IMPACT AND PROCESS EVALUATION OF 2006 AND 2007 NEW BUILDING EFFICIENCY PROGRAM

Final Report

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Energy Trust of Oregon

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES, continued

LIST OF TABLES, continued

EXECUTIVE SUMMARY

This report presents the results of the impact and process evaluations of the New Building Efficiency (NBE) Program that Energy Trust of Oregon (Energy Trust) offered for businesses in Oregon during 2006 and 2007.

ES.1 IMPACT EVALUATION:

The main features of the approach used for the impact evaluation are as follows:

- Data for the study were collected through interviews with NBE program staff, review of program materials and processes, on-site inspections, end-use metering, and interviews with participating firms.
- On-site visits of sample sites were used to collect data for savings impacts calculations, while telephone surveys provided the information for the net-to-gross analysis and process evaluation.
  - The on-site visits were used to verify installations and to determine any changes to the operating parameters since the measures were first installed.
  - Facility staff were interviewed to determine the operating hours of the installed system and to locate any additional benefits or shortcomings with the installed system.
  - Monitoring of lighting, HVAC equipment, or motors/VFDs was conducted to obtain more accurate information on hours of operation.
- Gross savings were estimated using proven techniques, including computer simulations using DOE-2.
- Survey-based techniques for estimating free-ridership in a program were applied to the data collected through a telephone survey of decision-makers.
  - Data collected through this survey were also used to assess qualitatively the extent of program spillover effects.
  - Participants representing about a fifth of realized kWh savings provided answers that indicated some spillover was occurring.

The results of the impact evaluation of the New Building Efficiency Program for 2006 and 2007 are summarized in Table ES-1.

- The overall realization rate for the NBE program has declined over the period 2004-2007. In part this reflects a declining realization rate for lighting measures, which are accounting for increasing percentages of kWh savings for the program.
- The net-to-gross ratios for the NBE program have not changed significantly over time. Net savings have represented about two-thirds of gross achieved savings over the period 2004-2007.

Table ES-1. Summary of kWh and Therm Savings and kW Reductions for New Building Efficiency Program in 2006 and 2007

	2006		***2007***	
	kWh savings	***Therm savings***	***kWh savings***	***Therm savings***
Expected Gross	18,922,788	515,648	22,633,360	699,525
Realization Rate	101.9%	105.1%	92.3%	111.3%
Achieved Gross	19,287,774	542,169	20,889,521	778,653
Minimum Free-rider Rates				
Net-to-Gross Ratio	65.5%	67.0%	67.2%	68.6%
Net Achieved	12,625,867	363,195	14,036,588	534,112
Maximum Free-rider Rates				
Net-to-Gross Ratio	64.2%	67.0%	64.3%	67.2%
Net Achieved	12,378,921	363,195	13,458,493	522,889

ES.2 PROCESS EVALUATION

Findings and conclusions from the process evaluation of the NBE Program were as follows.

- The program has evolved nicely over the last five years. The program managers have exhibited a pattern of observing customer response to the program and adapting the program to make it more effective. Customers have noted and commented positively on the changes to the program.
- The program has communicated effectively with potential customers. One-to-one communication and word-of-mouth communication by participants has been an effective marketing strategy.
- Customers with whom we spoke indicated that overall they were satisfied or very satisfied with the program.
- The major complaint with the program has to do with the paperwork. While the paperwork is consistent with Energy Trust's fiduciary responsibilities, many customers find it difficult. This is particularly true of the smaller trade allies. Energy Trust has made some adjustments in the paperwork that have been noticed by the participants. In addition, some of the smaller trade allies have been adaptive and work with their distributors or others to complete the paperwork.
- The program has four tracks: standard, custom, LEED and Energy Star. The system of tracks may be important for administration, but there is neither interest nor widespread awareness of the tracks among clients. The track system could probably be simplified and reduced to a two-track system of standard and custom and the LEED and Energy Star tracks incorporated into the custom track. Several participants interviewed indicated that they preferred the standard as opposed to the custom track because of the simplicity of that track and the cost of documentation for the custom or LEED tracks.

- There is widespread interest in LEED. However, because of the costs of LEED certification many customers are asking, and many design professionals are suggesting, that projects build either to LEED standards or to the most efficient green standard that the customer can afford.
- Financial incentives played different roles. Several participants suggested higher incentives. For some participants, especially large customers and national chains, there were indications that incentives may not have made much difference. For public entities, there were instances where incentives appeared to be the difference between installing the measure and having a measure value engineered out of a project. The relationship between incentives and participation is not a linear function but rather more like a step function.
- Risk is important for smaller participants, who discussed this topic a lot. Smaller customers are particularly anxious about trying technologies that might fail. It was suggested that the program might install samples at smaller locations to demonstrate the value of the equipment. This is consistent with good marketing practice.
- For national retail chains:
  - The prototype is the key determinant of what can be installed.
  - A third party, such as the rebate administration firm, can have some influence (usually somewhat small) by pointing to opportunities for potential improvements in prototypes across a wide program base although the recommendation is vetted by the national chain.
  - A financial incentive is unlikely to change the specifications for a given store although a financial incentive broadly offered by many utilities may result in an upgrade to a prototype.
  - Chains are increasingly installing and using advanced monitoring capabilities
  - Chains are often unable to take advantage of incentives for EMS systems because third party suppliers provide general rather than specific information about savings.
  - There is substantial opportunity still to be realized with retail chains especially in the lighting arena.

  Energy Trust needs to work with others to engage chains at the national level. Such national engagement of chains needs to focus on both engineering and merchandising.
- Training and webinars were positively received. The manuals were largely unused.

There were some dramatic examples of market transformation, mostly replication effects. Energy Trust may want to examine these effects in future studies. These studies should focus on replications, emulation, incidental efficiency, sustained behavior, and cultural change rather than spillover, of which the preceding are a subset.

STAFF RESPONSE MEMO

EnergyTrust of Oregon

Date: August 31, 2009
To: Board of Directors
From: Spencer Moersfelder, Business Sector Manager
Philipp Degens, Evaluation Manager
Subject: Staff Response for the 2006-2007 New Buildings Program Process and Impact Evaluation

The evaluation has shown that the New Buildings (NB) program continues to deliver predicted energy savings. Gas and electric realization rates are above 100% in 2006. In 2007 the realization rate for gas savings exceeded 100% while the realization rate for electric savings was 92.3%. The study indicated that the reduction in the electric realization rate might be due to lighting measures, which have become a larger component of program activity over time, and whose realization rates have shown a downward trend. Energy Trust is currently engaged in market research on the commercial and industrial lighting market which may shed light on whether these low realization rates are just a fluctuation or a permanent trend.

Many changes are anticipated in the commercial new construction and C&I lighting markets in the near future:

- Oregon commercial new construction code will be revised in 2010
- National energy standards will require fluorescent T8 HOs to be the minimum standard in 2012
- National energy code changes will begin the phasing out of incandescent lamps in 2012

Energy Trust plans on monitoring how these upcoming changes impact program offerings and requirements, allowing program managers to make appropriate, timely changes to the program. For example, there are presently many projects enrolled in the LEED Track. The program has been accepting the USGBC-approved energy savings established in pursuit of the LEED at face value and the realization rate for these savings in the Energy Trust program is yet to be determined.

Estimated free rider rates, though high, have remained stable over the four years 2004-2007, a period where the size of the construction market has fluctuated widely. In addition, the number of projects participating in the program has risen dramatically and the estimated program share of the total market has been high.

The evaluation noted that the program appeared to have some significant market transformation effects. Energy Trust recognizes that there is spillover from program activities but we have not expended resources to establish the spillover rates. The big savings from spillover will manifest in the code change that is pending in 2010. Anticipated code changes are expected to require average efficiency increases of 15-20% over the current commercial code. The increase in the commercial code is unprecedented and it is going to be a situation where policy is driving code as opposed to code being the codification of common market practice. It

will be interesting to see in future evaluations how this new dynamic will influence baseline and program realization rates for projects that are affected by the new code standard beginning around April of 2010.

The 2009 Commercial Building Stock Assessment will have updated gas and electricity consumption for 2007. With this data available, it will be possible to compare the performance of program buildings with current practice.

Program participants indicated a high overall satisfaction level with the program. Given the change in the program PMC in 2009, this will be one area to monitor in the future. The lower level of satisfaction associated with paperwork is expected, and has been identified as a recurring theme in all evaluations. Energy Trust is very aware that paperwork simplification is desired by all program participants, and has been working on improving this process. New Buildings program has taken significant steps to streamline the program to enhance the customer experience. Recent enhancements including:

1) Establishing market and account assignments to build relationships in the form of one contact that will result in more savings per project.
2) Specializing positions in the program team including having operations team members focus on project reviews while outreach team members are focused on outreach and customer relations. The purpose is to focus program staff members' talents and preferences in areas where they excel and this extends into more focused outreach which will enhance the customer experience.
3) Redesigning program forms in an effort to make them more consistent and easier to use.
4) Eliminating duplicative cut-sheet submittals.
5) Developing standardized technical guidelines, template reports and savings spreadsheet for the technical community that the program addresses.
6) Reinforcing cross-program coordination with Existing Buildings program to leverage contacts across programs to improve program handoffs and streamline communications on overarching Energy Trust messaging.

Furthermore, on an organizational level, Energy Trust has been migrating all of its forms to an electronic format and allows for scanned signatures. For high volume programs in the residential sector Energy Trust has created on-line forms. Eventually Energy Trust expects that this technology will also be available to the commercial market.

1. INTRODUCTION

Under contract with the Energy Trust of Oregon (Energy Trust), ADM Associates, Inc. (ADM) has conducted an impact and process evaluation of the New Building Efficiency (NBE) Program that Energy Trust fielded in 2006 and 2007. Innovologie LLC and Nexus Market Research (NMR) were sub-contractors to ADM, performing the process evaluation and market analysis.

This report presents and discusses the results of the impact and process evaluation of the 2006 and 2007 NBE Program.

1.1 DESCRIPTION OF NBE PROGRAM

The New Building Efficiency program offers technical design assistance and financial incentives for the building of new, energy-efficient commercial facilities. The assistance and incentives are offered through four different program tracks.

- The Standard Track provides prescriptive incentives for equipment upgrades and components of lighting and controls, motors, drives, HVAC and gas equipment. The Standard Track, which requires no energy calculations, offers incentives up to $50,000 per project.
- The Custom Track is for a project in the concept, schematic or early design stages and allows the program to influence equipment choices and building design using an integrated, whole building design approach. Energy calculations or energy models showing savings above code or standard practice are required. The Custom Track offers incentives up to $200,000 per project.
- The LEED-NC Track is for projects participating in the US Green Building Council's Leadership in Energy and Environmental Design rating system for commercial new construction projects.
- The ENERGY STAR track was established to target buildings occupied after January 2005 that did not participate in the program during construction in order to encourage building "tune-ups." Up to $30,000 is available for buildings that become certified as an ENERGY STAR building.
- The Standard Track may be combined with the Custom Track making available up to $250,000 per project. For all tracks, program approval must be received before the project design is finalized or before equipment is purchased.

There were 156 sites with 156 projects that participated in the NBE Program during 2006, and 135 sites with 135 projects that participated in 2007. Table 1-1 shows the kWh and therm savings expected from these projects (as well as for projects from 2004 and 2005).

Table 1-1. Expected kWh and Therm Savings for New Building Efficiency Projects: 2004-2007

Program Year	*Number of Sites*	*Number of Projects*	*Expected kWh Savings*	*Expected Therm Savings*
2004	18	18	3,007,619	25,573
2005	85	87	8,719,145	124,854
2006	156	156	18,922,788	515,648
2007	135	135	22,633,360	699,525
Totals	394	396	53,282,912	1,362,953

1.2 EVALUATION OBJECTIVES

The goals for the impact evaluation included the following:

- Developing reliable estimates of gross and net program savings for the 2006 and 2007 NBE Program;
- Making observations and developing recommendations to help the Energy Trust improve the implementation of the NBE Program; and
- Reviewing and making recommendations on Energy Trust and NBE Program energy savings estimation methods.

The following types of estimates were to be determined for gross and net program savings:

- Estimates of:
  - Total program savings and savings by end-use or measure class (e.g. lighting, HVAC, etc.).
  - Realization rates by measure and program
  - Free ridership for each major measure category
  - Participant spillover, i.e. whether participants implemented further measures as a result of participation in the program.
  - Market spillover, i.e. whether nonparticipants implemented measures as a result the program through changes in the market.
- Gross kWh and therm savings at the program, building and major end-use (HVAC and lighting) levels
- Net kWh and therm savings at the program, building and major end-use (HVAC and lighting) levels

1.3 OVERVIEW OF EVALUATION APPROACH

The approach used for evaluating the NBE Program had the following features.

"Baseline" conditions for calculating savings were defined primarily with respect to the Oregon building energy code requirements, 2003 version. A second set of baseline conditions was defined with regard to what customers would have done in the absence of the program. Information was obtained in several ways. This included:

- Questioning customers directly,
- Interviewing appropriate NBE program representatives, and
- Reviewing design assistance documentation for each site.

As part of this procedure, other non-rebated, non-recommended energy efficiency measures that customers installed and that could be attributed to the influence of the program were identified.

Evaluation of the 2006 and 2007 NBE program was based on data collected for samples of sites drawn from the population of participant sites in the program. To accomplish the sampling, an approach was used whereby a number of sites with large kWh savings were selected for the sample with certainty, and a random sample was taken of the remaining sites.

- Certainty sites were selected to represent sites with the largest energy savings. Certainty sites do not have backup sites.
- Non-certainty sites (i.e., those sites selected with probability) were selected for the sample through systematic random sampling. That is, after the certainty sites have been selected, a random sample of sites remaining is selected by ordering the non-certainty sites according to the magnitude of their kWh savings and using systematic random sampling. Sampling systematically from a list that is ordered according to the magnitude of savings ensures that any sample selected will have some units with high savings, some with moderate savings, and some with low savings. Samples cannot result that have concentrations of sites with atypically high savings or atypically low savings.

On-site visits were made in order to collect data on building and equipment characteristics for the samples of program participants. On-site visits to collect data on building and equipment characteristics for program participants with subsequent engineering analyses were accomplished for 63 sample sites for the 2006 program and for 60 sample sites for the 2007 program.

- For some sample sites "high resolution" data were collected to allow simulation of energy use with the DOE-2 building energy analysis computer model. The data collection was also used to identify any non-recommended, non-rebated efficiency measures that participants installed that may be attributable to the effects of the NBE Program.
- Monitoring was conducted at a sample of 18 of the 65 NBE 2006 sample sites to verify hours of operation for HVAC and lighting.

