy Trust receives funding from a 3% public purpose charge paid by the customers of Portland General Electric and PacifiCorp, Oregon's two major investor-owned electric utilities. These funds are in turn invested by Energy Trust in energy efficiency and renewable energy.

Energy Trust's Production Efficiency (PE) Program offers energy efficiency services for industrial processes, including manufacturing, agricultural and water/wastewater treatment. The program funds studies to identify electrical energy efficiency opportunities and provides financial incentives to implement these opportunities.

This impact evaluation covers industrial projects completed under the PE Program between January 1, 2003 and December 31, 2005. The evaluation included all projects at industrial facilities including compressed air, refrigeration, motor systems, pumps, and fans, as well as industrial process modifications. Some prescriptive measures, such as motors and lighting, are also included in these results.

Energy Trust has two overall goals for this impact evaluation:

- To develop reliable estimates of program savings, and
- To report observations and make recommendations on improving energy savings estimates and future evaluations.

Evaluation Approach

As the majority of the energy savings were realized by a relatively small number of customer sites, stratification by energy savings was used for the sampling approach.

A total of 98 site visits were performed for this evaluation. This includes 6 sites visited for an earlier process evaluation. Another sample was used for

telephone interviews of 22 smaller participants using the same questions as were asked during the site visits.

In addition to the participant site visits and telephone interviews, the evaluation also performed telephone interviews with 33 “audit-only participants” that received an Energy Trust-funded energy study but did not apply for an incentive on a recommended project.

Results Summary

Table I summarizes PE Program energy savings achievements by end-use, and Table II provides an overall program summary. The PE Program has achieved an overall realization rate of 92.8% for projects implemented in calendar years 2003-2005 with an overall free-ridership for the program of 17.2% (7.8% with Mega-projects included).

Table I: Program Results by End-use, PE Program 2003-2005

Measure Category	Working kWh	Engineering Adjustment /Realization Rate	Gross Savings, kWh
Compressed Air	27,089,414	99.95%	27,075,110
Fresh Water	4,519,322	63.25%	2,762,685
HVAC	9,564,380	100.00%	9,564,380
Hydraulics	3,579,654	104.16%	3,728,634
Lighting	10,567,189	93.20%	9,848,620
Motors	805,943	77.40%	623,800
Pneumatic Conveyance	16,122,115	89.24%	14,386,953
Process Fans	5,768,788	84.78%	4,890,877
Process Modification	184,955,244	93.76%	173,419,192
Process Pumping	6,251,153	63.81%	3,989,023
Refrigeration	5,566,445	97.23%	5,411,981
Wastewater	4,144,378	77.48%	3,211,238

Table II: Overall Program Results, PE Program 2003-2005

	Working kWh	Engineering Adjustment /Realization Rate	Gross Savings, kWh	Overall Market Adjustment Factor	Net Program Savings, kWh
Total, Mega-projects¹	153,073,574	92.3%	141,307,774	100%	141,307,774
Total, without Mega-projects	125,860,451	93.4%	117,604,718	82.8%	97,362,788
Total, all projects	278,934,025	92.8%	258,912,492	92.2%	238,670,562

Evaluation Observations

This is a summary of the evaluation observations of the PE Program. Detailed recommendations to address these observations and for Energy Trust to consider for current and future program design and implementation are in the expanded version on page 28 of this report.

The observations are grouped into three categories: program satisfaction, those related to evaluation, and customer service.

Program Satisfaction Observations

- Satisfaction with the PE Program is very high.
- Regard for PE Program representatives is very high.
- For a number of customers, this is their first experience with an energy efficiency incentive program and it has been positive.
- Some customers have concerns with perceived variation in Energy Trust programs and policies.

¹ Mega-projects include two projects at pulp and paper mills and one project at a wood products facility. There is no free-ridership associated with Mega-projects.

- Some customers have concerns about the number of different people representing Energy Trust interests.

Evaluation Observations

- Project evaluability is an issue: key information for impact evaluation was not uniformly present in project documents.
- Project data has been inconsistently recorded – the database should be redesigned to accommodate all program needs, including evaluation.
- Much of the variance in project realization rate is not due to performance, but to baseline assumptions, measure operating assumptions and inappropriate analysis approaches – Energy Trust should establish standards for level of effort, documentation, and analysis of project savings.
- Many program audit-only participants have installed or are planning to install recommended efficiency measures without incentives – Energy Trust should consider performing an impact evaluation of the projects implemented by the audit-only participants.
- Very large projects should have evaluation oversight assigned early in the design and development process.

Customer Service Observations

- Knowledge and use of the Oregon Business Energy Tax Credits (BETC) program is not universal and there is uneven awareness that it can be used for projects that save natural gas.
- Not all customers understand that the PE Program can help with efficiency projects beyond their current effort. A communications plan could help resolve this issue.

- For “major accounts” a regular and formal review of project opportunities should be undertaken.
- Projects identified by the evaluation as “not operating as designed” and “not achieving savings” should be revisited.

Energy Trust Staff Response

MEMO



Date: February 13, 2008

To: Board of Directors

From: Philipp Degens, Evaluation Manager

Elaine Prause, Sr. Industrial Sector Manager

Subject: Staff Response to the 2003-2005 Production Efficiency Impact Evaluation

The impact evaluation of the Production Efficiency (PE) program covered the first three years of the program. These three years covered the ramp up period through 2005, when the program was forced to reduce its activities due to availability of funds, ushering in the reservation system. Through this time the number of projects and savings grew significantly every year while the satisfaction level with the program and its implementation contractors has remained quite high.

The evaluation shows that program is doing a good job at delivering the predicted savings with a 93% realization rate. The program is also getting industry to increase its efficiency level as compared to standard practice with only 18% of the non-megaproject savings associated with free-riders. This free-rider rate is at a similar level to that of Energy Trust's Existing Buildings program.

One issue identified by the evaluation is the high variation in actual to predicted savings. Much of the variance was due to baseline assumptions and not measure performance. Energy Trust is working with the Program Delivery Consultants (PDCs) to develop standards for documenting and analyzing projects. For some projects that have fairly predictable savings Energy Trust is considering developing prescriptive savings. Energy Trust is currently doing research on the small compressed air market to identify such measures.

Improving communication with the customers is also seen as a priority. Clearly informing them that participation may require site visits for verification and evaluation as part of Energy Trust's QA/QC and due diligence on the part of investing ratepayer dollars will help with evaluation. Also letting customers know that they can consult us on other renewable and efficiency projects and about the availability of funding for projects outside of the Energy Trust such as BETC or federal tax credits may increase participants' investment into efficiency and renewables. As of 2008 Energy Trust staff is more involved in the daily implementation of the program and anticipates the program to have more direct communications with and develop long-term relationships with industrial participants.

The depth of analysis for both developing a project as well as evaluating a project were also an issue with Megaprojects. Evaluation is now planning to treat Megaprojects more like a program unto themselves. Evaluation will:

- Review Megaproject proposals to ensure that appropriate baseline conditions have been estimated, savings methods are valid, and that an appropriate monitoring and verification (M&V) plan has been proposed
- Review Megaprojects as they are implemented to ensure that the M&V plan is being implemented
- Estimation of the project impacts one year after implementation and possibly periodically after this first year.