Gross savings from HVAC measures were assessed through proven energy analysis procedures, which are based on using DOE-2 simulations of HVAC energy use calibrated against monthly billing data.

Interviews were conducted with decision makers for sites in the 2006 and 2007 NBE Program to gather information on their decision making and on the factors determining the net-to-gross savings ratios for the program. Net savings (i.e., net-to-gross ratios) for the program were assessed by applying survey-based techniques to the data collected through the telephone survey to estimate free-ridership.

1.4 ORGANIZATION OF REPORT

This report on the impact and process evaluation of the New Building Efficiency Program for 2006 and 2007 is organized as follows.

- Chapter 2 presents and discusses the methods used for and the results obtained from estimating gross savings for measures installed under the New Building Efficiency Program. Gross savings estimates are presented for different categories of energy efficiency improvement projects (e.g., lighting, HVAC, motors, etc.). For each category of projects, there is a discussion of the methodology used to determine savings for that category.
- Chapter 3 presents and discusses the methods used for and results obtained from estimating net savings for the New Building Efficiency Program.
- Chapter 4 presents and discusses the results from a survey of decision making for facilities that participated in the New Building Efficiency Program in 2006 and 2007.
- Chapter 5 presents the results of the process evaluation of the NBE Program.
- Chapter 6 provides a discussion of the commercial building market in Oregon from 2004 through 2007 and characterizes NBE Program participation in that market.
- Chapter 7 presents findings and recommendations.
- Appendix A provides a discussion of realization rates for individual projects.
- Appendix B provides a copy of the data collection form used during on-site visits.
- Appendix C provides a copy of the questionnaire used for the survey of decision-making and net-to-gross.

2. ESTIMATION OF GROSS SAVINGS

This chapter addresses the estimation of gross kWh and therm savings and kW reductions for facilities that participated in the New Building Efficiency Program in 2006 and 2007. Section 2.1 describes the methodology used for verifying gross savings. Section 2.2 presents the results from estimating gross savings for the sites that participated in the NBE Program in 2006 and 2007. Section 2.3 uses the realization rates presented and discussed in Section 2.2 to estimate program-level savings.

2.1 METHODOLOGY USED TO ESTIMATE GROSS SAVINGS

Table 2-1 provides summary statistics showing the numbers and expected kWh and therm savings by building type for sites that participated in the NBE Program in 2006 and 2007.

Table 2-1. Numbers and Expected kWh and Therm Savings by Building Type for Sites Participating in NBE Program in 2006 and 2007

Building Type	***Number of Sites***	***Expected Savings***	
		kWh	***Therms***
	2006		
Grocery	18	2,656,470	42,730
Hospital	5	4,249,062	229,220
Hotel	2	742,874	0
Manufacturing	21	735,770	4,224
Multifamily	5	550,992	58,549
Office	13	505,955	4,558
Other	39	6,108,368	119,868
Retail	32	1,768,043	779
Restaurant	2	7,009	1,472
School	6	363,846	3,471
Warehouse	13	1,234,399	50,777
Totals: 2006	156	18,922,788	515,648
	2007		
Hospital	10	8,343,422	288,118
Hotel	2	314,729	12,179
Manufacturing	9	1,637,716	0
Multifamily	3	917,063	52,655
Office	17	2,582,098	79,354
Other	22	4,049,794	67,383
Restaurant	6	3,893	0
Retail	33	1,982,168	5,697
Schools K-12	10	1,090,347	105,214
Warehouse	23	1,712,130	88,925
Totals: 2007	135	22,633,360	699,525

2.1.1 Data Collection

Data for the estimation and evaluation of gross savings for the NBE Program in 2006 and 2007 were collected through on-site visits to samples of sites that participated in the program in each year. The type of data collection depended on the types of energy efficiency measures installed at the sites:

- For sites where only lighting measures were installed, data were collected with which to verify the numbers and wattages of the lighting equipment.
- For sites where HVAC measures had been installed, "high resolution" data collection was conducted to collect data on building and equipment characteristics that allowed simulation of building energy use with DOE-2.

The data collection was also used to identify any non-recommended, non-rebated efficiency measures that participants installed that may be attributable to the effects of the NBE program.

- *Standardized data collection form:* Field personnel used this form to ensure that the required data were collected at each site. A copy of this form is provided in Appendix B. The form is comprehensive in addressing a facility's characteristics, its modes and schedules of operation, and its electrical and mechanical systems. The form also addresses various energy efficiency measures, including high efficiency lighting (both lamps and ballasts), lighting occupancy sensors, lighting dimmers and controls, air conditioning, high efficiency motors, and refrigeration. As part of the data collection effort, program measures were verified and data collected pertaining to the operation of the measures.
- *Monitoring* was conducted at selected sites to verify hours of operation for lighting and HVAC equipment. Lighting loggers were installed at sites to collect data pertaining to hours of operation for lighting equipment. Monitoring was also used to collect data on the operation of HVAC fans, ASDs, and other equipment for which self-reported information on hours of operation may not be accurate.

2.1.2 Building Simulations

Building Simulation Modeling was used to estimate gross savings for selected sites, using the data collected on-site. Estimates of energy savings for participant buildings were prepared for various energy conservation measures, both rebated and recommended. Measures analyzed include those for lighting, for HVAC (including ASDs and high efficiency motors for fans, pumps and blowers on HVAC systems, high efficiency chillers and shell measures), and for other end uses.

Before beginning the simulation analysis, the program documentation for each participant site was reviewed to assess the degree to which the savings calculations are supported and defensible and documentation was adequate. Computer inputs were checked to make sure that the buildings and their systems were properly modeled. The base case run was checked against code requirements and the proposed case runs were compared to the base case to identify any improper inconsistencies between them (such as altered schedules or building configurations).

Following the review of project documentation, energy simulation analyses were prepared for the participant sites. This analysis was accomplished using ADM's *CPA 123,* a software program that automates the analysis of energy use and energy efficiency opportunities in buildings. The analytical engine for *CPA 123* is DOE 2.1E.

In developing the calibrated buildings simulation models, the focus was on the main factors that determine energy use. The accuracy of a savings estimate developed through engineering calculations depends on the extent to which the analysis is based on correct assumptions regarding such factors as usage patterns and operating hours. Normally, the weakest part of any engineering calculation of savings relates to the characterization of the operational schedules of energy using equipment for the building being analyzed. The review of energy savings calculations in the project documentation was used to determine whether the assumptions for usage patterns were within the range of reasonable hours for each end-use application. For sites where monitoring was conducted, the data on operating hours derived through the monitoring was used to develop estimates of savings for lighting efficiency measures and for any non-HVAC ASDs and motors.

Lighting measures examined in this evaluation study included energy efficient fixtures, lamps and/or ballasts. Analyzing the savings from such lighting measures required data for (1) fixture wattage and (2) hours of operation. Information on per-fixture baseline demand, existing demand, and appropriate operating hours was used to calculate peak capacity savings and annual energy savings for sampled fixtures of each usage type.

Savings estimates were derived through a series of building simulation runs. The various simulation runs are identified in Table 2-2. Each simulation produced estimates of energy and demand usage to be expected under different assumptions about equipment and/or construction conditions.

Table 2-2. Parametric Runs for Energy Savings Simulations and Analysis

Run	Name	Rebated Measures	All Other Measures	Operating Schedule	Occupancy Level	Weather Data
Billing Reconciliation						
1.	Model Calibration	As Built	As Built	Actual	Current	Actual
Estimates of Energy Use (for calculating savings)						
2.	As Built	As Built	As Built	Actual	100%	TMY
3.	Expected Measure	Application	As Built	Actual	100%	TMY
4.	Measure Base	Per Code	As Built	Actual	100%	TMY
5.	Whole Building Base	Per Code	Per Code	Actual	100%	TMY

2.1.2.1 Model Calibration Run

The Model Calibration Run was a base case simulation to ensure that the energy use estimates from the simulations had been reconciled against actual data on the building's energy use. This run was based on the information collected in the on-site visit pertaining to types of equipment,

their efficiencies and capacities, and their operating profiles. Current occupancy levels were used for this simulation, as were local weather data from Oregon weather stations covering the study period. (Current occupancy levels might represent less than full occupancy, since some time may be required for a new commercial building to achieve full occupancy.)

2.1.2.2 Baseline Efficiency Runs

Simulation runs were made to determine the energy use for a building under specified baseline conditions. There were two sets of baseline conditions considered.

The primary baseline for the simulation analyses was established by the requirements of the version of Oregon's building energy efficiency codes in effect at the time of construction. Commercial buildings in Oregon are built to satisfy Oregon's building code through a Prescriptive approach, a Simplified Trade-off approach, or a Whole Building approach.

- The Prescriptive Approach, which is the simplest and least time-consuming of the three approaches, requires that an applicant fill out compliance forms to show that each individual building component or system complies with the standards as described by Oregon non-residential Energy Code. For most buildings, it is easier to complete the compliance forms manually. However, many applicants use the state's computer compliance tool. The software allows the user to use the simplified tradeoff approach.
- The Simplified Tradeoff Approach (STA) is an alternative method to show compliance of the building envelope. The STA may allow the applicant to tradeoff between component efficiencies. For example, increased roof insulation may compensate for windows less efficient than perspective levels. The STA is fairly time consuming and requires the use of CodeComp software. The current version of this software CodeComp5.0 must be used for all projects taking advantage of the Simplified Trade-Off Approach for compliance with the building envelope provisions of the Oregon Energy Code.
- The Whole Building Approach allows the applicant to trade off between envelope, mechanical and lighting equipment efficiencies. However, this approach gives the applicant more flexibility in terms of trade off among various building components and equipment efficiencies. The Whole Building Approach is rarely used because it is time-consuming and complex. It requires the applicant to model interaction of all of the proposed building elements using the DOE 2.1E building simulation software.

A secondary baseline for the simulation analyses was established by determining what would have been installed in the building in the absence of the NBE program. This baseline was based on information gathered regarding customers' intentions absent the program. This information was obtained (1) through direct questioning of the customers, (2) through interviews with NBE representatives, and (3) through detailed review of any design assistance documentation.

The baseline efficiencies were applied twice in the parametric simulation analyses: once to the rebated measures and then to all of the remaining energy-use measures in the building. For the

As-Built Efficiency Run, full occupancy is assumed and average weather data are used. This run provides information with which to gauge the long-term savings impacts.

For the Expected Measure Efficiency Run, it is assumed that the efficiencies of the measures that were recommended and for which a customer received rebates are those designated in the program application. Additionally, measures that were recommended but not rebated will also be considered in the Expected Measure Run. The efficiencies may or may not be the same as the efficiencies observed for the equipment in the field. These runs calculate the energy use of a building as it would occur if all the expected measures were installed. The difference between this energy use and the actual energy use reflects any mismatches between the expected efficiency and the actual.

The results of the various simulations are used to develop estimates of energy savings for the individual sites, following the taxonomy defined in Table 2-3 and depicted graphically in Figure 2-1.

Table 2-3. Definitions of Savings Calculations

	Savings to be Calculated	How Calculated
A	Total Achieved Savings	Difference between results of Run 2 and Run 5
B	Non-rebated Measure Savings	Difference between results of Run 4 and Run 5
C	Rebated Measure Savings	Difference between results of Run 2 and Run 4
D	Expected Measure Savings	Difference between results of Run 3 and Run 4

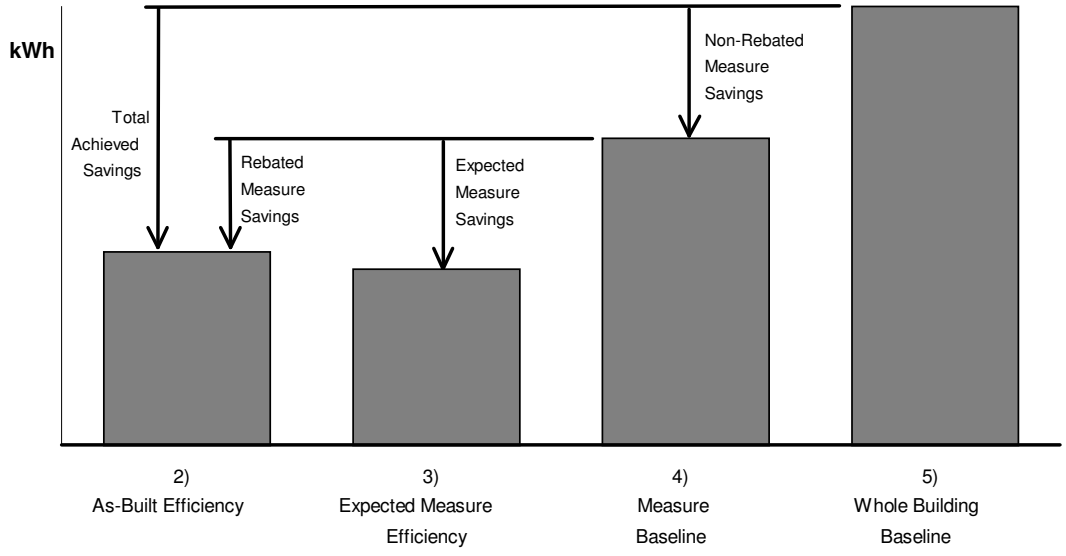

Figure 2-1. Illustration of Calculating Savings from Energy Use Comparison

2.2 RESULTS OF ESTIMATING GROSS SAVINGS

For each set of gross savings estimates for a site, measure savings were calculated as the difference between energy use for a building built only to baseline conditions as defined by building code requirements and the building as-built, including the energy efficiency measure.

2.2.1 Realized Gross Savings for 2006

Estimates of realized gross kWh and therm savings for 2006 are presented in this section.

2.2.1.1 Realized Gross kWh Savings for 2006

Realized gross kWh savings and realization rates for the sample sites for program year 2006 are reported in Table 2-4 by major end uses. Table 2-5 shows the estimated program-level achieved gross kWh savings for the 2006 program.

Table 2-4. Estimated Realization Rates for Gross kWh Savings by End Use for NBE Program in 2006 (Savings in kWh/year)

Type of Energy Efficiency Improvement	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rates*
Custom Controls	1,015,557	1,061,870	104.6%
HVAC	951,543	1,315,475	138.2%
Lighting	4,607,842	4,347,514	94,4%
Motors and Drives	20,283	11,404	56.2%
Other	3,931,573	3,681,688	93.6%
Total	10,526,798	10,417,951	

Table 2-5. Estimated Program-Level Achieved Gross kWh Savings for New Building Efficiency Projects in 2006

Type of Energy Efficiency Improvement	*Expected kWh Savings*	*Realization Rates*	*Achieved Gross Program-Level kWh Savings*
Custom Controls	1,414,363	104.6%	1,478,863
HVAC	3,298,453	138.2%	4,559,997
Lighting	8,055,855	94.4%	7,600,725
Motors and Drives	306,739	56.2%	172,462
Other	5,847,378	93.6%	5,475,727
	18,922,788		19,287,774

2.2.1.2 Realized Gross Therm Savings for 2006

Realized gross therm savings and realization rates for the sample sites for program year 2006 are reported in Table 2-6 by major end uses. Table 2-7 shows the estimated program-level achieved gross therm savings for the 2006 program. Note that the negative therm savings for lighting shown in Table 2-7 are reflect the interaction effect between lighting and space heating.

Table 2-6. Estimated Realization Rates for Gross Therm Savings by End Use for NBE Program in 2006 (Savings in Therms per Year)

End Use	*Expected Therm Savings*	*Realized Therm Savings*	*Realization Rate*
HVAC	40,293	47,746	118.5%
Other gas	191,547	185,217	96.7%
Lighting	13,546	6,287	46.4%
Totals	245,386	239,250	97.5%

Table 2-7. Estimated Program-Level Achieved Gross Therm Savings for New Building Efficiency Projects in 2006 (Savings in Therms per Year)

Type of Energy Efficiency Improvement	*Expected Therm Savings*	*Realization Rates*	*Achieved Gross Program-Level Therm Savings*
HVAC	132,752	118.5%	157,307
HVAC Controls	35,099	118.5%	41,591
Other gas	361,653	96.7%	349,702
Lighting	-13,856	46.4%	-6,431
Totals	515,648		542,169

2.2.2 Realized Gross Savings for 2007

Estimates of realized gross kWh and therm savings for 2007 are presented in this section.

2.2.2.1 Realized Gross kWh Savings for 2007

Realized gross kWh savings and realization rates for the sample sites for program year 2007 are reported in Table 2-8 by major end uses. Table 2-9 shows the estimated program-level achieved gross kWh savings for the 2007 program.

Table 2-8. Estimated Realization Rates for Gross kWh Savings by End Use for Sample Sites from NBE Program in 2007 (Savings in kWh/year)

Type of Energy Efficiency Improvement	*Expected kWh Savings*	*Verified kWh Savings*	*Realization Rates*
Custom Measures	5,639,197	4,892,896	86.8%
HVAC	5,543,140	5,145,829	92.8%
LEED	569,096	673,536	118.4%
Lighting	8,245,821	7,678,061	93.1%
Motors and Drives	264,564	260,705	98.5%
Other	413,467	272,141	65.8%
Total	20,675,285	18,923,168	

Table 2-9. Estimated Program-Level Achieved Gross kWh Savings for New Building Efficiency Projects in 2007 (Savings in kWh per Year)

Type of Energy Efficiency Improvement	***Expected kWh Savings***	***Realization Rates***	***Achieved Gross Program-Level kWh Savings***
Custom Measures	5,639,197	86.8%	4,892,896
HVAC	5,683,654	92.7%	5,268,419
LEED	724,946	118.4%	857,987
Lighting	10,058,940	93.1%	9,366,339
Motors and Drives	269,006	98.5%	265,082
Other	257,617	92.7%	238,796
	22,633,360	92.3%	20,889,521

2.2.2.2 Realized Gross Therm Savings for 2007

Table 2-10 reports the realized gross therm savings and realization rates by major end uses for the sample sites from the 2007 Program. Table 2-11 shows the estimated program-level gross therm savings.

Table 2-10. Estimated Realization Rates for Gross Therm Savings by End Use for NBE Program in 2007 (Savings in Therms per Year)

End Use	***Expected Therm Savings***	***Realized Therm Savings***	***Realization Rate***
Custom Measures	501,030	500,002	99.8%
HVAC	94,954	149,758	157.7%
LEED	15,536	18,791	121.0%
Other	34,063	21,254	62.4%
Totals	645,583	689,805	

Table 2-11. Estimated Program-Level Achieved Gross Therm Savings for New Building Efficiency Projects in 2007 (Savings in Therms per Year)

Type of Energy Efficiency Improvement	***Expected Therm Savings***	***Realization Rates***	***Achieved Gross Program-Level Therm Savings***
Custom Measures	455,812	99.8%	454,877
HVAC	165,670	144.2%	238,835
LEED	32,925	121.0%	39,823
Other	45,118	100.0%	45,118
Totals	699,525	111.3%	778,653

2.3 TRENDS IN REALIZATION RATES

Table 2-12 shows the trends in realization rates for overall and lighting kWh savings over the four program years 2004-2007. There is a downward trend in the realization rates, both overall and for lighting. The decline in the realization rates for lighting is a significant factor in the decline of the overall realization in that expected kWh savings from lighting became an increasingly larger percentage of overall expected kWh savings. Expected kWh savings from lighting were about 35% of total expected kWh savings in 2004, about 30% in 2005, about 43% in 2006, and about 44% in 2007.

Table 2-12. Realization Rates for Overall and Lighting kWh Savings

Year	***Realization Rates***	
	Overall kWh Savings	***Lighting kWh Savings***
2004	108.4%	127.6%
2005	103.6%	102.9%
2006	101.9%	94.4%
2007	92.3%	93.1%

In looking at site-specific realization rates for lighting, a number of apparent large differences between the calculated and the tracking system reported savings were observed, especially for CFLs. It appears that the Energy Trust incentives are deemed at fixed amounts per type of unit and that the tracking system savings are not based on lighting operating hours, as-built parameters, the density of lighting installed, as is reflected in the code requirements.

For example, apparently a fixed tracking system savings level is assigned for any CFL that has a wattage between 9 to 26. However, if one CFL is used more than another, it can save more energy. For example, industrial space typically has more operating hours than schools, banks and offices.

Also, for replacements or upgrades, the savings calculation would compare replacing a 75-watt incandescent with 18-watt CFL as an equivalent replacement. However, in assessing actual energy savings for new construction several factors induce variation:

- LPD requirements within the Oregon energy code are used to set the baseline, and all the fixtures within the improved area/ added area / new construction area are to be included in the calculation regardless of rebated or not.
- Actual monitored or surveyed operating hours at the facility might vary from the operating hour values used to establish the tracking system savings,
- The lighting power installed may vary relative to the Code baseline LPD.

The above factors can cause substantial site-to-site differences between tracking system savings estimates and realized savings estimates.

2.4 COMPARISON OF EUIs

For NBE facilities that were analyzed through building simulations, whole-building energy use intensities (e.g., kWh per square foot) could be derived. For this evaluation, there were 65 buildings that were analyzed using whole-building simulations (i.e., 29 from the 2006 program and 36 from the 2007 program). In addition, similar data were available for 36 sites that were analyzed previously in the evaluation of the 2004-2005 program. The additional information on EUIs for these 101 sites is used in this section for two sets of comparisons:

- As-built EUIs to Code EUIs
- As-built EUIs to standard practice EUIs

2.4.1 As-Built versus Code

Table 2-12 provides data comparing as-built EUIs to code EUIs for different types of buildings. The as-built EUIs pertain to a building as it was built under the NBE program, while the code EUI pertains to the building as if it were built to code specifications. The energy use values are derived through the parametric runs outlined in Table 2-2, with Run 5 providing estimated electricity use under the code baseline and Run 2 providing estimated electricity use for the building as-built. Percentage savings are calculated as the difference between code and as-built EUIs, divided by the code EUI.

Table 2-13. Comparison of As-Built EUIs to Code EUIs for Different Types of Buildings

Building Type	*Number of Buildings*	*Code EUI*	*As-Built EUI*	*Percentage Savings*
Auto Service	1	15.65	15.65	0.0%
College	1	27.36	21.68	20.8%
Community Center	1	14.99	7.15	52.3%
Detention Facility	1	28.84	24.97	13.4%
Education/Lab	1	54.21	38.83	28.4%
Food Store	10	47.51	43.61	8.2%
Hospital / Clinic	9	29.52	24.12	18.3%
Hotel	4	23.21	19.07	17.8%
Library	1	17.51	16.77	4.2%
Multifamily	7	11.33	9.45	16.7%
Office	13	23.14	17.98	22.3%
Restaurant	2	47.98	46.88	2.3%
Retail	27	24.34	20.82	14.4%
School	11	12.80	10.89	14.9%
Special	4	4.95	3.24	34.6%
Warehouse	2	8.10	7.53	7.0%
Other	6	89.11	72.97	18.1%
All Buildings	101	22.67	19.01	16.1%

Table 2-12 shows that for this sample of buildings that savings from as-built NBE buildings *vis-à-vis* code were 16.1%.

2.4.2 As-Built versus Standard Practice

A second comparison can be made between as-built EUIs (as reported in Table 2-12) and standard practice EUIs (as shown in Table 2-13)[1]. The building type information for this evaluation study does not match against the building types defined for the baseline study. However, for building types where some commonality could be expected, the EUIs for NBE buildings are lower than the standard practice EUIs reported in Table 2-13. Building types where the NBE as-built EUI is lower than the standard practice EUI include food stores, retail, and hospitals. For schools, however, the NBE as-built EUI is higher than the standard practice EUI. As pointed out in the Baseline Study, however, there is considerable variation of EUIs even across buildings of a given type.

Table 2-14. Electric EUIs from NEEA Baseline Study (kWh per square foot)

Baseline Study Building Type	***Baseline Study EUI 2002-2004***	***NBE As Built EUI 2004-2007***
Assembly	13.3	7.15
College	12.7	21.68
Education (Schools)	9.6	10.89
Grocery	46.6	43.61
Health Services	14.3	
Hospital	25.3	24.12
Institution	15.4	
Office	17.8	17.98
Other	18.3	
Residential/Lodging	10.6	9.45
Restaurant/Bar	86.2	46.88
Retail	21.6	20.82
Warehouse	15.1	7.53

[1] The standard practice EUIs are taken from Ecotope, Inc., *Baseline Energy Use Index of the 2002-2004 Nonresidential Sector: Idaho, Montana, Oregon, And Washington*, Draft Report, October 2008, Prepared for Northwest Energy Efficiency Alliance, p. 15.

3. ESTIMATION OF NET SAVINGS

This chapter reports the results from estimating the net impacts of the NBE Program during 2006 and 2007, where net savings represent that part of gross savings achieved by program participants that can be attributed to the effects of the program.

3.1 PROCEDURES USED TO ESTIMATE NET SAVINGS

The procedures used to estimate net savings addressed (1) free ridership and (2) spillover are discussed in this section.

3.1.1 Procedures Used to Estimate Free Ridership

A basic issue in net savings analysis is determining what part of gross savings achieved by program participants can be attributed to the effects of the program. That is, to what extent were the savings achieved by program participants induced by the program? The savings induced by the program are the "net" savings that are attributable to the program.

Net savings may be less than gross savings because of free-ridership impacts, which arise to the extent that participants in a program would have adopted energy-efficiency measures and achieved the observed energy changes even in the absence of the program. Free riders for a program are defined as those participants that would have installed the same energy efficiency measures without the program.

The goal of the net-to-gross analysis was to estimate the impacts of energy efficiency measures attributable to the New Building Efficiency Program that were net of free ridership. That is, because the energy savings realized by free riders are not induced by the program, these savings should not be included in the estimates of the program's actual impacts. Without adjustment for free-ridership, some savings that would have occurred naturally would be attributed to the program. The measurement of the net impact of the program requires estimation of the marginal effect of the program over and above the "naturally occurring" patterns for installation and use of energy-efficient equipment.

Various techniques have been used to estimate free ridership rates, ranging from simple self report methods to elaborate econometric decision models (including in some cases the use of comparison groups to adjust for, but not directly estimate free ridership). Because of the relatively smaller number of participants in commercial and industrial energy efficiency programs than in residential programs, self report methods have been used most commonly for estimating free ridership for commercial and industrial programs. With the self report methods, information collected through the surveying of a sample of program participants is used for the free ridership analysis.

The manner in which self report methods are used to estimate free ridership have evolved over time. Initially, self report methods often estimated free ridership using no more than a simple yes

/no question such as "Would you have done it without the program?". However, self report methods have now evolved to where a battery of questions is used to collect information with which to model the nuances of the decision making process and extract the influence of the program. Multiple questions with a range of answers for each question require methods for weighting and scoring, as well as an algorithm to arrive at a final estimate of free ridership.

Energy Trust has over time used different self report methods to estimate free ridership for its commercial and industrial energy efficiency programs. These methods have been shown to have a various weaknesses and biases. However, suggested approaches developed in other parts of the country to address these shortcomings have tended to increase data collection requirements.

To address both shortcomings and increased data requirements, Energy Trust staff have developed a method for calculating free ridership that is to be applied to evaluation of Energy Trust commercial and industrial programs. One goal in developing this method was the ability to apply it to all programs and their markets. A second goal was the ability to obtain the self-reported results through a reduced set of survey questions that can be incorporated in a short program feedback survey administered online or on paper at the time of participation.

With the Energy Trust's recommended method for estimating free ridership, three main criteria are used for determining what portion of a customer's savings for a particular project should be attributed to free-ridership. These criteria include the following:

- Influence of program on customer's decision making;
- Customer's stated intentions as to actions that would have been taken in absence of the program; and
- Customer's financial ability to undertake a project without financial incentives from program.

The first criteria used in assessing free ridership is the influence of the program. For this evaluation of the New Building Efficiency program, information with which to gauge the influence of the program was collected by asking decision makers the following question:

> *"How influential was the New Building Efficiency program incentive in planning the design and installation of energy efficiency equipment/measures for this project?"*

Free ridership scores were assigned according to the responses to this question. Participants rated influence on a scale from "critical influence" to "no influence". Two of the response options ("little influence", "no influence) were given the same free rider score of 1. Thus, there were four scores for free ridership, distributed across a range from 0 to 1.

In practice, it is not always absolutely clear if the program has had an influence on the participant's action/decision. Accordingly, in the set of rules and algorithms that Energy Trust evaluation staff developed for the free ridership assessment, equal odds are given to the outcome that the program had an influence and the outcome that the program did not have an influence.

That is, the probability of the program having influence is 50% and the probability of it NOT having an influence is 50%. The participant has a 50% chance of being a free rider. Applying this probability to the free ridership scores gives the assigned rates for free ridership associated with program influence that are shown in Table 3-1.