Introduction

Energy Trust of Oregon, Inc. (Energy Trust) is an independent nonprofit 501(c)(3) corporation dedicated to energy efficiency and renewable energy development in Oregon. Under an agreement established with the Oregon Public Utility Commission in January 2002, Energy Trust receives funding from a 3% public purpose charge paid by the customers of Portland General Electric (PGE) and PacifiCorp, Oregon's two major investor-owned electric utilities. These funds are in turn invested by Energy Trust in energy efficiency and renewable energy.

Production Efficiency Program Overview

Energy Trust's Production Efficiency (PE) Program offers energy efficiency services for industrial processes, including manufacturing, agricultural and water/wastewater treatment. The program funds studies to identify electrical energy efficiency opportunities and provides financial incentives to implement these opportunities. Key services provided are:

- Energy audits and technical assistance,
- Installation and project management, and
- Post-installation inspections.

A Senior Industrial Sector Manager that is Energy Trust staff provides oversight of the PE Program on behalf of Energy Trust. All program implementation is conducted by contractors. The Program Management Contractor (PMC) provides overall management and coordinates the work of four Program Delivery Contractors (PDC), three of which serve customers by geography and the fourth serves all fresh water and wastewater end-users. The PDC are responsible for conducting scoping studies, helping develop measure specifications, and to perform project verification. The also help facilitate program paperwork and applications for Oregon BETC program.

The PMC also manages a pool of technical resources for detailed studies. These Allied Technical Assistance Contractors (ATAC) work with the PDC and customer to deliver energy studies with more detail than scoping studies and where knowledge of specific industrial processes is required.

Certain large customers that use more than one average megawatt may "self-direct" their public purpose charge payments to fund certified energy efficiency projects. Self-direction is optional and over time a customer may change its self-direct status. The PMC and PDC also coordinate with the Oregon Department of Energy for these few self-directing customers that participate in the PE Program. Self-directors also receive only 50% of the incentive amount.

In 2002, Energy Trust began this program by offering industrial customers incentives through the serving utilities and their existing programs. After this "Transition Program" was completed, Energy Trust established the PMC, PDC and ATAC contractual arrangements and began providing incentives directly to customers. Initially there was an additional incentive to "kick start" participation and in 2005 a reservation system was established to stabilize the flow of projects and incentives.

PE Program Activity

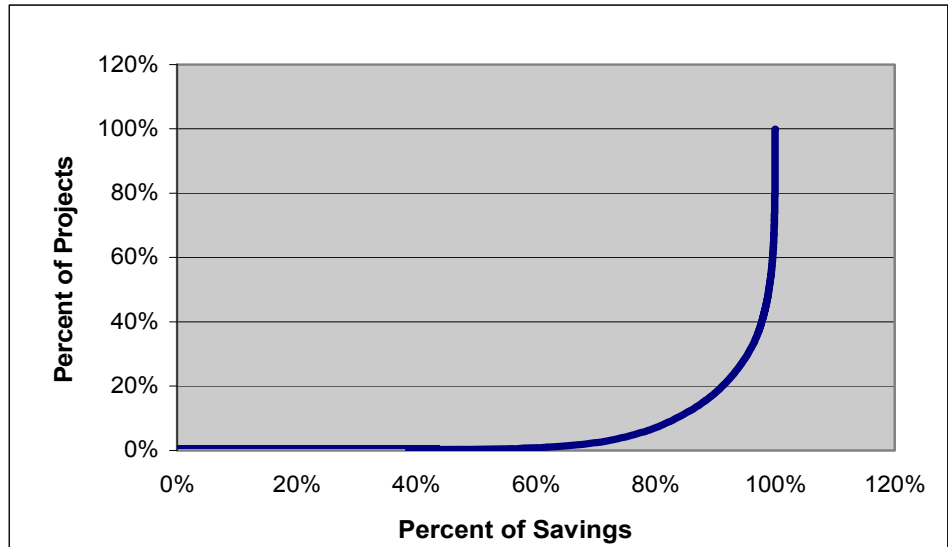
The tables and figure below describe the program activity for the evaluation period covered in this report. The change from the utility-offered Transition Program to Energy Trust's Production Efficiency Program resulted in only two specific projects in 2003, but another 576 in the following years. The majority of the savings occur in 2005 with several "mega projects" implemented.

Table 1: PE Program Activity by Year

Program Year	Working kWh	Number Projects
2003	418,074	2
2004	90,189,407	107
2005	188,326,544	469
Total	278,934,025	578

For the calendar years 2003-2005 five projects account for 60% of program savings and included three very large pulp and paper mill projects and large projects at a particleboard facility and a microelectronics plant. Figure 1 describes the percent of energy savings graphed against the percent of projects. Also, note that the smallest projects, 55% of all of program effort in terms of number, only account for 1% of all energy savings.

Figure 1: PE Program – Percent Savings vs. Percent Projects



As noted above, many small projects make up the majority of program activity, but only a small part of the total energy savings. The most common projects are lighting, motors and compressed air. These end-uses account for 73% of all project activity but only 13% of energy savings. The lighting and motors were for the very most part prescriptive projects using assumed savings without scoping or detailed analysis. The largest five projects mentioned earlier are process modifications. Note also that some sites have taken advantage of Energy Trust programs over a number of years with a variety of projects in both size and end-use.

Table 2: PE Program Activity by End-use

End-Use	Working kWh	% of Total Savings	Total Projects
Compressed Air	27,089,414	9.7%	123
Fresh Water	4,519,322	1.6%	11
HVAC	9,564,380	3.4%	12
Hydraulics	3,579,654	1.3%	7
Lighting	10,567,189	3.8%	164
Motors	805,943	0.3%	128
Pneumatic Conveyance	16,122,115	5.8%	21
Process Fans	5,768,788	2.1%	10
Process Modification	184,955,244	66.3%	56
Process Pumping	6,251,153	2.2%	20
Refrigeration	5,566,445	2.0%	17
Wastewater	4,144,378	1.5%	9
TOTAL	278,934,025		578

Evaluation Methodology and Goals

This impact evaluation, conducted by Strategic Energy Group (SEG), covers industrial projects completed under the PE Program between January 1, 2003 and December 31, 2005. All projects at industrial facilities with a completion date within this time period are included in this evaluation.

This evaluation includes energy efficiency projects at industrial facilities including compressed air, refrigeration, motor systems, pumps, and fans, as well as process modifications. Some prescriptive measures, such as motors and lighting, are also included in the results but were not formally evaluated as they comprise only about 4% of the total savings for this program.

Energy Trust has two overall goals for this impact evaluation:

- **To develop reliable estimates of program savings** for the PE Program.
- **To report observations and make recommendations**, including:
1) how to improve the energy savings analysis for the PE and other Energy Trust programs; and 2) how to improve the independent evaluation of those savings.

This report's findings and recommendations will also assist Energy Trust improve the PE Program and its implementation.

Evaluation Sampling Plan

As the majority of the energy savings were realized by a relatively small number of customer sites, stratification by energy savings was used for the sampling approach.

The very largest projects, about 26 sites and 81% of the savings, were considered as the "certainty sample" and received site visits. The next largest group (in terms of energy savings) was randomized and the top 62 sites representing 6.5% of the savings were also selected for site visits. Pulling a sample from the bottom of that same list, telephone interviews were conducted that included most of the same questions that were asked during the site visits. The smallest projects in terms of number and energy

savings, prescriptive lighting and motor projects, were not formally analyzed and realization rates were imputed from another study.