Table 3-1. Free Ridership Rates Assigned for Responses on Program Influence

Response to Program Influence Question	***FR Score***	***Probability Associated with Program Influence***	***FR Rate Associated with Program Influence***
Installation planned before we considered incentive	1.00	50%	0.500
Incentive had *no influence*	1.00	50%	0.500
Incentive had a *little influence*	0.75	50%	0.375
Incentive had a *moderate influence*	0.50	50%	0.250
Incentive had a *significant influence*	0.25	50%	0.125
Installation would not have happened without the incentive *(critical influence)*	0.00	50%	0.000

The second major criteria used in assessing free ridership pertains to customers' stated intentions as to actions that they would have taken in absence of the program. Information with which to gauge the stated intentions was collected by asking decision makers the following question:

> *"If the financial incentive for this project that you received through the New Building Efficiency Program had not been available, how would your plans for the equipment/measures for this project have changed?"*

Free ridership scores for stated intentions were assigned according to the responses to this question. The assigned scores are shown in Table 3-2. In the set of rules and algorithms that Energy Trust evaluation staff developed for the free ridership assessment, equal odds are given to whether stated intents show that the program had an influence and the outcome that the program did not have an influence. That is, the probability of the program having influence according to stated intents is 50% and the probability of it NOT having an influence is 50%. The participant has a 50% chance of being a free rider. Applying this probability to the free ridership scores gives the assigned rates for free ridership associated with stated intents that are shown in Table 3-2.

The third criterion used in assessing free ridership takes in to account a customer's financial ability to undertake a project without financial incentives from the New Building Efficiency Program. As part of the survey of decision making, customers were asked the following question.

> *"Would you have been financially able to install the energy efficiency equipment/measure without the financial incentive provided through the New Building Efficiency Program?"*

Table 3-2. Free Ridership Rates Assigned for Responses on Stated Intentions

Response to Stated Intentions Question	***FR Score***	***Probability Program Had NO Influence according to Stated Intent***	***FR Rate Associated with Stated Intent in Absence of Program***
No change. Definitely would have installed same equipment	1.00	50%	0.50
Probably would have installed same equipment	1.00	50%	0.50
Probably would have postponed installing equipment/measures to another year	0.50	50%	0.25
Probably would have installed standard efficiency equipment/measures	0.00	50%	0.00
Probably would have scaled back the scope of the project	0.50	50%	0.25
Probably would have changed the design	0.50	50%	0.25
Probably would have used less expensive equipment	0.50	50%	0.25
Probably would have reduced the energy efficiency of the equipment/measures	0.50	50%	0.25

The information about financial ability that responses to this question provides informs the section of the free ridership calculation pertaining to stated intentions. It is assumed that having budget available is a necessary but not sufficient reason to move forward on the project. Not having the financial ability to undertake a project is consistent with stating that the project would be changed significantly or partially, but it is not consistent with stating that it would not have changed at all. In those cases where customers stated that they either did not have the financial ability to undertake the project or did not know, the free ridership score for stated intents was modified.

- For the case where a customer said they did not have the financial ability to undertake a project, a free ridership score of 0.50 (reflecting partial change in a project) was assigned.
- For the case where a customer said that they did not know if they had the financial ability, a range from 0.50 to 1.00 was assigned for the free ridership score associated with stated intents.

Based on the three criteria just discussed, free ridership rates were assigned to different combinations of customer responses to the associated questions. The assigned free ridership rates are shown in Table 3-3.

Table 3-3. Criteria for Assigning Free Ridership Rates

Program Influence	*FR Rate Program Influence*	*Budget Available*	*Stated Intent*	*FR Rate Stated Intent*	*FR Rate Range*	*Minimum FR Rate*	*Maximum FR Rate*
5	-	Yes	Change	-	0	0	0
4	0.125	Yes	Change	-	12.50%	12.50%	12.50%
3	0.250	Yes	Change	-	25.00%	25.00%	25.00%
2	0.375	Yes	Change		37.50%	37.50%	37.50%
0	0.500	Yes	Change	-	50.00%	50.00%	50.00%
DK	0 to 0.50	Yes	Change	0	0% to 50%	0.0%	50.0%
5	-	Yes	Partial	0.25	25.00%	25.00%	25.0%
4	0.125	Yes	Partial	0.25	37.50%	37.50%	37.5%
3	0.250	Yes	Partial	0.25	50.00%	50.00%	50.0%
2	0.375	Yes	Partial	0.25	62.50%	62.50%	62.5%
0	0.500	Yes	Partial	0.25	75.00%	75.00%	75.0%
DK	0 to 0.50	Yes	Partial	0.25	25% to 75%	25.0%	75.0%
5	-	Yes	nochange	0.50	50.00%	50.0%	50.0%
4	0.125	Yes	nochange	0.50	62.50%	62.5%	62.5%
3	0.250	Yes	nochange	0.50	75.00%	75.0%	75.0%
2	0.375	Yes	nochange	0.50	87.50%	87.5%	87.5%
0	0.500	Yes	nochange	0.50	100.00%	100.0%	100.0%
DK	0 to 0.50	Yes	nochange	0.50	50% to 100%	50.0%	100.0%
5	-	Yes	DK	0 to 0.50	0% to 50%	0.0%	50.0%
4	0.125	Yes	DK	0 to 0.50	12.5% to 67.5%	12.5%	67.5%
3	0.250	Yes	DK	0 to 0.50	25% to 75%	25.0%	75.0%
2	0.375	Yes	DK	0 to 0.50	37.5% to 87.5%	37.5%	87.5%
0	0.500	Yes	DK	0 to 0.50	50% to 100%	50.0%	100.0%
DK	NA	Yes	DK	NA	NA	NA	NA
5	-	No	Partial	0.25	25.00%	25.0%	25.0%
4	0.125	No	Partial	0.25	37.50%	37.5%	37.5%
3	0.250	No	Partial	0.25	50.00%	50.0%	50.0%
2	0.375	No	Partial	0.25	62.50%	62.5%	62.5%
0	0.500	No	Partial	0.25	75.00%	75.0%	75.0%
DK	0 to 0.50	No	Partial	0.25	25% to 75%	25.0%	75.0%
5	-	DK	Partial	0.25 to 0.50	25% to 50%	25.0%	50.0%
4	0.125	DK	Partial	0.25 to 0.50	37.5% to 62.5%	37.5%	62.5%
3	0.250	DK	Partial	0.25 to 0.50	50% to 75%	50.0%	75.0%
2	0.375	DK	Partial	0.25 to 0.50	62.5% to 87.5%	62.5%	87.5%
0	0.500	DK	Partial	0.25 to 0.50	75% to 100%	75.0%	100.0%
DK	0 to 0.50	DK	Partial	0.25 to 0.50	25% to 100%	25.0%	100.0%

3.2 PROCEDURES FOR ESTIMATING SPILLOVER (FREE-DRIVERSHIP)

With respect to spillover or free-drivership, the analysis focuses primarily on additional energy efficiency actions that participants might have undertaken at the same time or after their participation in the program that were caused primarily by the program, but for which they received no additional financial incentive. For example, after their experience with energy efficient lighting for which they received financial incentives through the program, some customers may have installed additional energy efficient lighting (as the need arose) that they

would not have otherwise, but for which they did not seek additional incentives. Given that some program participants installed measures without receiving an incentive, the question associated with free-drivership impacts is the extent to which installation of these measures were induced by participation in the NBE Program.

Participant free-drivership impacts could be associated with those program participants who had *not* previously installed energy efficient measures but who had installed some measures without incentives and indicated that the program had some influence on that decision. Information with which to assess the extent of such participant spillover effects was collected through the telephone survey of program participants. The answers to two were used in analyzing whether there were "free driver" effects associated with non-rebated purchases by program participants. These questions were as follows:

> *"Before you knew about the Energy Trust's energy efficiency incentive programs, had you purchased and installed any energy efficient equipment at this facility?"*
>
> *"Has your experience with the New Building Efficiency Program led you to buy any energy efficient equipment for which you did not apply for a rebate?"*

If a participant answered "no" to the first question, and "yes" to the second question, the participant was considered to show some spillover.

Tabulation of the answers to these two questions from the decision-makers survey for this report allows the defining of a qualitative indication of possible free-drivership.

3.3 RESULTS OF FREE-RIDERSHIP ESTIMATION

The procedures described in Section 3.1.1 were used to estimate free-ridership rates and net- to -gross ratios for the 2006 and 2007 New Building Efficiency Program. The data used to assign free-ridership scores were collected through a telephone survey of decision makers for 52 projects that participated in the NBE Program during 2006 and for 30 projects that participated during 2007.

The free-ridership scoring procedure was applied to kWh savings projects both to all projects together and to projects by end use categories. Separate free ridership rates for kWh savings were estimated for four categories of projects:

- Custom controls / measures;
- Lighting;
- HVAC;
- Other projects.

Free ridership rates for therm savings were estimated for the following categories of projects:

- Custom measures

- HVAC projects; and
- Other projects

3.3.1 Free Ridership Estimates for 2006

The results of applying the free ridership scoring procedure for projects in the different end uses categories are presented in Table 3-4 to kWh savings and in Table 3-5 for therm savings.

Table 3-4. Summary of Estimated kWh Free Ridership Rates and Implied Net- to -Gross Ratios by End Use Category: 2006

Category of Energy Efficiency Improvement Project	***Minimum FR Rate***		***Maximum FR Rate***	
	Estimated Free Ridership Rate	***Implied Net- to -Gross Ratios***	***Estimated Free Ridership Rate***	***Implied Net- to -Gross Ratios***
Custom Controls	6.1%	93.9%	6.1%	93.9%
HVAC	28.0%	72.0%	29.2%	70.8%
Lighting	49.5%	50.5%	52.0%	48.0%
Other	26.9%	73.1%	26.9%	73.1%

Table 3-5. Summary of Estimated Therm Free Ridership Rates and Implied Net-to-Gross Ratios by End Use Category: 2006

Category of Energy Efficiency Improvement Project	***Minimum FR Rate***		***Maximum FR Rate***	
	Estimated Free Ridership Rate	***Implied Net- to -Gross Ratios***	***Estimated Free Ridership Rate***	***Implied Net- to -Gross Ratios***
HVAC	52.6%	47.4%	52.6%	47.4%
Other	24.2%	75.8%	24.2%	75.8%

3.3.2 Free Ridership Estimates for 2007

The results of applying the free ridership scoring procedure for projects in the different end uses categories are presented in Table 3-4 to kWh savings and in Table 3-5 for therm savings.

Table 3-6. Summary of Estimated kWh Free Ridership Rates and Implied Net- to -Gross Ratios by End Use Category: 2007

Category of Energy Efficiency Improvement Project	***Minimum FR Rate***		***Maximum FR Rate***	
	Estimated Free Ridership Rate	***Implied Net- to -Gross Ratios***	***Estimated Free Ridership Rate***	***Implied Net- to -Gross Ratios***
Custom Measures	6.1%	93.9%	8.4%	91.6%
HVAC	35.1%	64.9%	35.1%	64.9%
LEED	48.5%	51.5%	48.5%	51.5%
Lighting	44.0%	56.0%	48.9%	51.1%
Motors and Drives	33.8%	66.2%	33.8%	66.2%
Other				

Table 3-7. Summary of Estimated Therm Free Ridership Rates and Implied Net-to-Gross Ratios by End Use Category: 2007

Category of Energy Efficiency Improvement Project	***Minimum FR Rate***		***Maximum FR Rate***	
	Estimated Free Ridership Rate	***Implied Net- to -Gross Ratios***	***Estimated Free Ridership Rate***	***Implied Net- to -Gross Ratios***
Custom Measures	14.5%	85.5%	16.7%	83.3%
HVAC	63.6%	36.4%	63.6%	36.4%

3.4 SPILLOVER OR FREE-DRIVERSHIP EFFECTS

As discussed in Section 3.1.2, answers to two questions on the survey of decision-makers were used in analyzing whether there were "free driver" effects associated with non-rebated purchases by NBE Program participants. These questions were as follows:

> *"Before you knew about the Energy Trust's energy efficiency incentive programs, had you purchased and installed any energy efficient equipment at this facility?"*
>
> *"Has your experience with the New Building Efficiency Program led you to buy any energy efficient equipment for which you did not apply for a rebate?"*

If a participant answered "no" to the first question, and "yes" to the second question, the participant was considered to show some free-drivership.

Table 3-8 shows how realized kWh savings for the NBE Program in 2006 and 2007 were distributed according to answers that indicated spillover effects for lighting, HVAC, and custom projects. These effects occurred primarily through customers buying additional energy efficient equipment for the same facility that participated in the NBE program.

Table 3-8. Responses from Survey of Decision-Makers Showing Spillover Effects for 2006 and 2007 NBE Program Participants

Type of Project	***Percent of Population Realized kWh Savings***
Lighting	13.55%
HVAC	13.15%
Custom	13.15%

3.5 ESTIMATES OF NET SAVINGS

Estimates of the net realized savings for projects in the NBE Program during 2006 and 2007 were estimated by applying the net-to-gross ratios developed in Section 3.2 to the estimates of

achieved gross program-level savings developed in Chapter 2. The estimates of net savings for 2006 and 2007 are presented in this section.

3.5.1 Estimates of Net Savings for 2006

Estimated program-level achieved net savings are reported in Table 3-7 for kWh savings and in Table 3-8 for therm savings.

Table 3-9. Estimated Program-Level Achieved Net kWh Savings for New Building Efficiency Projects in 2006

Category of Energy Efficiency Improvement Project	***Achieved Gross Program-Level kWh Savings***	***Minimum FR Rates***		***Maximum FR Rates***	
		Net- to -Gross Ratio	***Achieved Net Program-level kWh Savings***	***Net- to -Gross Ratio***	***Achieved Net Program-level kWh Savings***
Custom controls	1,478,863	93.9%	1,388,652	93.9%	1,388,652
HVAC	4,559,997	72.0%	3,283,198	70.8%	3,228,478
Lighting	7,600,725	50.5%	3,838,366	48.0%	3,648,348
Motors and Drives	172,462	65.5%	112,894	64.18%	110,686
Other	5,475,727	73.1%	4,002,756	73.1%	4,002,756
Totals	19,287,774	65.5%	12,625,867	64.2%	12,378,921

Table 3-10. Estimated Program-Level Achieved Net Therm Savings for New Building Efficiency Projects in 2006

Category of Energy Efficiency Improvement Project	***Achieved Gross Program-Level Therm Savings***	***Minimum FR Rates***		***Maximum FR Rates***	
		Net- to -Gross Ratio	***Achieved Net Program-level Therm Savings***	***Net- to -Gross Ratio***	***Achieved Net Program-level Therm Savings***
Custom controls	41,591	67.0%	27,866	67.0%	27,866
HVAC	157,307	47.4%	74,564	47.4%	74,564
Lighting	-6,431	67.0%	-4,309	67.0%	-4,309
Other	349,702	75.8%	265,074	75.8%	265,074
Totals	542,169	67.0%	363,195	67.0%	363,195

3.5.2 Estimates of Net Savings for 2007

Estimates of the net realized savings for projects in the NBE Program during 2007 were estimated by applying the net-to-gross ratios developed in Section 3.2 to the estimates of achieved gross program-level savings developed in Chapter 2. Estimated program-level achieved net savings are reported in Table 3-7 for kWh savings and in Table 3-8 for therm savings.