Altogether site visits were completed at 98 sites, and with phone survey completed at an additional 22 sites. Site visits and phone surveys were conducted by SEG and two subcontractors.

Evaluation Site Visits

A total of 98 site visits were performed for this evaluation. This includes six sites visited for a previous process evaluation (Research Into Action report, November 10, 2005). SEG conducted 68 site visits, and subcontractors conducted 30.

The approach to performing participant surveys, gathering project data and verifying operating conditions through the site visits involved the following:

- Before conducting each site visit, evaluators examined available project reports, including the original energy study and any follow-up documents verifying savings, where available.
- The field evaluator met with a facility staff person familiar with the efficiency project(s) under review. Each site visit included: 1) a walk-through of the facility focusing on the installed energy efficiency measures; 2) an interview with the staff person to complete a survey focused on the company's decision making and planning related to the installed energy efficiency measure(s); 3) where possible, collection of data from the participants' own process monitoring systems; and 4) where appropriate and practical, installation of short-term metering by the evaluator. The following types of data were gathered through the site visits:
 - Presence or absence of the installed measures and components,
 - Any differences between the documented energy efficiency measures and those observed on site,
 - Any modifications to the production process, or changes in production capacity that might impact the efficiency measures,

- Any differences between the documented operating parameters for the energy efficiency measures and those observed, and
- Evidence of free-ridership. (As part of the participant survey, customers are asked a series of questions about the likelihood that they would have installed the efficiency measures in the absence of the incentives.)

SEG used the information to make adjustments to the reported energy savings and to calculate the project's realization rate and free-ridership score. The methodologies employed to make these adjustments varied from site to site and included the particular production process, the types of energy efficiency measures, and other site-specific circumstances.

Motor and lighting efficiency projects were not formally evaluated. For these measures imputed realization rates of 77.4% and 93.2%, respectively, were applied.²

Energy study assumptions and change in use of the measure were the two most common causes for differences between predicted and calculated energy use. Energy study assumption differences found include inappropriate use of cube-law or inadequate representation of the installed measure. Examples of change in use include longer hours of operation or different parameters, such as air pressure setpoints. Table 3 summarizes the major causes for variance and their influence on expectations of savings for projects with realization rates less than about 90% and greater than about 110%.

² Imputed realization rates for motors and lighting are from: *Building Efficiency Program: Process & Impact Evaluation*, for Energy Trust by RIA, December 30, 2005.

Table 3: Causes for Variance

	RR less than 90%	RR greater than 110%	Savings Deemed
Change in use	8%	7%	
Measure performance	8%	3%	
Measure not in use or not installed	4%		
Conservative analysis		7%	
Energy study assumptions	15%	18%	
Project documentation	5%	2%	
No project baseline provided	4%	1%	2%
No metering possible or no customer data available			16%

It was not possible to calculate energy savings for every project. This was most often due to the lack of performance or energy use data for a project. For example, for measures with seasonal variation such as refrigeration system upgrades, energy use can only be determined from a full year of performance data. This is occasionally but not always available from refrigeration control systems. Without long-term performance or energy use data energy savings cannot be estimated.

At a minimum during every site visit the presence and operational status of the energy efficiency project was confirmed. If the project is in place and operating as expected, the savings were deemed to be as estimated in the energy study.

Participant Phone Survey

In addition to the field gathered survey results during site visits, SEG completed phone surveys of 22 participant sites. These sites represented three percent of program energy savings. The evaluators interviewed the facility staff person most familiar with the energy efficiency project to collect information on the following:

- Presence or absence of the efficiency measures as described in project files,
- Any differences between the documented energy efficiency measures and those observed on site,
- Any differences between the documented operating hours for the energy efficiency measures and those reported by the respondent, and

- Free-ridership (using the same approach as for the site visits; see Market Effects on page 24).

The evaluators used this data to determine if any adjustments to energy savings should be performed and calculated a realization rate and free-ridership score. The results of the participant surveys by phone were blended with the surveys performed during site visits.

“Audit-only” Participant Phone Survey

As part of the Production Efficiency evaluation process, the evaluation team also surveyed sites of 33 audit-only participants. An audit-only participant is an organization that requested an Energy Trust-funded energy study to be conducted at one or more of its sites, but did not apply for an incentive on a recommended project. This section of the report details the findings of that survey.

The goal of the survey was to answer the following key questions:

- Why did the site not go forward with the incentive application process?
- Did the site implement a recommended project in the absence of an incentive?

Audit-only Participant Survey Methodology

At the beginning of this survey process, the evaluation team identified 102 sites that qualified as audit-only participants, based on the definition given above. However, in the process of obtaining project files from Lockheed-Martin, the program management contractor, it was learned that many of these sites had in fact applied for and received incentives for implemented projects (This stems from the fact that the evaluation team had program data through the end of 2005, and some projects were completed in 2006.) In addition, many sites were still considered by Lockheed-Martin to be in its “pipeline” for implementation. “Pipeline” sites, as well as those with completed projects, were removed from the survey sample.

The evaluation team settled on a revised audit-only participant population of 56 sites. Of this population, 33 randomly-selected sites were successfully contacted and surveyed by phone.

The telephone survey instrument was adapted from the on-site visits field survey. The modified phone survey consisted of 59 questions, including firmographics and the same open-ended questions as the survey used during site visits.

In seven cases, the surveyor made multiple calls to key contacts but was unable to reach them. Often the person was preoccupied with manufacturing duties and was not commonly near a phone. Others were traveling and unavailable. Otherwise, the survey length and time to administer it seemed acceptable to the vast majority of respondents. Most phone calls lasted roughly 20 minutes. The surveys were conducted in late August and early September 2006.

In three cases, the surveyor found it difficult to find a person who had experience and knowledge with the audit and application for the incentive because so much time had elapsed since the respondent had made a decision on the project (as long as three years).

Evaluation Results

Results Summary

Table 4 summarizes PE Program energy savings achievements by end-use, and Table 5 provides an overall program summary. The PE Program has achieved an overall realization rate of 92.8% for projects implemented in calendar years 2003-2005 with an overall free-ridership for the program of 17.2% (7.8% with Mega-projects included). The net-to-gross ratio includes savings from prescriptive measures such as motors and lighting. These prescriptive measures were not formally evaluated and used imputed realization rates of 77.4% and 93.2%, respectively.³ The evaluation team estimated program free-ridership based on surveys conducted with participants.

Table 4: Program Results, PE Program by End-use, 2003-2005

Measure Category	Working kWh	Engineering Adjustment /Realization Rate	Gross Savings, kWh
Compressed Air	27,089,414	99.95%	27,075,110
Fresh Water	4,519,322	63.25%	2,762,685
HVAC	9,564,380	100.00%	9,564,380
Hydraulics	3,579,654	104.16%	3,728,634
Lighting	10,567,189	93.20%	9,848,620
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Refrigeration	5,566,445	97.23%	5,411,981
Wastewater	4,144,378	77.48%	3,211,238

³ Imputed realization rates for motors and lighting are from: *Building Efficiency Program: Process & Impact Evaluation*, for Energy Trust by RIA, December 30, 2005.

Table 5: Overall Program Results, PE Program 2003-2005

	Working kWh	Engineering Adjustment /Realization Rate	Gross Savings, kWh	Overall Market Adjustment Factor	Net Program Savings, kWh
Total, Mega-projects⁴	153,073,574	92.3%	141,307,774	100%	141,307,774
Total, without Mega-projects	125,860,451	93.4%	117,604,718	82.8%	97,362,788
Total, all projects	278,934,025	92.8%	258,912,492	92.2%	238,670,562

Table 6 summarizes the disposition of the research for this evaluation. “Sites” are customer locations, while “projects” are energy efficiency equipment installations of which there may be more than one at each site. “Working kWh” is the electrical energy savings identified for each project as recorded by Energy Trust. Unless otherwise described, site and project describe program participants.

Table 6: Evaluation Research Disposition, PE Program 2003-2005

	Number	Percent	Working kWh	Percent kWh
Total number of sites	224	100%	278,934,025	100%
Site visits completed	98	44%	243,522,683	87%
Customer deferred evaluation sites	4	2%	5,332,799	2%
Phone interview sites	22	11%	7,572,589	3%
Total audit-only participant sites	56	100%	n/a	n/a
Phone survey audit-only participant sites	33	58%	n/a	n/a

It is noteworthy that several customer sites have indefinitely deferred cooperation with the evaluation. These sites include a microelectronics

⁴ Mega-projects include two projects at pulp and paper mills and one project at a wood products facility. There is no free-ridership associated with Mega-projects.

facility and three facilities operated by a metal casting company. The energy savings for these sites were deemed for purposes of this analysis, representing 2% of the total program savings. It is not likely that by deeming these projects that the overall program results were affected. It is, however, recommended that the program improve the communication of the evaluation goals and objectives to customers and Energy Trust's expectation of customer cooperation.

Participant Survey Results

This section of the report details the findings of the survey results gathered during 88 site visits and 22 telephone surveys (surveys were not completed at all site visits due to scheduling issues, etc.).

As requested by Energy Trust staff, the PE Program evaluation survey was based on the Building Efficiency Program survey. Minor modifications made to accommodate the change in target audience. The survey consisted of 66 questions, including firmographics and several questions to solicit open-ended comments from participants.

For the purposes of this survey, a participant is defined as an organization that requested an Energy Trust-funded energy study be conducted at one or more of its sites, applied for an incentive on a recommended project, and received Energy Trust funds. This section of the report answers the following questions:

- What factors and attributes characterized the group of participants?
- Would some of the participants have installed the equipment without the energy study?
- What were dominant non-energy benefits to the projects?
- Did participants express common suggestions for program improvement?
- Contrasted with audit-only participants in the program, what differences stand out in their decision making to install equipment after a study is completed?

Following are key findings, the survey methodology used and discussion of findings, both quantitative and qualitative.

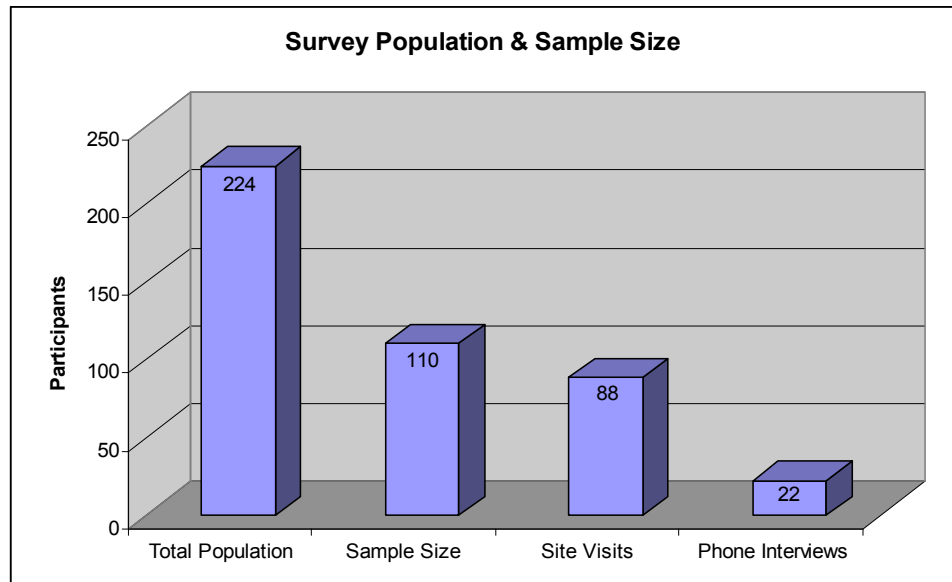
Key Findings

- The participants' overall satisfaction with the program is high, based on an average score of 4.5 on a five-point scale with five being very satisfied.
- Nearly half of those surveyed claimed to have prior plans to install the equipment before participating in the Production Efficiency program.
- Nearly four-fifths of the sample stated they had received either an Energy Trust incentive or a state tax credit (BETC) prior to participation with current projects.
- A majority of the participants reported receiving non-energy benefits from the projects. Nearly three-fifths reported less maintenance for equipment or operations improvements following installation of the projects.

Methodology

The evaluation team reached 110 participants that completed the survey. All of them reported saving at least 70,000 kWh per year. During the site visits, 88 surveys were completed and 22 were completed by phone. In addition, another six results were included from site visits performed for the previous process evaluation.

Figure 2: Participant Survey Disposition



The evaluation team conducted the telephone surveys and site visits in the summer, fall and winter of 2006. The team reached participants throughout Energy Trust service territory in Oregon.

Discussion of Quantitative Findings

The survey results point out several common themes for participation in the program and suggest shared characteristics of the participants.

The participants' overall satisfaction with the program is high: approximately 93% indicated they were either very satisfied or somewhat satisfied, and over half (56%) reported they were very satisfied. On a five-point scale with five as very satisfied, the average satisfaction rated 4.5.

In terms of prior participation in incentive programs for energy efficiency, 87% stated they had received either an Energy Trust incentive or a state tax credit (BETC). About half (51%) had taken the tax credit for a prior equipment installation.

The vast majority of the participants have dedicated staff resources to managing energy efficiency improvements. Twelve percent have energy management plans in place, and 57% employ a staff person to carry out energy efficiency projects and policies; together these groups make up

69% of the sample. Almost one-quarter of the participants have corporate policies that address energy efficiency (23%).

As for financial decision making, the most common analysis is simple payback, as nearly three-fourths (73%) of the participants declared their use of that approach. The average payback required for energy efficiency projects for this vast majority was 2.8 years. Among the 14 public agencies included in the sample, nearly one-third apply simple payback to efficiency projects and look for an average payback of 4.5 years.

In terms of timing, most of the participants learned about the incentive program either from prior experience with Energy Trust or before planning the energy efficiency project (58%). Thirty-seven percent of the participants learned about the program during planning. Nearly one-half (47%) reported having plans to install the equipment before participation in the incentive for these projects.

When asked about the sources of information about the program, the most common response was that they learned about it through an equipment vendor or contractor (44% when the “Other” responses are included). Nearly one-fifth cited a utility company representative as a source of initial information. The next two most mentioned sources were (1) friends and colleagues and (2) architects, engineers and consultants (total of 15%).

When asked about the importance of prior participation in an Energy Trust program for decision making, more than one-fifth (22%) indicated this was either very or somewhat important. Approximately one-quarter (24%) said that it was not important at all; while half answered that they did not know.