Table 3-11. Estimated Program-Level Achieved Net kWh Savings for New Building Efficiency Projects in 2007

Category of Energy Efficiency Improvement Project	***Achieved Gross Program-Level kWh Savings***	***Minimum FR Rates***		***Maximum FR Rates***	
		Net- to –Gross Ratio	***Achieved Net Program-level kWh Savings***	***Net- to -Gross Ratio***	***Achieved Net Program-level kWh Savings***
Custom Measures	4,892,896	93.9%	4,594,429	91.6%	4,481,893
HVAC	5,268,419	64.9%	3,419,204	64.9%	3,419,204
LEED	857,987	51.5%	441,863	51.5%	441,863
Lighting	9,366,339	56.0%	5,245,150	51.1%	4,786,199
Motors and Drives	265,082	66.2%	175,484	66.2%	175,484
Other	238,796	67.0%	160,458	64.4%	153,849
Totals	20,889,521	67.2%	14,036,588	64.3%	13,458,493

Table 3-12. Estimated Program-Level Achieved Net Therm Savings for New Building Efficiency Projects in 2007

Category of Energy Efficiency Improvement Project	***Achieved Gross Program-Level Therm Savings***	***Minimum FR Rates***		***Maximum FR Rates***	
		Net- to -Gross Ratio	***Achieved Net Program-level Therm Savings***	***Net- to -Gross Ratio***	***Achieved Net Program-level Therm Savings***
Custom Measures	454,877	85.5%	388,920	83.3%	378,913
HVAC	238,835	36.4%	86,936	36.4%	86,936
LEED	39,823	68.6%	27,317	67.2%	26,742
Other	45,118	68.6%	30,949	67.2%	30,298
Totals	778,653	68.6%	534,122	67.2%	522,889

3.6 TRENDS IN NET-TO-GROSS

Table 3-13 summarizes the overall net-to-gross ratios estimated for the NBE Program from 2004 through 2007 for both kWh and therm savings. (Note that the methodology for calculating free ridership and hence net-to-gross was somewhat different between the 2004-2005 programs years and the 2006-2007 program years.) The net-to-gross ratios have varied only slightly over the various years, with net savings being about two-thirds of the gross kWh and therm savings of the program.

Table 3-13. Net-to-Gross Ratios for kWh and Therm Savings

Year	***Net-to-Gross Ratios***	
	kWh Savings	***Therm Savings***
2004	67.2%	67.2%
2005	68.8%	69.1%
2006	64.2% - 65.5%	67%
2007	64.3% - 67.2%	67.2% - 68.6%

4. SURVEY OF DECISION MAKING

As part of the evaluation work effort, a survey was made of a sample of decision makers for facilities that participated in the New Building Efficiency Program in 2006 and 2007. That survey provided the information used in Chapter 3 to estimate free-ridership for projects in the NBE Program during 2006 and 2007. However, the survey also provided more general information pertaining to the making of decisions to improve energy efficiency by program participants. An analysis of that information is presented and discussed in this chapter.

- Section 4.1 provides a brief descrption of the survey methodology.
- Section 4.2 provides a summary of major findings from the survey.
- Section 4.3 provides question-by-question tabulations of the survey responses.
- Section 4.4 presents results from analyzing the survey results to identify differences across business types with respect to the effects of the NBE Program.

4.1 SURVEY METHODOLOGY

Of the facilities that participated in the New Building Efficiency Program, interviews with were completed with decision makers for 52 facilities that participated in 2006 and for 30 facilities that participated in 2007.

Each participant was interviewed using the survey instrument provided in Appendix C. For those sites that received on-site visits, the interviews were conducted during the visits. For sites not visited, the interviews were conducted by telephone. During the interview, a participant was asked questions about (1) his/her general decision making regarding purchasing and installing energy efficient equipment, (2) his/her knowledge of and satisfaction with the New Building Efficiency Program, and (3) the influence that the New Building Efficiency Program had on his/her decision to install energy efficiency measures (e.g., lighting measures, HVAC measures,).

4.2 SUMMARY OF MAJOR FINDINGS FROM SURVEY

Based on a review of the survey tabulations, major findings from the sruvey can be summarized as follows.

- Overall, respondents indicated a relatively high level of satisfaction with the NBE Program. On a scale of 1 to 5, where 5 indicates very satisfied, satisfaction was scored at 3.89. This compares to a satisfaction score of 3.76 for the 2004-2005 NBE Program.
- Architects, engineers or energy consultants were most cited as sources of information about the NBE Program by respondents.
- Incentive payments from Energy Trust of Oregon were important in decision making on energy efficiency improvements.

- Survey responses indicate that a significant percentage of participants would have been financially able to install the energy efficiency equipment for which they received a NBE financial incentive even without that incentive.

4.3 TABULATIONS OF SURVEY RESPONSES

Question-by-question tabulations of the survey responses are presented in this section. Each table provides the responses to a question from the survey interview form (see Appendix B.) Each table shows the percentage distributions of respondents across response categories, with responses weighted so that respondents reflect the population in terms of both number of participants in the program and the realized kWh savings of these participants.

1. How did your organization decide to make energy efficiency improvements for the construction project for this facility? Was the decision:	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Based on staff recommendations to a decision maker	18.9%	19.6%
	Made by a group or committee	14.9%	20.4%
	Made by one or two key people	50.3%	48.4%
	Other (please explain)	13.8%	5.5%
	(blank)	1.9%	6.1%
	Totals	100.0%	100.0%

2. What were the **primary sources** your organization relied on for **information** about energy efficient equipment, materials, and design for the project at this facility?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Architect, engineer or energy consultant	39.6%	36.7%
	Equipment vendor or building contractor	26.8%	9.1%
	Representative of New Building Efficiency Program	3.5%	2.8%
	Trade association	2.1%	4.2%
	Other owners or developers (word of mouth)	1.8%	0.6%
	Utility representative	3.3%	2.1%
	All	2.0%	2.2%
	Other	17.8%	37.3%
	Not answered	3.1%	5.1%
	Totals	100.0%	100.0%

3. How easy was it for you to comply with Oregon building code standards on the project for this facility?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Very easy	52.8%	25.7%
	Somewhat easy	30.9%	24.1%
	Somewhat difficult	6.2%	37.3%
	Don't know	8.9%	8.5%
	Not answered	1.2%	4.3%
	Totals	100.0%	100.0%

4. More generally, how easy has it been for you to comply with Oregon building code standards on **other new construction projects** over the past five years?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Very easy	28.3%	10.3%
	Somewhat easy	37.6%	25.1%
	Somewhat difficult	6.7%	35.0%
	Very difficult	0.4%	0.6%
	Don't know	14.4%	14.3%
	Not answered	12.6%	14.7%
	Totals	100.0%	100.0%

5. Are you familiar with the Business Energy Tax Credits (BETC) offered by Oregon?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes	64.2%	82.3%
	No	10.3%	6.0%
	Don’t know	20.4%	3.1%
	Not answered	5.1%	8.6%
	Totals	100.0%	100.0%

6. Did you apply for BETC for the project at this facility?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes, applied and got it	43.2%	65.0%
	Yes, applied but did not get it because it did not meet BETC specs	3.3%	1.5%
	No, did not apply	16.0%	10.2%
	Other	1.8%	2.1%
	Don’t know	8.8%	8.8%
	Not answered	27.0%	12.5%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
7. How difficult was it to meet the 10% better than code hurdle that is needed to get BETC?	Very easy	6.8%	3.3%
	Somewhat easy	14.2%	17.0%
	Not difficult or easy	9.9%	3.7%
	Somewhat Difficult	15.5%	42.9%
	Don't know	10.1%	13.2%
	Not answered	43.6%	19.9%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
8. When considering the influence of the BETC and the Energy Trust incentive on your decision to install the energy efficient equipment, would you say:	Energy Trust incentive had most influence	8.3%	10.2%
	BETC and Energy Trust incentive had equal importance	11.5%	10.4%
	Combination of the BETC and the incentive had most influence	29.3%	56.5%
	Other (please explain)	8.5%	3.7%
	Not answered	42.4%	19.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
9. Besides the New Building Efficiency Program, has your company participated in any **other** energy efficiency incentive programs? *(check all that apply)*	Yes, Other New Construction Incentive programs	14.8%	13.0%
	Yes, Retrofit Incentive Programs	14.0%	15.4%
	Yes, Both types	43.1%	50.4%
	No, no others	22.1%	14.1%
	Don't know	3.9%	1.3%
	Not answered	2.0%	5.8%
	Totals	100.0%	100.0%

10. On a scale of 1 to 5, where "5" is "Very important" and "1" is "Not important at all," how would you rate the importance of the following factors in your decision to install energy efficiency features during the construction project for this facility?

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
10A. Energy Efficiency	2	0.4%	1.6%
	3	0.8%	1.5%
	4	27.7%	13.7%
	5, Very Important	69.9%	78.8%
	Not reported	1.2%	4.3%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
10B. Past experience with energy efficient equipment/design	1, Not important at all	3.7%	2.5%
	2	4.1%	5.8%
	3	20.9%	40.1%
	4	24.7%	22.3%
	5, Very Important	39.6%	19.1%
	Don't know	5.8%	5.8%
	Not reported	1.2%	4.3%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
10C. Your organization's policies	1, Not important at all	3.7%	3.0%
	2	0.4%	1.6%
	3	10.2%	9.6%
	4	43.5%	40.9%
	5, Very Important	30.5%	31.6%
	Don't know	5.8%	7.8%
	Not reported	5.8%	5.5%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
10D. Advice and/or recommendations from NBE Program	1, Not important at all	6.4%	3.3%
	2	12.9%	32.7%
	3	27.5%	7.8%
	4	17.6%	16.4%
	5, Very Important	18.8%	16.5%
	Don't know	15.3%	18.4%
	Not reported	1.6%	4.9%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
10E. Advice and/or recommendations from the mechanical contractor	1, Not important at all	6.2%	29.5%
	2	16.7%	17.8%
	3	24.7%	9.3%
	4	19.0%	15.8%
	5, Very Important	22.7%	13.4%
	Don't know	9.1%	9.3%
	Not reported	1.6%	4.9%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
10F. Advice and/or recommendations from the electrical contractor	1, Not important at all	4.7%	28.6%
	2	10.7%	7.8%
	3	23.0%	13.3%
	4	23.9%	21.7%
	5, Very Important	31.8%	23.2%
	Don't know	4.7%	1.1%
	Not reported	1.2%	4.3%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
10G. Advice and/or recommendations from the architect	1, Not important at all	6.7%	29.7%
	2	12.1%	7.6%
	3	28.6%	9.2%
	4	14.0%	16.1%
	5, Very Important	27.2%	25.2%
	Don't know	9.9%	7.2%
	Not reported	1.6%	4.9%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
10H. Incentives from NBE Program	1, Not important at all	1.9%	1.0%
	2	0.8%	1.8%
	3	21.5%	4.2%
	4	23.3%	27.8%
	5, Very Important	51.3%	60.9%
	Not reported	1.2%	4.3%
	Totals	100.0%	100.0%

11. On a scale of 1 to 5, where "5" is "Very important" and "1" is "Not important at all," how would you rate the importance of each reason in your decision to install energy efficiency features during the construction project for this facility?

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11A. Code or regulations	1, Not important at all	7.3%	7.1%
	2	11.5%	37.0%
	3	22.3%	3.8%
	4	17.9%	14.4%
	5, Very Important	34.5%	27.6%
	Don't know	3.0%	4.0%
	Not reported	3.5%	6.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11B. Safety	1, Not important at all	9.9%	3.6%
	2	6.1%	29.7%
	3	19.3%	15.9%
	4	21.5%	10.4%
	5, Very Important	29.2%	23.2%
	Don't know	5.1%	4.0%
	Not reported	8.9%	13.0%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11C. Improved reliability	1, Not important at all	1.3%	3.5%
	2	2.7%	0.9%
	3	25.8%	49.4%
	4	37.4%	13.9%
	5, Very Important	28.5%	22.5%
	Don't know	0.8%	3.7%
	Not reported	3.5%	6.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11D. Tenant comfort	1, Not Important at All	3.5%	2.5%
	2	0.0%	0.0%
	3	20.9%	20.3%
	4	37.3%	40.4%
	5, Very Important	32.7%	28.7%
	Don't know	2.1%	1.8%
	Not reported	3.5%	6.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11E. Better design	1, Not Important at All	2.2%	1.9%
	2	0.0%	0.0%
	3	17.6%	37.5%
	4	37.5%	15.5%
	5, Very Important	37.8%	38.2%
	Don't know	1.4%	0.7%
	Not reported	3.5%	6.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11F. Improved tenant attraction/retention	1, Not important at all	8.2%	4.8%
	2	0.4%	1.0%
	3	17.7%	4.3%
	4	26.4%	53.3%
	5, Very Important	24.9%	18.3%
	Don't know	18.4%	11.6%
	Not reported	4.0%	6.7%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11G. Increased rent	1, Not Important at All	6.1%	3.7%
	2	4.9%	2.7%
	3	28.3%	35.7%
	4	9.7%	3.8%
	5, Very Important	4.6%	4.8%
	Don't know	42.8%	43.2%
	Not reported	3.5%	6.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11H. Client wanted	1, Not important at all	5.5%	3.4%
	2	5.1%	27.4%
	3	12.1%	11.7%
	4	24.8%	8.4%
	5, Very Important	16.6%	21.5%
	Don't know	29.2%	19.8%
	Not reported	6.8%	7.9%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11I. Air quality	1, Not important at all	3.5%	4.5%
	2	0.4%	1.0%
	3	1.4%	0.0%
	4	27.5%	11.6%
	5, Very Important	20.8%	25.6%
	Don't know	19.3%	13.2%
	Not reported	27.1%	44.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11J. Energy cost savings	1, Not important at all	0.0%	0.0%
	2	0.4%	1.6%
	3	0.0%	0.0%
	4	9.1%	8.9%
	5, Very Important	80.9%	81.8%
	Don't know	1.4%	0.0%
	Not reported	8.2%	7.7%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
11L. Other cost savings (labor, O&M, improved scheduling	1, Not important at all	1.4%	0.3%
	2	0.4%	1.6%
	3	23.2%	12.9%
	4	20.2%	10.9%
	5, Very Important	32.7%	24.4%
	Don't know	3.5%	6.7%
	Not reported	18.6%	43.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
12. Was there a formal commissioning process for this building?	Yes: There was a commissioning agent involved who performed verification and testing of building systems or who observed the testing.	42.4%	75.1%
	Yes: The equipment start-ups were done by individual contractors.	19.5%	10.1%
	Yes: Other	1.4%	0.1%
	No	14.8%	6.6%
	Don't know	18.4%	2.0%
	Not reported	3.5%	6.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
13-Lighting: Before participating, had you installed any similar ***lighting*** energy efficiency equipment/measures at other buildings?	Yes	62.9%	65.2%
	No	26.9%	25.7%
	Not reported	10.1%	9.1%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
13-HVAC Before participating, had you installed any similar ***HVAC*** energy efficiency equipment/measures at other buildings?	Yes	50.9%	31.8%
	No	21.9%	47.4%
	Not reported	27.1%	20.8%
	Totals	100.0%	100.0%