Non-energy benefits appear to be significant for participants. Nearly three-fifths (58%) reported less maintenance in their equipment or improvement in operations following project installation. The installed measures provided less noise or environmental impact for about one-third (35%) of the participants; nearly the same portion of the group (32%) experienced increased productivity as a result of the project. Nearly one-seventh of the participants said the measures contributed to both increased product quality and more consistent processes. One-fifth (21%) said the production process had changed or improved since project completion.

The following description of non-energy benefits was the most extensive reported: *“Performance of cleaners is improved. Removes more*

contaminants, don't have to downgrade product, also probably less breaks, and much decreased maintenance. Pumping soft starts eliminates water hammer. VFD (variable frequency drive) reduces wear and tear on valves and piping, less noise and vibration, maintenance benefits. Improved control on filtrate line, better operating range for system. Reduction of effluent, gas savings, less pressure variation."

"Audit-only" Participant Survey Comparison

In comparing quantitative findings from participants to audit-only participants, there is only one noteworthy difference. In contrast to participant's use of simple payback to evaluate energy efficiency projects as noted above (73%), audit-only participants indicated in the previous survey that only about one-third use simple payback. The payback periods in the two groups, nonetheless, are very similar: the audit-only participants use approximately three years on average as their preferred term versus 2.8 years among participants.

Discussion of Qualitative Findings

At the end of the survey, participants had the opportunity to provide comments about their experience. The most common comment from participants at the end of the survey was that Energy Trust needs to provide a more consistent stream of funds, a comment on the budget constraints seen in 2006.

One participant wondered why multiple audits must be performed for one project. The evaluators recognize that participants have historically not always been clearly informed about verification and evaluation steps that are required by the program.

The availability of incentives for natural gas projects was also raised as a concern. One participant suggested providing an incentive for a large cogeneration project: the lack of such an incentive prevented it from being implemented. A second suggested offering an incentive program for natural gas efficiency projects. (Note: Since Energy Trust does not collect public benefits charges from industrial gas customers it has no programs in this area.)

Energy Trust procedures were also cited by participants. Both comments address consistency of rules applied to the program: "ETO rules change

all the time in regards to self-generation. Because of these changes we are now considering self-direction.” (Note: Energy Trust’s rules have not changed on this subject since they were initially established.) And this: “The program doesn’t have clear rules and program guidelines change. It’s not clear whether we are going to get funding or not for each project.”

Audit-only Participant Survey Results

Audit-only Participant Key Findings

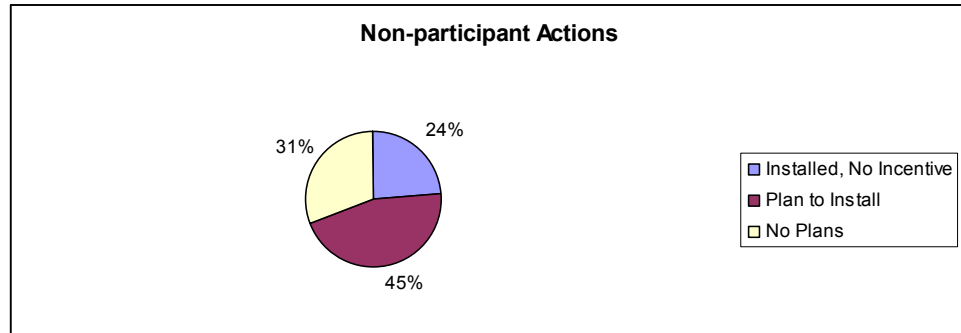
- Audit-only participants did not go forward with projects either because the estimated payback period was too long or the timing of the incentive did not match their plans to install the recommended equipment.
- Eight of the 33 sites contacted (24%) did install the recommended, or similar, equipment without applying for an incentive.
- A small majority of the respondents indicated they did not have plans to install the measures prior to having an energy study performed.

Audit-only Participant Quantitative Results

The survey revealed several important points about why the audit-only participants did not implement projects and take advantage of the Energy Trust incentive.

Although they did not receive an Energy Trust incentive, 24% of the sample reported that they installed the measures anyway. Forty-five percent of the sample stated that they have plans to install the measures in the future. All told, 69% have installed or may eventually install the measure (see Figure 3).

Figure 3: Audit-only Participant Actions



Seven out of eight who installed the measures without an incentive said they used the same or similar equipment recommended by the study. Several of these respondents stated they could estimate the energy savings from the equipment. The evaluation team did not pursue verification of these savings estimates.

Table 7 contains details on some of the equipment installed without an incentive. Note: that this table describes the recommended measures – actual equipment installed may have differed.

Table 7: Audit-only Participant Implemented Projects

Site ID / PE No.	Industry / Measure Description
S00000115998	Wood products
PE0345	Install 250hp VFD compressor with VFD cooling fan, add receiver storage
PE0345	Install new cycling refrigerated air dryer
PE0345	Install VFD cooling fan conversion kits
S00000115710	Food processing, distillery
PE0281	Install 75HP VFD compressor, add air storage, improve piping
S00001117279	Refrigerated food distribution warehouse
PE0231	Reduced condensing pressure
PE0231	Dock evaporator fan VFD control
PE0231	Trim compressor VFD
PE0231	Cooler and Dock evaporator fan cycling control
PE0231	Cooler high speed doors
S00000116060	Agriculture, irrigation
PE0311	Install center pivot irrigation system
S00000116081	Wastewater treatment plant
PE0184	N. Plant: install VFD on effluent pump station
PE0184	S. Plant: Install VFD on blower and VFD on effluent pump
S00000115599	Frozen food processing
PE0091	Improve control algorithm
PE0091	Increase condenser capacity, wet-bulb approach condensing pressure control, and condenser fan VFD
PE0091	Cold storage compressor VFD
PE0091	Fan VFDs on the new cold storage evaporators
S00000115703	Auto/truck tire distributor
PE0347	Install air recapture equipment
PE0303	Improve performance of compressors
PE0303	Convert some high pressure air usage to low pressure
PE0303	Reclaim pre-cure storage energy

Of those who had no plans to install any measures (31% of the sample), the vast majority responded that the payback period would be too long. About one-third used simple payback to evaluate energy projects. On average, those who use simple payback have a three year payback requirement, with public agencies accepting slightly longer payback periods. Only a small number (13%) said that their process had changed, rendering the recommended measures inappropriate.

Of those who installed measures, 6% received the Oregon BETC, while another 9% did not know whether they had or not.

A majority of the sample (58%) indicated they did not have plans to install the measures prior to participation in the program.

Nearly half of the sample (45%) responded that a representative of the program recommended that the measures be installed.

Seventy-two percent of the sample claimed they had purchased other energy efficient equipment in the past two years without applying for an incentive from the PE Program. The most common reason for not applying (given by one-third of this group) was that the incentive wasn't sufficient to warrant the application. (In most cases, these were low capital cost installations such as motors and VFD systems.) Others reasons for not pursuing an incentive included non-energy projects offered higher return for the cost; did not know whether the equipment qualified for a financial incentive; insufficient time to apply for the incentive; and the paperwork was considered too extensive.

Eighteen percent of the sample indicated that they were either dissatisfied or indifferent with their overall program experience. Of this one-third (18%) indicated they had questions regarding the adequacy of the consultant's audit or problems understanding the incentive application process. Another one-third noted barriers from the time constraints for submitting incentive paperwork.

Audit-only Participant Discussion of Qualitative Findings

In addition to gathering responses to survey questions, SEG gleaned a number of general impressions from the sample that merit discussion.

Many of those who did not receive incentives still found value in the process of conducting an energy efficiency study. They often found the application process afforded learning opportunities for management and staff. Several audit-only participants were public agencies who had recently developed energy management plans or appointed sustainability committees that address energy efficiency. Many indicated that the Energy Trust process provided these committees financial and process experience where they had little, if any, prior to their involvement in the program. Many businesses had recently initiated corporate policies that incorporated energy efficiency into operations. These projects were often some of the

first to be considered under these policies and enabled management fresh examples to apply revised procedures for allocating resources.

Scale and timing of availability of incentives were often critical factors in deciding whether or not to pursue an incentive. The respondents often indicated that there was a narrow window of opportunity to install the equipment, and if a potential participant was unsure whether the incentive would be available during that period, they felt forced not to participate. Many respondents gave the general impression that concrete timelines and clear information about availability of incentives were critical for budgeting, planning and decision making.

Uncertainty over funding requirements of the program came up in two survey responses. Specifically, respondents indicated it would have been helpful to clearly understand from the start that while the incentive is paid soon after the project's completion, the applicant must bear the entire capital cost of the equipment up front.

Overall, people seemed pleased and well-served by Energy Trust staff and their representatives. Dissatisfaction stemmed from other factors as outlined above.

Conservation vs. Efficiency

The PE Program focuses on projects that improve the overall efficiency of delivered services: for example, reduced kWh per cubic foot of compressed air or kWh per gallon of water pumped. Conservation, in terms of operational changes, that do not reduce services could also be considered. However, there were a number of projects in this evaluation where changes in operating parameters (operating hours) contributed to savings. For example, plants that operated two shifts saw a decrease in demand for products and are now operating just one shift.

Energy Trust's Evaluation Manager asked the evaluators to look for projects that had reductions in operating hours that might contribute to apparent energy savings and differentiate them as conservation rather than efficiency. Adjustments were made for those few situations where customers reported changes in shifts or hours of operation that changed savings estimates. Savings on three projects were adjusted.

Besides their presentation in Table 8, no other changes were made to the savings or realization rates in the evaluation database. To recalculate the current savings, the baseline and savings estimates were redone. However, as the Working kWh (a given from the Energy Trust Fast Track database), we did not include these changes in the program results summary. Since the savings adjustment is less than one-half of one percent of the total program savings, this approach is reasonable.

Table 8: Conservation vs. Efficiency Adjustments

Site ID / PE No.	Industry / Measure Description	RR Change / kWh Savings Change
S00000115996	Wood Products	118% → 144%
PE0306	Observed operation was only one shift rather than two as described as the baseline in the energy study.	-334,601
S00000115973	Wood Products	112% → 102%
PE0178	Current hours of operation are slightly lower than the baseline in the energy study due to construction market turndown.	-308,250
S00000116090	Metals Fabricating	66% → 66%
PE0251	With only 5% difference in hours no adjustments were made.	0
S00001126371	Wood Products	158% → 77%
PE0285	Plant superintendent reported that production was slow during metering, and would continue to be slow during the winter. Were production normal, the realization rate would be lower.	-161,767
S00000116090	Dairy Processing	235% → 235%
PE0251	Production hours have been reduced on Wednesday to just 5 hours, resulting in 13 less hours of production per week. However, with this small change in hours, no adjustments were made.	0
TOTAL		-804,618

Negative Savings

It is possible that the energy use of an installed energy efficiency measure would be equal to or greater than the baseline energy use for that project.

Typically this is because the baseline is inappropriate or because the measure operating parameters (for example, hours of operation) were misjudged in the original analysis, or because operations are different than assumed.

For situations where current energy use is greater than predicted energy use, the value of zero savings was assigned, even though energy use may have increased. However, in some cases the specified measure may actually increase energy use, although that would never have been the original intention. The clearest example of this would be a VFD where it is operated at full speed, either by design, necessity or by operating decision. Because a VFD has internal losses, the energy use for driving a motor at full speed is about 5% higher, depending on the drive size.

Negative savings would only appear in situations where overall measure efficiency has decreased for delivery of the same services. Although there were three project identified where VFD were operating at or near full speed, the energy savings analysis approach used (and/or the operating evidence available) do not indicate that there would be an increase in energy use. Thus, there are no projects that show negative energy savings in this evaluation.

Variance in Realization Rate

The evaluation identified a substantial variance in the realization rate and an analysis of that variance was performed to help understand its source. Table 9 and Figure 4 examine the mean of realization rates and the coefficient of variation (CV), which is the standard deviation divided by the mean. The CV can be used to compare the relative variation in results. Note that this table and figure represent information drawn from a portion of the projects that were evaluated for this report. This information should only be used to gain an understanding of the variance in realization rates and not used as an indication of program results.

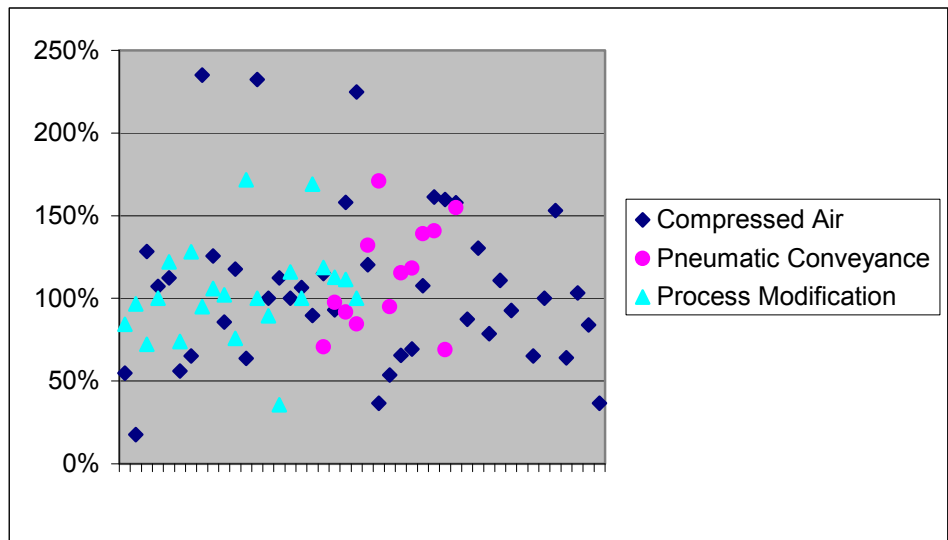
In terms of variance by end-use, process pumping and wastewater projects tend to have savings overestimated, while compressed air is underestimated. In regards to variation, only a very small variation for pneumatic conveyance and process modification was noted. The Working kWh of Process Modification is again the largest end-use because of the work at pulp and paper facilities.

Table 9: Variance in Realization Rate by End-use⁵

End-use	N	RR Mean ⁶	CV	Percent Total Working kWh ⁷
Compressed Air	44	121%	94%	6.6%
Pneumatic Conveyance	13	114%	28%	4.9%
Process Modification	22	104%	29%	78.2%
Process Pumping	6	65%	58%	1.3%
Wastewater	5	89%	91%	1.0%
Overall	90	117%	77%	

Figure 4 shows the variance graphically for the three major end-uses. There is a tendency for results around 100% for process modifications, but it's unclear if there is a central tendency for compressed air or for pneumatic conveyance.