13-Custom Before participating, had you installed any similar ***custom*** energy efficiency equipment/measures at other buildings?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes	39.6%	27.8%
	No	20.2%	45.6%
	Not reported	40.2%	26.7%
	Totals	100.0%	100.0%

14-Lighting How influential was the New Building Efficiency program incentive in planning the design and installation of ***lighting*** energy efficient equipment/measures for this project?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Installation was planned before we considered the incentive	18.1%	7.9%
	Incentive had no influence on our plans	7.2%	2.2%
	Incentive had a little influence on our plans	6.0%	4.5%
	Incentive had a moderate influence on our plans	16.9%	17.2%
	Incentive had a significant influence on our plans	23.8%	48.3%
	Installation would not have happened without the incentive (critical influence)	19.9%	13.0%
	Not reported	8.2%	7.0%
	Totals	100.0%	100.0%

14-HVAC How influential was the New Building Efficiency program incentive in planning the design and installation of ***HVAC*** energy efficient equipment/measures for this project?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Installation was planned before we considered the incentive	10.9%	1.7%
	Incentive had no influence on our plans	8.7%	0.6%
	Incentive had a little influence on our plans	6.0%	4.5%
	Incentive had a moderate influence on our plans	17.6%	26.7%
	Incentive had a significant influence on our plans	10.0%	9.6%
	Installation would not have happened without the incentive (critical influence)	18.7%	34.9%
	Not reported	28.1%	22.0%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
14-Custom How influential was the New Building Efficiency program incentive in planning the design and installation of ***Custom*** energy efficient equipment/measures for this project?	Installation was planned before we considered the incentive	9.7%	1.0%
	Incentive had no influence on our plans	6.8%	0.6%
	Incentive had a little influence on our plans	2.7%	2.8%
	Incentive had a moderate influence on our plans	3.9%	12.9%
	Incentive had a significant influence on our plans	7.6%	8.0%
	Installation would not have happened without the incentive (critical influence)	11.5%	32.7%
	Not reported	57.8%	42.1%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
15-Lighting Did a representative of the New Building Efficiency Program recommend that you install the ***lighting*** energy efficiency equipment/measures?	Yes	16.4%	17.7%
	No	75.4%	75.0%
	Not reported	8.2%	7.3%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
15A –Lighting If the representative of the New Building Efficiency Program had not recommended installing the energy efficiency lighting equipment/measures, how likely is it that you would have installed the equipment/measures anyway?	Definitely would have installed	5.4%	6.9%
	Probably would have installed	4.1%	10.3%
	Probably would not have installed	2.1%	2.2%
	Definitely would not have installed	2.7%	1.3%
	Don't know	0.8%	1.4%
	Not reported	84.8%	78.0%
	Totals	100.0%	100.0%

15-HVAC Did a representative of the New Building Efficiency Program recommend that you install the ***HVAC*** energy efficiency equipment/measures?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes	6.8%	4.1%
	No	64.6%	66.1%
	Not reported	28.5%	29.8%
	Totals	100.0%	100.0%

15A-HVAC If the representative of the New Building Efficiency Program had not recommended installing the energy efficiency HVAC equipment/measures, how likely is it that you would have installed the equipment/measures anyway?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Definitely would have installed	5.4%	6.9%
	Probably would have installed	4.1%	10.2%
	Probably would not have installed	1.4%	0.4%
	Definitely would not have installed	1.4%	0.5%
	Don't know	0.4%	0.9%
	Not reported	87.3%	81.1%
	Totals	100.0%	100.0%

15-Custom Did a representative of the New Building Efficiency Program recommend that you install the ***custom*** energy efficiency equipment/measures?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes	2.7%	0.7%
	No	47.7%	57.7%
	Not reported	49.6%	41.6%
	Totals	100.0%	100.0%

15A-Custom If the representative of the New Building Efficiency Program had not recommended installing the energy efficiency custom equipment/measures, how likely is it that you would have installed the equipment/measures anyway?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Probably would have installed	0.4%	7.8%
	Probably would not have installed	1.4%	0.4%
	Not reported	98.2%	91.8%
	Totals	100.0%	100.0%

16-Lighting Would you have been financially able to install the ***lighting*** equipment / measures without the financial incentive provided through the Program?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes	53.2%	29.1%
	No	27.8%	43.7%
	Don't know	10.9%	20.3%
	Not reported	8.2%	7.0%
	Totals	100.0%	100.0%

16-HVAC Would you have been financially able to install the ***HVAC*** equipment / measures without the financial incentive provided through the Program?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes	48.0%	21.9%
	No	14.4%	36.6%
	Don't know	7.6%	18.5%
	Not reported	30.1%	23.0%
	Totals	100.0%	100.0%

16-Custom Would you have been financially able to install the ***custom*** equipment / measures without the financial incentive provided through the Program?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes	30.7%	11.9%
	No	7.2%	28.4%
	Don't know	5.6%	17.9%
	Not reported	56.5%	41.8%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
17-Lighting If the financial incentive for this project that you received through the Program had not been available, how would your plans for the ***lighting*** equipment/measures for this project have changed?	No Change. Definitely would have installed same lighting equipment	21.0%	12.3%
	Probably would have changed the lighting design	10.3%	14.2%
	Probably would have installed same lighting equipment	9.3%	7.7%
	Probably would have installed standard efficiency lighting equipment	18.4%	10.9%
	Probably would have postponed installing lighting equipment / measures to another year	4.5%	6.5%
	Probably would have reduced energy efficiency of lighting	2.4%	1.6%
	Probably would have scaled back the scope of lighting project	5.1%	8.9%
	Probably would have used less expensive lighting equipment	8.2%	27.5%
	Other	3.1%	2.4%
	Not reported	17.9%	8.0%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
17-HVAC If the financial incentive for this project that you received through the Program had not been available, how would your plans for the ***HVAC*** equipment/measures for this project have changed?	No Change. Definitely would have installed same HVAC equipment	16.1%	8.4%
	Probably would have changed the HVAC design	3.1%	5.9%
	Probably would have installed same HVAC equipment	5.4%	4.9%
	Probably would have installed standard efficiency HVAC equip.	12.7%	9.3%
	Probably would have postponed installing HVAC equipment to another year	3.3%	1.9%
	Probably would have reduced energy efficiency of HVAC equipment	11.1%	9.3%
	Probably would have scaled back the scope of HVAC project	2.4%	8.6%
	Probably would have used less expensive HVAC equipment	7.4%	29.0%
	Other	2.7%	1.5%
	Not reported	35.9%	21.2%
	Totals	100.0%	100.0%

	Response	***Percent of Population N***	***Percent of Population Realized kWh Savings***
17-Custom If the financial incentive for this project that you received through the Program had not been available, how would your plans for the ***custom*** equipment/measures for this project have changed?	No Change. Definitely would have installed same equipment	7.5%	2.3%
	Probably would have changed the design	3.1%	5.9%
	Probably would have installed same equipment	0.8%	4.2%
	Probably would have installed standard efficiency equipment / measures	13.4%	8.6%
	Probably would have reduced energy efficiency of equipment / measures	1.9%	1.0%
	Probably would have scaled back the scope of project	0.4%	7.8%
	Probably would have used less expensive equipment	5.2%	26.4%
	Other	1.4%	0.9%
	Not reported	66.2%	42.9%
	Totals	100.0%	100.0%

18-Lighting How did the availability of information and financial incentives affect the level of energy efficiency you chose for the ***lighting*** equipment/measures?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Did not affect level of efficiency that we chose for equipment	29.5%	18.0%
	Efficiency of equipment was better than otherwise would have chosen	54.6%	74.0%
	Not reported	16.0%	8.0%
	Totals	100.0%	100.0%

18-HVAC How did the availability of information and financial incentives affect the level of energy efficiency you chose for the ***HVAC*** equipment/measures?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Did not affect level of efficiency that we chose for equipment	20.7%	15.3%
	Efficiency of equipment was better than otherwise would have chosen	39.5%	61.7%
	Not reported	39.8%	23.0%
	Totals	100.0%	100.0%

18-Custom How did the availability of information and financial incentives affect the level of energy efficiency you chose for the ***custom*** equipment/measures?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Did not affect level of efficiency that we chose for equipment	11.6%	7.9%
	Efficiency of equipment was better than otherwise would have chosen	24.2%	50.4%
	Not reported	64.3%	41.7%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
19. How did you learn of the Energy Trust's New Building Efficiency Program?	Approached directly by representative of New Building Efficiency Program	16.7%	10.3%
	Architect, engineer or energy consultant	27.9%	15.8%
	Equipment vendor or building contractor	5.1%	4.0%
	Heard from other business owners or developers (word of mouth)	6.0%	7.2%
	Other (please explain)	29.3%	54.0%
	Saw information brochure	1.8%	1.5%
	Not reported	13.2%	7.2%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
20. When did you learn of the New Building Efficiency Program?	Had participated in other Energy Trust energy efficiency incentive programs	44.1%	61.7%
	Before planning for the new building began	18.2%	13.8%
	During our planning to construct the building	16.7%	11.9%
	After planning was completed	5.7%	2.9%
	Other	0.8%	1.8%
	Not reported	14.6%	8.0%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
21. How easy was it for you to **understand** the **requirements** for participating in the New Building Efficiency Program?	Very easy	30.3%	14.2%
	Somewhat easy	29.9%	31.3%
	Somewhat difficult	10.0%	7.9%
	Very difficult	4.9%	27.4%
	Don't know	11.6%	12.0%
	Not reported	13.2%	7.2%
	Totals	100.0%	100.0%

22. How easy was it for you to meet the **paperwork requirements** of the New Building Efficiency Program?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Very easy	21.1%	5.7%
	Somewhat easy	30.6%	31.8%
	Somewhat difficult	17.1%	15.3%
	Very difficult	6.2%	28.0%
	Don't know	11.6%	12.0%
	Not reported	13.2%	7.2%
	Totals	100.0%	100.0%

23. How helpful was staff **for the New Building Efficiency Program** in answering questions and providing professional support?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Very helpful	61.4%	44.7%
	Somewhat helpful	8.3%	36.7%
	Don't know	15.7%	10.5%
	Not reported	14.6%	8.1%
	Totals	100.0%	100.0%

24. Has your experience with the Program led you to install any energy efficient equipment for which you did not apply for an incentive?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes, for this facility	13.6%	15.2%
	Yes, for new construction at other facilities	8.4%	7.5%
	No	46.7%	53.5%
	Don't know	9.4%	7.9%
	Not reported	21.9%	15.9%
	Totals	100.0%	100.0%

25. Given your experience with the Program, would you install energy efficient equipment in the future, even if Energy Trust were not offering financial incentives?	***Response***	***Percent of Population N***	***Percent of Population Realized kWh Savings***
	Yes	48.2%	33.5%
	No	16.7%	9.7%
	Don't know	16.6%	47.0%
	Not reported	18.5%	9.8%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
26. If you were to install equipment that qualifies for an incentive in another new construction project, would you choose to participate in the Program again?	Yes	82.1%	90.4%
	Not reported	17.9%	9.6%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
27. Is there any assistance or information that NBE Program representatives could have provided to you that would have increased the ease with which you obtained management approval for the project?	Yes	21.4%	37.2%
	No	57.0%	47.5%
	Don't know	5.1%	6.3%
	Not reported	16.5%	9.0%
	Totals	100.0%	100.0%

28. On a scale of 1 to 5, where "5" is very satisfied and "1" is very unsatisfied, how would you rate your satisfaction with the following aspects of the New Building Efficiency Program?

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
28A. Performance of equipment installed	3	3.5%	10.0%
	4	28.7%	17.1%
	5 - Very Satisfied	45.3%	61.1%
	Don't know	3.3%	0.6%
	Not reported	19.1%	11.1%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
28B. Energy savings	2	1.9%	0.6%
	3	1.4%	0.3%
	4	36.1%	26.1%
	5 - Very Satisfied	36.9%	57.9%
	Don't know	4.6%	4.0%
	Not reported	19.1%	11.1%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
28C. Incentive amount	2	0.4%	0.9%
	3	13.4%	9.4%
	4	25.5%	51.3%
	5 - Very Satisfied	38.6%	21.3%
	Don't know	3.1%	5.9%
	Not reported	19.1%	11.1%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
28D. Application process	1 - Not satisfied	0.4%	0.9%
	2	9.0%	28.0%
	3	18.7%	8.9%
	4	23.0%	29.1%
	5 - Very Satisfied	24.8%	15.4%
	Don't know	5.1%	6.5%
	Not reported	19.1%	11.1%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
28E. Quality of the work conducted by contractor	3	1.4%	0.3%
	4	34.1%	56.6%
	5 - Very Satisfied	45.7%	32.6%
	Don't know	1.8%	1.2%
	Not reported	17.1%	9.3%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
28F. Overall program experience	3	6.1%	29.4%
	4	42.2%	34.8%
	5 - Very Satisfied	31.5%	20.5%
	Don't know	3.1%	5.9%
	Not reported	17.1%	9.3%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
28G. Knowledge of program staff	2	1.4%	0.4%
	3	16.1%	33.6%
	4	17.2%	19.2%
	5 - Very Satisfied	32.1%	25.6%
	Don't know	16.1%	11.9%
	Not reported	17.1%	9.3%
	Totals	100.0%	100.0%

	Response	*Percent of Population N*	*Percent of Population Realized kWh Savings*
28H. With any program issue that needed resolution	3	13.3%	34.6%
	4	17.3%	20.0%
	5 - Very Satisfied	17.7%	10.6%
	Don't know	29.1%	18.6%
	Not reported	22.5%	16.2%
	Totals	100.0%	100.0%

4.4 ANALYSIS OF NBE PROGRAM EFFECTS BY BUSINESS TYPE

As shown in Table 4-1, the 82 survey respondents represented several different types of businesses. Accordingly, survey responses were further analyzed to determine whether there were differences across business types in their perceptions of the NBE Program.