Figure 4: Realization Rate for Major End-uses



⁵ This table includes only includes projects that received site visits.

⁶ This is an unweighted calculation of mean realization rate.

⁷ Does not include all end-use categories. Therefore, percentages do not total 100%.

Market Effects

This section of the report describes the two market effects of the PE Program: free-ridership and spillover. As described in more detail below, free-ridership attempts to measure if participants would have installed the measure without an incentive. Survey responses were used to quantitatively estimate free-ridership. Free-ridership, along with realization rate were the adjustments used to arrive at the final program net-to-gross.

Spillover is desired activity attributed to the program influence that a participant or non-participant undertakes without receiving incentives. Spillover activity for participants was surveyed qualitatively and is summarized below. Non-participants were not surveyed for this evaluation and spillover for that group was not estimated.

Free-ridership

As directed by Energy Trust staff for consistency across program sectors, the PE Program evaluation used the Building Efficiency (BE) Program survey instrument. In addition, the PE evaluation followed the BE approach for scoring free-ridership.

Free-ridership scoring estimates the degree to which participants may have implemented the project without program intervention. The scoring ranges from zero to one, with zero indicating a participant was fully influenced by the program and one indicating that the participant would most likely have done the project on his or her own. Free-ridership scores are used as part of the net-to-gross determination along with realization rate.

For surveyed sites, uniform weighting for free-ridership values was used for this program evaluation with scoring identical for different factors. The following factors were used: 1) financial wherewithal; 2) customer plans and intentions; 3) experience with a similar measure; and 4) program influence. For unsurveyed sites, free-ridership scores were set to the weighted average free-ridership score for the surveyed sites.

Customers were asked if they had previously installed similar equipment. Since many industrial processes are unique, there are often few opportunities to install comparable equipment.

The variables, survey question number, and free-ridership values are shown in Table 10. Free-ridership was evaluated in the order shown in the table: if the answer to the first question was false, no other free-ridership factors were evaluated.

Several projects that are included in this evaluation were assessed as part of the Process Evaluation (Research Into Action report, November 10, 2005). The free-ridership scoring is different, but uses essentially the same approach.

Table 10: PE Program Evaluation Free-ridership Scoring

Definitions of Indicator Variable	Free-ridership Value if True
Would customer have been financially able to install energy efficiency measure without program incentive? (Q19 yes to continue)	Initial Screen
Had customer installed any similar measure before participating in the PE Program? (Q15 yes)	0.333
Did customer have plans to install measure before participating in the program? Would customer have gone ahead with planned installation even if not participating in the program? (Both parts Q16 yes)	0.333
Would customer definitely or probably have installed even if not recommended by Energy Trust? (Q18a or Q18b yes)	0.333

Of the 88 sites that completed surveys, 36 sites were identified as “free-riders” using the approach above; with scores ranging between 0.33 and 1.00 (there were two full free-riders). The adjustment in energy savings for this level of free-ridership is 20.2 million kWh or about 8% of total gross savings. Free-ridership scoring is calculated in Table 11. The table shows each permutation of possible responses to the free-ridership questions and the associated frequency and the free-ridership score.

In Table 11 those sites with prescriptive measures and sites that were not surveyed were assigned an imputed program average free-ridership score of 0.172. An overall free-ridership rate for the program of 17.2% was calculated (7.8% with Mega-projects included).

Table 11: Free-ridership Scoring⁸

Customer financially able? (Q19)	Customer installed similar measure before? (Q15)	Customer planned to install and would have? (Q16)	Customer would have definitely or probably installed? (Q18)	Frequency	Total Gross Savings, MWh	Free-ridership Score	Percent Program Free-ridership
No				25	35,441	0.000	0.0%
Don't know				8	2,277	0.000	0.0%
Yes	No	No	No	16	10,100	0.000	0.0%
Yes	Yes	No	No	8	11,193	0.333	4.97%
Yes	No	Yes	No	10	2,852	0.333	1.27%
Yes	No	No	Yes	6	3,954	0.333	1.76%
Yes	Yes	Yes	No	1	1,375	0.667	1.22%
Yes	Yes	No	Yes	4	2,472	0.667	2.20%
Yes	No	Yes	Yes	5	2,815	0.667	2.50%
Yes	Yes	Yes	Yes	2	2,462	1.000	3.29%
Total Surveyed Projects				85	74,941		17.21%
Not Surveyed – Imputed Average Free-ridership Score ⁹					42,663	0.172	
Mega-projects				3	141,308	0.000	0.00%
Overall, including Mega-projects				88	258,912		7.82%

There were eight “Don’t know” responses to the financial ability question (Q19). It would be possible for the response in those cases to have been yes or no if respondents with more complete knowledge would have been interviewed. In order to determine a range of possible free-ridership scores, these “Don’t know” answers were evaluated as both “yes” and “no” responses to determine “Best Case” and “Worst Case” scenarios. Seven of those eight “don’t know” respondents could have been free-riders with a decrease in net savings of 997,251 kWh. This is 0.4% of total net savings. The results of this range analysis are shown in Table 12.

⁸ Table does not include three Mega-projects as they were pre-screened for free-ridership issues.

⁹ In addition to sites not surveyed, this includes the prescriptive measures of motors, lighting and HVAC.

Table 12: Free-ridership – Financial Ability Range Values

Response to Financial Ability	# Free-riders	Net Program Savings, MWh
Best Case	36	238,671
Midpoint	n/a	238,172
Worst Case	43	237,674

Spillover

Customers were asked if their experience with the PE Program had encouraged them to buy any energy efficiency equipment for which they did not apply for an incentive. Thirty-seven percent said that they had bought efficient equipment without an incentive; the majority of self-reported purchases included efficient motors and lighting. There were interestingly a few mentions for facility heating, ventilation and air conditioning (HVAC), gas furnaces and natural gas fired processes suggesting spillover to other fuel sources. Table 13 outlines these responses.

The survey questions and site work did not pursue information on the magnitude of energy savings from spillover. Non-participants were not surveyed for this evaluation and spillover for that group was not estimated.

Table 13: Spillover – Participant Self-Reports

Reported Spillover End-use	Mentions	Percent of Mentions
Motors	18	41%
Lighting	9	20%
Process	4	9%
Pneumatic Conveying	3	7%
HVAC	3	7%
VFD	3	7%
Air Compressor	2	5%
Natural Gas	2	5%

Evaluation Observations and Recommendations

This section includes evaluation observations on the PE Program and recommendations for Energy Trust's current and future program design and implementation.

This report's findings and recommendations will assist Energy Trust to improve the PE Program and its implementation.

The observations are grouped into three categories: program satisfaction, those related to evaluation, and customer service.

Program Satisfaction Observations

- Satisfaction with the PE Program is very high.
 - The Energy Trust program was highly rated by the majority of customers. Many customers made voluntary statements further describing their satisfaction with the program. (Over half of customers were very satisfied. On a five-point scale, the average rating for overall satisfaction with the program was 4.5.)
- Regard for PE Program representatives is very high.
 - Many customers made glowing reports on the exemplary service provided by the PDC and ATAC and the high regard they had for their professional capabilities and concern for their organization, with a number of contacts mentioned by name. These relationships are a very important asset for the program.
- For a number of customers, this is their first experience with an energy efficiency incentive program and it has been positive.
 - For some there is new awareness of energy costs and the potential for efficiency. A number have

mentioned that they are learning about energy efficiency from their PDC contacts.