Table 4-1. Distribution of Survey Respondents by Business Type

Type of Business	***Number of Survey Respondents***	***Percentage of Population Realized kWh Savings Represented***
Grocery	13	10.31%
Hospital	7	37.40%
Hotel	1	0.62%
Manufacturing	6	5.49%
Multifamily	4	4.55%
Office	9	4.47%
Other	16	20.11%
Retail	14	7.32%
School	5	3.62%
Warehouse	7	6.10%
All	82	100.00%

As part of the survey, respondents were asked to rate how important both advice and / or recommendations and incentives from the NBE Program were in their decision to install energy efficiency features during the construction of their new facility. (Importance was rated on a scale of 1 to 5, where 1 represented "Not important at all" and 5 represented "Very Important). The responses were used to develop an importance score for each factor for each business types. There importance scores, which are reported in Table 4-2, show that incentives are regarded as more important than advice and / or recommendations. Moreover, there are differences among business types in how important these factors are in their decision making..

Table 4-2. Importance Scores by Business Type for NBE Advice and NBE Incentives

Type of Business	***Importance Scores***	
	NBE Advice and / or Recommendations	***NBE Incentives***
Grocery	2.19	4.33
Hospital	2.42	4.81
Hotel	4.00	5.00
Manufacturing	4.20	4.87
Multifamily	1.75	4.52
Office	4.53	5.00
Other	4.09	4.33
Retail	3.20	4.44
School	3.49	2.20
Warehouse	3.88	4.47
All	3.13	4.52

Given the importance of incentives in respondents' decision making, survey respondents were also asked to rate how influential NBE Program incentives were in their planning and design for installing different types of energy efficient equipment / measures (i.e., for lighting, HVAC, or custom measures). Their responses were scored according to the following scale to develop influence scores for incentives.

Table 4-3. Influence Scoring for NBE Program Incentives

Survey Response	***Assigned Score***
Installation was planned before we considered the incentive	0
Incentive had no influence on our plans	0
Incentive had a little influence on our plans	1
Incentive had a moderate influence on our plans	2
Incentive had a significant influence on our plans	3
Installation would not have happened without the incentive (critical influence)	4

The results of applying the influence scoring are reported in Table 4.4. Note that the influence scores for schools are relatively lower than for other types of businesses.

Table 4-4. Influence Scores for NBE Incentives by Business Type and Type of Measure

Type of Business	***Influence Scores by Type of Measure***		
	Lighting	***HVAC***	***Custom***
Grocery	3.67	3.83	3.67
Hospital	2.59	3.38	3.72
Hotel	3.00	n / a	n / a
Manufacturing	3.00	1.98	n / a
Multifamily	1.78	2.00	n / a
Office	1.72	1.99	3.00
Other	2.31	2.06	2.00
Retail	2.26	2.26	2.17
School	1.32	1.32	1.00
Warehouse	2.42	2.00	2.00
All	2.53	2.90	3.16

Survey respondents were also asked to indicate their level of overall satisfaction with the NBE Program using a scale of 1 to 5, where 5 indicates very satisfied. The resulting satisfaction scores for the different types of businesses are shown in Table 4-5.

Table 4-5. Satisfaction with NBE Program by Business Type

Type of Business	***Satisfaction Score***
Grocery	4.19
Hospital	3.42
Hotel	5.00
Manufacturing	4.72
Multifamily	3.59
Office	4.69
Other	4.26
Retail	4.29
School	3.89
Warehouse	4.17
All	3.89

5. PROCESS EVALUATION FINDINGS

This chapter presents the findings from the process evaluation of the New Building Efficiency Program. This chapter describes the program and examines the effectiveness of the delivery mechanisms from the perspective of staff and participants in the program. There are several major sections that address the following:

- A program description and history based on staff interviews and a review of documents.
- A characterization of participation in the program for 2006-7 based on an examination of records received from the Energy Trust of Oregon.
- An examination of program operations based on in-depth interviews with twenty-two participants including owners, trade allies, vendors, and others.

5.1 PROGRAM DESCRIPTION AND HISTORY

5.1.1 Program History

During early 2003, Energy Trust program staff solicited input from the various Oregon stakeholders regarding objectives and strategies for a commercial new construction program. The Energy Trust then issued a competitive solicitation in order to select a Program Management Contractor (PMC); Science Applications International Corporation (SAIC) was selected as the winning bidder. In July 2003, Portland General Electric and Pacific Power were disallowed from enrolling any new projects in their commercial new construction programs, and the New Building Efficiency Program was allowed to begin marketing. Before the program developed internal policies and procedures, many of the initial projects were handled on a case-by-case basis.

The NBE Program has evolved since its inception. The major changes are described in the following bullets.

- **Addition of natural gas incentives.** Incentives for gas measures were not included in the initial program design because Northwest Natural Gas did not sign a contract with the Energy Trust to operate natural gas programs until July 2003. Natural gas incentives were approved in August 2004.
- **Elimination of the High-Performance track.** The program initially offered both a Custom track and a High-performance track. The difference was that High Performance projects were eligible for a higher level of incentives than Custom projects. The High Performance track was eliminated in 2005 and all relevant projects are processed under the Custom track.
- **Elimination of the Energy Design Advisory Contractor services and addition of Technical Assistance funding.** In 2005, due to lack of participation, the program eliminated the Energy Design Advisory Contractor services, which provided funding for program-approved contractors to assist in building design and energy analysis. In its place, funding for

technical assistance was added, which provides up to $25,000 or one-half of the incentive amount (whichever is less). In 2008, the technical assistance funding was made available in addition to, rather than in place of, incentive funding.

- **Trade Allies.** In 2005, the program began recruiting trade allies, such as electrical and HVAC contractors as well distributors and manufacturing representatives. These trade allies promote the program to customers, especially the smaller spec-built or design-build projects that are likely to participate in the Standard Track.
- **Elimination of the Commissioning Oversight Contractor services and addition of pilot Commissioning initiative.** The program initially offered Commissioning Oversight Contractor services for participating Custom track projects; however this service yielded little uptake and was eliminated in 2005. In its place, the program now offers up to $40,000 in incentive funding towards commissioning.
- **Streamlined documentation requirements**. Until January of 2005, customers were required to submit paperwork proving that the owner paid for the installation of approved energy efficient equipment. This requirement was streamlined to allow participants more flexibility in meeting paperwork requirements.
- **Addition of LEED track.** In 2006, the program added a LEED track for buildings seeking LEED NC certification. This track does not require the development of a separate energy model; instead, the incentive is calculated based on the LEED energy modeling rules or the number of Energy & Atmosphere Credit 1 points attained. This track provides a simple way for LEED projects to participate in the program and obtain up to $300,000 in incentive funding.
- **Addition of ENERGY STAR track.** This track was established to target buildings occupied after January 2005 that did not participate in the program during construction in order to encourage building "tune-ups." Up to $30,000 is available for buildings that become certified as an ENERGY STAR building.
- **Maximum funding levels increased.** The maximum level of incentives has increased for several of the tracks.
  - **Standard track.** The cap was increased from $25,000 to $50,000 in 2005 and then to $100,000 in 2008. These changes were made to increase the volume and size of projects that qualify for the Standard track. Because Standard projects require less staff time for processing than do Custom projects and are therefore believed to be more cost effective, the goal was to encourage more projects to apply for the Standard track.
  - **Custom track.** The limit for Custom projects was increased from $200,000 to $300,000 in 2008 in order to create "buzz" in the market, though few projects had actually reached the $200,000 cap.
- **Established a project notice form.** This form alerts staff of the intent to participate in the program and establishes the applicant's intent to be energy efficient. However, it does not

require the applicant to estimate energy savings, which presented an obstacle to early program participants.

5.1.2 Program Design and Delivery

Projects that meet the following requirements are eligible to participate in the NBE Program:

- The project must be served by Portland General Electric or Pacific Power to receive incentives for electric measures and by Northwest Natural Gas or Cascade Natural Gas to receive incentives for gas measures.
- The project must pay or plan to pay the public purposes charge.
- The project site must be located in Oregon.
- The project must be new construction, an addition, tenant build-out, or a major renovation to an existing structure. A major renovation of an existing commercial, non-residential structure is defined as the replacement of both lighting and HVAC that serve more than 50% of the total building floor area.
- The project must be a commercial, industrial, manufacturing, or institutional building.

Projects that are determined to be eligible for the NBE Program fall under one of four program tracks:

- Standard Track
- Custom Track
- LEED Track
- ENERGY STAR track

When potential participants call PMC staff, they are asked a few questions to help decide which program track to pursue.

- If the project is not pursuing LEED certification, then the LEED track is not applicable.
- If the building is still under construction then the ENERGY STAR track is not applicable either.
- If the building is less than 15,000 square feet, then they are typically directed to the Standard track, as the amount of the Custom track incentives is probably not justified based on the labor invested in the energy analysis.
- If the building will operate more than 60 hours per week, then the Custom track may be warranted. If the caller is familiar with energy analyses (typically an engineer) or the building is larger (most larger buildings require an energy analysis) then they are also usually directed to the Custom track.

Projects may change tracks anytime prior to completion.

The majority of program projects fall under the Standard track. Program staff believe this is reasonable, as participants select which program track to pursue. They believe that their goal is to cost-effectively utilize program resources by maximizing energy savings with the least program labor and least program incentives.

The volume of projects has fluctuated over time, depending on market conditions and the level of outreach conducted by the program. The typical project length is approximately 12 months to 18 months for Standard track and 18 months to three years for Custom track, plus an additional year for LEED projects (due to the one-year post-occupancy requirement). This situation creates a lag between outreach campaigns and claimed savings of between one and three years.

Standard Track. The Standard Track addresses the market for smaller and spec-built projects and those with severe time constraints and budgets. The Standard Track is designed for projects beyond the design stage in order to provide a simple, quick process to obtain a relatively small amount of incentives for cost-effective measures. Up to $100,000 per project is available for prescriptive measures including lighting and controls, motors, variable speed drives, air conditioners, heat pumps, air-to-air heat exchangers, demand control ventilation, chillers and natural gas equipment (water heaters, heating systems, and cooking equipment).

Participants must submit the Project Enrollment form (Form 510E) before eligible equipment is purchased. The enrollment form serves to notify the program staff of the project's intent to participate in the program and establishes their intent to be energy efficient. The form collects contact information for the applicant and the owner, the building size and type, an estimated schedule, and the intended program track; however, it does not require preliminary estimates of energy savings. If the enrollment form is not received before the purchase of eligible equipment, the project is eligible only for up to $3,000 in incentives if *all* forms are received within 60 days of project completion.

The Standard Track Project Workbook (Form 520S), which calculates the project incentive funding for eligible prescriptive measures, may be received either before or after the eligible equipment has been purchased; this form also must include the owners' signature. Next the participant submits equipment product data sheets, which provide information on equipment type, model numbers, and efficiency levels. PMC staff assigns a project number, enters data into the tracking system, reviews the application forms, and drafts an approval letter that specifies the approved incentive funding level.

Once the equipment has been purchased and installed, the participant submits the Completion document (form 540D) within 60 days of the completion date provided to the program; changes to this date can be made by contacting PMC staff. If any changes have been made regarding the number or type of equipment installed, the participant must submit a revised workbook. Supporting documentation includes vendor invoices with equipment type, model, quantity, and dates of purchase. PMC staff reviews the incentive amounts, quantities, efficiency levels, invoices, and dates to ensure that all equipment meets program standards. Participants are contacted if information is missing, inconsistent, or does not meet program standards.

A site inspection occurs for all projects receiving incentives of $10,000 or more, while a random sample of projects earning less than $10,000 receive site inspections. During these inspections, a PMC staff member will visually confirm the expected quantity, type, and model number of installed equipment, including taking digital photographs.

The program reviews all completion documentation within 30 days of submission, and typically mails out the incentive check within 45 days of approval.

Custom Track. The Custom Track is designed for larger projects where a "systems-based" approach is appropriate. Program incentives are available up to $300,000 per project based on the first year annual energy savings estimates. In order to receive incentives for energy efficiency measures, projects must provide a summary of the measures to be installed as well as an energy efficiency analysis report that supports the estimated energy savings figures. The incentive rates for first year annual savings varies for new construction projects, renovation projects, and measure type as follows:

- New construction: $0.10/kWh and $0.80/therm for first year annual savings
- Major renovation: $0.15/kWh for lighting measures, up to 30% of eligible project cost and 100% of incremental cost
- Major Renovation: $0.20/kWh and $1/therm for all other measures, up to 35% of eligible project cost and 100% of incremental cost

Participants must submit the Project Enrollment form (Form 510E) before eligible equipment is purchased. If the project team elects to apply for technical assistance funding, they submit the Technical Assistance workbook (Form 520T). The Custom Project Incentive Workbook (Form 520C), which lists the energy efficiency measures along with the owners' signature, is submitted next. In addition, the program cost-effectiveness calculator (CEC) spreadsheet and a supporting energy analysis that estimates energy savings relative to Oregon Energy code are also required. The CEC spreadsheet calculates the benefit-cost ratio (BCR) for each measure using the societal and utility cost effectiveness tests; measures must have a BCR of greater than 1.0 to be eligible for program incentives.

The NBE program website offers several software calculators to help participants calculate the energy savings for several common measures, including chillers, demand control ventilation, enthalpy economizers, heat recovery systems, variable frequency drives, and lighting. The energy analysis submitted by participants can take various forms, from spreadsheets to DOE2 models; the baseline energy models are compared to energy use intensity values for similar buildings in terms of size, type, and occupancy. The measure assumptions are assessed in comparison to engineering literature, the past experience of staff, or engineering calculations. The objective of the technical review is to determine if the energy analysis results are reasonable and conform to standard engineering practice. There is often communication back and forth between the participant and program staff, particularly if this is their first time participating in the Custom track.

Next the participant submits equipment product data sheets; PMC staff then review and mail out an approval letter that specifies the approved funding level. Once the equipment has been purchased and installed, the participant submits the Completion document with vendor invoices specifying equipment type, model, quantity, and dates of purchase. The program will also accept a CPA letter for BETC eligible measures or AIA Payment documents.