- Some customers have concerns with variations in Energy Trust programs and policies.
 - Some of these concerns are historical and relate to early program revisions and the budget limitations of 2006. A uniform communications plan would help clarify Energy Trust’s policies, procedures and program offerings.
- Some customers expressed concerns about the number of different people representing Energy Trust interests.
 - As Energy Trust programs are contracted rather than administered directly by Energy Trust employees, customers are required to work with a number different people and organizations. This extends to the evaluation process, adding *one more* entity and person that a customer needs to work with. Although this is part of the program, it might be addressed through a strategic communications plan where customers are educated about what to expect in terms of program partners.
- A few customers indefinitely deferred the evaluation of their projects; others had requested substantial delay.
 - Energy Trust is considering options to make it clearer to these customers that evaluation is part of the program and has made recent efforts to improve communications regarding the importance of evaluation. The January 1, 2007 letter “*Energy Trust Commitment to Quality*” is a step towards uniformly alerting customers to the importance of verification and evaluation. Again, a strategic communications plan could help address this issue.

Evaluation Observations

- Project evaluability remains an issue.
 - While requests for projects documents were delivered in a timely fashion, the evaluators found that approximately one-tenth of project documentation was not available to them. This includes documents that would have been useful to determine evaluation results.
 - Key information for effective impact evaluation was not uniformly present in project documents. As this information is useful to PE Program management, a one-page summary, perhaps as part of Form 440, should be created with the following information:
 - Description of original system or equipment that was removed, modified or supplanted
 - Description of the installed system or equipment *as installed* (energy studies only describe as intended)
 - Baseline energy use of the original system or equipment
 - Projected energy use of the installed system or equipment
 - If any subsequent inspections or operations changes are observed, for example, during project verification, an additional item should be included describing changes to the measure and to energy use and savings

- Project data has been inconsistently recorded. The database should be redesigned to accommodate all program needs, including evaluation.
 - SEG worked with Energy Trust’s Evaluation Manager to use a “Site ID” to identify customer sites that participated in the program. This significantly improved evaluation team’s ability to track program efforts. The evaluation team would be pleased to work with Energy Trust staff to improve “Fast Track” and program data exchange.
 - End-use descriptions are sometimes inconsistent and are not adequately descriptive. SEC recommends the following list be used:
 - HVAC
 - Hydraulics
 - Wastewater
 - Irrigation
 - Fresh Water
 - Refrigeration
 - Motors
 - Lighting
 - Compressed Air
 - Process Pumping
 - Process Modification
 - Process Fans
 - Pneumatic Conveyance
 - There is inconsistency in project energy savings between different versions of energy studies, verification reports, program forms and the Energy Trust database. In a few cases, there are two different values in the same energy study.
 - In two cases we changed the Working kWh. For PE0185, ETO split the transaction into five separate database entries, dividing the total savings by five. To make the database yield proper results, we changed one of these entries to the entire savings amount. In PE0113, the Working kWh was grossly

different and clearly incorrect compared to the numbers found in project documents. For this project, the Working kWh was also changed. There were other cases where Working kWh seemed incorrect but no better value was available. These changes are described in Appendix A for individual projects.

- Project identification represents a challenge. Lockheed-Martin uses PE numbers, Energy Trust uses Measure ID, and ATAC sometimes use its independent project identification number without citing a PE number. There can be multiple Measure ID for the same project (multiple studies performed, for example) but they may not be tied together to indicate the same project.
 - A single consistent project identification number should be used and Energy Trust should display this identification, as well as a date, on a project cover page.
- Much of the variance in project realization rate is not due to measure performance but to baseline assumptions, measure operating assumptions and inappropriate analysis approaches.
 - Energy Trust should establish standards for level of effort, documentation, and analysis of project savings. These may initially (or only) apply to large projects, perhaps those over one million kWh savings annually.

Standards for large projects could include required metering to accurately establish baseline, citations for assumptions used, and calculations that include part-load conditions for both the original system or equipment, and the intended efficiency project.

- Many program audit-only participants have installed or are planning to install Energy Trust recommended efficiency measures without incentives.
 - Energy Trust should consider performing an impact evaluation of the projects implemented by the audit-only participants. The energy savings could be considered for inclusion in program impacts.
- Very large projects should have evaluation oversight assigned early in the design and development process.
 - It is recommended to document baseline conditions while the existing equipment is in place. The evaluation of large projects could justify new installation, upgrades or verification of existing metering systems.

Customer Service Observations

- Knowledge and use of the Oregon BETC program is not universal and there is uneven awareness that it can be used for projects that save natural gas.
 - For example, a number of public agencies were not aware of the pass-through option that BETC offers. A uniform communications plan for PMC, PDC and ATAC could ensure that customers are aware of these options.
- Not all customers understand that the PE Program can help with efficiency projects beyond their current effort.
 - For example, one customer implemented a very large variable speed drive project with the PE Program, and then purchased a new air compressor without consulting their PDC. The customer was unaware that the PDC could provide advice on selecting energy efficient equipment outside the existing project.

Again, this issue could be resolved by the implementation of a communications plan and/or regular efficiency project reviews (outlined below).

- For “major accounts” it is suggested that a formal and regular, perhaps annual, review of project opportunities be undertaken.
 - This was a suggestion from a customer. Working with customers to consider a long-term strategic approach to energy management would improve on the often used project-based approach.
- To provide continuing customer service, those projects identified by the evaluation as “not operating as designed” and “not achieving savings” should be revisited.
 - Some projects are not operating as expected, as most often indicated by the data logging for this evaluation. For example, some fans that customers claim get turned off at night are on all week. For most projects there may be simple operational changes to get them back on track. Others may require a small investment. Review of some other projects may show that there was not an appropriate specification or application for the efficiency measure. An example would be a retrofit VFD air compressor with inadequate turn-down ratio. The latter type of observations may either be applied to improving the program or, in some cases, Energy Trust may elect to re-invest in an efficiency measure with better performance.

APPENDIX A: Summary of Individual Site Results

The following pages summarize the results for the sites where site visits were performed and for which energy savings were estimated.

The projects are presented in descending order of site savings. Note: The Master Site ID is used in lieu of company name to ensure the anonymity of Energy Trust of Oregon customers. The key below provides a short explanation of the information for each project.

Master Site ID: A unique site identifier
Industrial Process: General industrial category
NAICS Code: North American Industry Classification System Code

PE #	Year	Measure Category	Working KWH	Deemed/Measured KWH	Deemed	Realization Rate
Project ID	Completed	Industrial end-use	Per Trust database	Evaluation calculated savings	Yes or No	<u>Calculated</u> Working kWh

Measure Description:

A brief description of the energy efficiency project.

Factors Contributing to Variance:

For projects with realization rates less than 80 or greater than 120%, this provided a brief explanation of any factors that may explain why savings were different than predicted. If there were issues with baseline or savings figures as presented in the Trust database or in energy studies, alternatives used are described along with the associated realization rate.

Non-energy Benefits:

Any non-electrical energy benefits for the project, as described by the customer.

***APPENDIX B:
PE Program Survey Instrument***

The following instrument was used during the site visits. A set of nearly identical questions were used for the participant telephone survey and a smaller subset, with questions about reasons for not pursuing incentives, were asked of audit-only participants.