PMC staff reviews the incentive amounts, quantities, efficiency levels, invoices, and dates to ensure that all equipment meets program standards. Participants are contacted if information is missing, inconsistent, or does not meet program standards.

A site inspection occurs for all projects receiving incentives of $10,000 or more, while a random sample of projects receiving less than $10,000 receive site inspections. The program reviews all completion documentation within 30 days of submission, and typically mails out the incentive check within 45 days of approval.

LEED Track. The LEED track provides incentives for projects that register for certification with the USGBC LEED program. In order to simplify the participation process, this track does not require a separate energy model; however the incentive rates are lower than the Custom track rates that require separate energy modeling. This track provides a simple way for LEED projects to participate in the program and obtain up to $300,000 in incentive funding. Because the LEED program requires 12 month of occupancy before certification, only a few projects have completed the LEED track so far.

The participant must submit the Project Enrollment form (Form 510E) before eligible equipment is purchased. Next is the USGBC LEED NC Incentive workbook (Form 520L), which includes the owners' signature. PMC staff assigns a project number, enters data into the tracking system, reviews the application forms, and drafts an approval letter that specifies the approved incentive funding level.

Projects are required to submit the LEED energy analysis report if the project is required to develop an energy model by LEED; incentives are calculated at $0.10/kWh and $0.80/therm for first year annual savings. In order to adjust for the fact that LEED uses ASHRAE 90.1 as the baseline (which is below Oregon code), the program derates the estimated LEED energy savings by 15% for LEED 2.0 projects (ASHRAE 90.1 2001 is baseline) and by 5% for LEED 2.1 and 2.2 projects (ASHRAE 90.1 2004 is baseline). If a project does not provide the LEED energy model, the incentive is calculated using building square feet, occupancy levels, and the number of LEED Energy & Atmospheric Credit 1 points. Projects are also eligible for incentives of $0.015/kWh and $0.10/therm for first year energy savings for LEED Enhanced Commissioning Credit 3 or LEED Measurement and Verification Credit 5.

Once the equipment has been purchased and installed, the participant contacts the program to provide an estimated date for receiving LEED certification. Once the LEED certification is obtained, the participant submits the Completion document (form 540D) within 60 days of the completion date provided to the program; changes to this date can be made by contacting PMC

staff. Supporting documentation include the USGBC Rating Certificate, Final LEED Review, ASHRAE Energy Cost Budget Comparison form, USGBC Energy Modeling Table of Comparative Assumptions, and the narrative for Energy & Atmospheric Credit 1.

A site inspection occurs for all projects receiving incentives of $10,000 or more, while a random sample of projects earning less than $10,000 receive site inspections. The program reviews all completion documentation within 60 days of submission, and typically mails the incentive check within 45 days of approval.

ENERGY STAR Track. The ENERGY STAR track offers up to $30,000 in building performance incentives to new commercial buildings that were occupied after January 2005 and have been occupied for at least 12 months. This track is available to buildings that that did not participate in the Custom or LEED tracks during construction in order to provide incentives for a "building tune-up". ENERGY STAR buildings must achieve a rating of 75 or higher using the ENERGY STAR Target Finder (the baseline is 60), be occupied at least 35 hours/week, and at least one-half the square footage must be institutional, hotel, school, office, retail store, warehouses, or wastewater treatment plant, and be no more than 10% computer data centers. In addition, a Professional Engineers' seal is required in order to certify the accuracy of the data, building characteristics, and that the analysis meets industry standards.

The participant must submit the Project Enrollment form (Form 510E), unless the form has already been submitted for another program track. The participant then submits the ENERGY STAR Incentive Workbook (Form 520ES) with the owners' signature. Next the participant submits equipment product data sheets; PMC staff review and mail out an approval letter that specifies the approved funding level.

The project obtains ENERGY STAR certification using the EPA Portfolio Manager, the Statement of Energy performance, and Letter of Agreement with P.E. stamp. Once the ENERGY STAR rating is obtained, the participant submits the Completion document (form 540D) within 60 days of the completion date provided to the program; supporting documentation include the ENERGY STAR Letter of Agreement, ENERGY STAR Statement of ENERGY Design Intent with P.E. stamp, and ENERGY STAR Target Finder printout, with baseline target rating of 60.

A site inspection occurs for all projects receiving incentives of $10,000 or more, while a random sample of projects earning less than $10,000 receive site inspections. The program reviews all completion documentation within 60 days of submission, and typically mails out the incentive check within 45 days of approval.

Combining Program Tracks. Projects may combine the Standard track with the Custom track or the ENERGY STAR track, though projects can receive only one incentive per measure. The combined maximum incentive for Standard and Custom track projects is $400,000. Including technical assistance and commissioning incentives results in a total of $465,000. The combined maximum incentive for Standard track and ENERGY STAR track is $130,000.

A project that includes both Standard measures and Custom measures is designated as both a Standard and Custom project. In these cases, the Standard measures are treated per Standard track guidelines and Custom measures are treated per Custom track guidelines. Such projects are usually buildings with mixed uses, such as manufacturing/office buildings, or projects where measures that are normally processed through the Standard track would receive higher incentives through the Custom track due to differing assumptions, such as higher hours of operation than assumed by the Standard track.

Technical Assistance Funding. Funding for technical assistance is available to participants in order to compensate them for the labor invested in completing program forms, providing documentation, and estimating energy savings. Up to $500 in technical assistance funding is available for Standard Track projects with estimated incentives of $3,000 or greater; the technical assistance monies are deducted from the final incentive of the project. Up to $25,000 or 50% of the estimated incentive funding, whichever is less, is available for technical assistance for Custom track projects; the technical assistance funding is in addition to the project's incentive. However, projects must install at least 50% of the estimated savings from the energy analysis otherwise the technical assistance funding is proportionately reduced.

In order to participate, participants submit the enrollment form before purchasing any equipment then submit the Technical Assistance Workbook (Form 520T), and then receive a program approval letter. Once the technical assistance work is completed, the participant submits the completion document form.

Commissioning Incentives. Commissioning incentives are available up to $40,000 per project for Custom track projects, at $0.03/kWh and $0.20/therm for first year electric and gas savings. Program staff view the commissioning incentive as a method to prevent persistent deficiencies in building performance, and protecting the program investment in the installed measures. However, there has been little uptake so far of commissioning incentives, though there is a long lead time for projects to complete construction and the commissioning process. For the handful of projects that have been commissioned, the deficiencies have been identified and corrected.

Measures eligible for commissioning include the following:

- Variable lighting systems with automatic controls
- HVAC systems and controls
- Building energy management systems
- Variable capacity and efficiency performing equipment, such as chillers
- On/off time controls

Projects must have completed the Custom track after January 1, 2006 and the commissioning authority must be a licensed P.E. in Oregon. Commissioning work must meet the standard for New Building Commissioning as outlined in the ASHRAE 2003 Applications Handbook Chapter 42.

After participating in the Custom track, the participant submits the Commissioning Project incentive Workbook (Form 520CX), including the owner's signature. After completing the commissioning process, the Completion Documentation form is submitted with the following supporting information: the P.E. commissioning certification and a summary of commissioning report with a description of the systems, work performed, findings, repairs, and functional test forms. The program then verifies that control systems are installed and operating according to design specifications.

Because the program does not require commissioning for all projects, the program does consider some degradation in the annual energy savings for installed measures.

Project Review. There are two stages of project review: approval review followed by completion review. Both of these steps require the participant to complete program forms and often supply supporting documentation. Some projects wait in preparation for review because there are missing documents, such as invoices. According to program staff, obtaining all the required documents is the most challenging part of the review process. The time necessary for review depends on the complexity of the project, typically three or four weeks for standard track projects, once all of the required document have been received. The program has received better Custom track applications over the last few years as repeat participants have are more familiar with the programs expectations, thus there is less back and forth needed.

Program staff expect some level of complaints regarding paperwork. The program uses excel-based forms that can be emailed to the program, though signatures must be faxed or scanned. There is occasionally some confusion over which forms are due although there are program checklists available for participants. The PMC staff have sent out the program checklists early that has helped alleviate some of the confusion. In addition, the program participation manual has been helpful, as participants can refer to it before calling staff with questions,

Program staff report that they receive the majority of phone calls from participants after all paperwork has been received, and the participants are waiting for the check. However, the check is not approved until all the paperwork is completed and measures installed and verified. After PMC approval, Energy Trust takes about one month the mail out the check.

Data Tracking. The Fastrack system is used to track program data, including building type, size, measure type, efficiency level, and energy savings, but not contact information. The PMC staff have to request Fasttrack reports from Energy Trust that are then exported into a spreadsheet for further analysis. Goldmine is the contact management database that stores information collected from the application forms. The PMC staff use Goldmine to identify contact information.

The quality of the tracking data in Fastrack depends upon the input data, which is affected by the sometimes inconsistent data specifications that require judgments regarding building types (i.e., is a mixed use building considered retail or multifamily?) and measure types for the Custom

track. Before Fastrack was implemented in 2006, the PMC used their own tracking system, which was discontinued after Fastrack became fully operational.

Trade Allies. The NBE Trade Ally initiative was designed to promote outreach with smaller spec-built or design-build projects that are likely to participate in the Standard Track. There are approximately 43 trade allies enrolled in the program, primarily lighting and HVAC contractors. The program has considered requiring that participating architects, engineers, contractors, and consultants be registered as trade allies in order to be eligible to participate in the program This would allow the program to "certify" people who promote the program and thus maintain better control. In addition, some staff believe that the program should leverage the existing BE program trade allies, particularly lighting and HVAC contractors, and provide them with information and tools to promote the NBE program. Energy Trust is planning to hire a trade ally coordinator to oversee the management of trade allies across the various programs.

Coordination with Other Building Programs. The Energy Trust coordinates with several programs offered by the Oregon Department of Energy (ODOE): the Business Energy Tax Credit (BETC) program, the High-Performance Schools program, and the State Energy Efficient Design (SEED) program. The NBE program and ODOE staff keep in regular contact and share information on project leads, and periodically renew their partnership agreement. NBE Program staff members are available to help customers with BETC paperwork that mostly occurs for Custom projects since BETC requires an energy analysis. In addition, the NBE Program accepts SEED models as-is in order to simplify participation in both programs even though the SEED models analyze all measures interactively rather than individually.

Energy Trust program staff hope that the Northwest Energy Efficiency Alliance (NWEEA) staff can serve as account managers for large organizations, such as hospitals and universities, in order to enact energy efficient policies and programs, but that the NBE program can provide incentives for specific projects.

Staff Responsibilities. The Energy Trust's NBE Program manager spends about 90% of his time on the NBE Program and is involved in all aspects of program management, including the development of program goals, plans, budgets, and marketing as well as the day-to-day management of PMC staff. In addition, he serves as the "public face" of the program, and typically passes along participants to PMC staff after the initial contact has been made. Two other Energy Trust managers spend about 15% of their time on the NBE program, assisting in the development of program goals, budgets, and providing advice.

In addition to the NBE Program managers, staff members from various other Trust departments are also involved in the program on an as-needed basis. The planning group provides technical support in developing new measures and efficiency criteria although PMC staff are also involved in this process. The marketing department is involved in the development of program marketing materials. The legal department provides legal review and the finance department is involved in budgeting and the processing of incentive checks.

The PMC is responsible for day-to-day program management, including marketing, recruitment, administration, and technical review of projects. In addition, the PMC is responsible for program tracking, reporting, and forecasting. The PMC staff includes about ten to twelve employees located in Portland, who serve as outreach program managers, technical reviewers, and administrative support staff. In addition, several PMC employees from other offices are involved on a part-time basis and provide administrative support and technical review. Different PMC staff are assigned as the primary point-of-contact for the various program tracks in order to direct participants to the appropriate person who can work with them for the entire project.

5.1.3 Program Marketing & Recruitment

The primary target audiences for the New Building Efficiency program consists of architects and engineers for larger owner-occupied projects, and builders and contractors for smaller design-build or spec projects. For most Custom track projects, architects and engineers are responsible for building design and thus present the best opportunity for boosting energy efficiency. In contrast, the architectural or engineering role is minimal in the small design-build or spec projects, thus the electrical or HVAC contractors have a strong influence on the decisions regarding lighting and HVAC systems, respectively, for many Standard track projects.

The program also works with owners and developers, though to a lesser degree, usually through BOMA or real estate seminars. Owners are typically less involved in the design of larger Custom track projects, but often are more involved in the design of smaller Standard track projects.

The program has emphasized the Portland metropolitan region, given the location of program staff in Portland and the savvy nature of designers and contractors working in the Portland market. Thus, the program usually exceeds savings goals for PGE and Northwest Natural Gas, but not PacifiCorp and Cascade Natural Gas. In addition, the program has achieved success with larger building projects through the Custom track, again primarily in the Portland region. Due to this situation, the program embarked on a campaign to recruit trade allies and smaller projects outside of the Portland region in 2007, using a series of "road show" presentations. In addition, the PMC is planning to hire a staff member located in central or southern Oregon to better serve projects from those regions.

In order to generate leads, the program primarily relies on personal relationships with developers, architects, engineers, and contractors. The PMC staff has good relationships with most of the architectural and engineering firms that conduct the majority of the commercial new construction works in the Portland region. There are often a few repeat participants from each firm, and sometimes one person is assigned as the program point-of-contact, though the program attempts to reach out to all A/E staff in order to garner broader participation. PMC staff members regularly conduct lunchtime brownbag presentations at some of the Portland architectural and engineering firms. In addition, the program offers web-based educational and training sessions for other potential recruits.

In addition to working with architects and engineers, the PMC staff review the Daily Journal of Commerce to find leads for new construction projects, in addition to reviewing local newspaper articles, conducting internet searches, and obtaining lead lists from the BETC program. The PMC staff also maintains regular contact with past participants via a monthly program update email that includes information from partner organizations and education opportunities sent to about 250 to 300 contacts. The program has conducted some advertising in trade journals, and issued a few bill inserts.

While the program does not specifically target out-of-state firms or chain stores, there are consultants and local contractors that enroll chain store projects. One program staffer believes there is more potential to recruit out-of-state chain businesses.

All businesses are eligible for the same incentives, regardless of whether they are a chain store or an independent store, and incentives are provided for multiple chain store locations using a common design. Program staff note that most chain stores use the Standard track and represent a relatively small amount of energy savings, and that chain store designs are not always consistent.

The program is working to emphasize the financial case for energy efficiency, especially for owners who rent or sell their new buildings. The goal is to quantify the value of energy efficiency in terms of higher rents or appraisal values.

Participation. Program staff believe that customers participate for a variety of reasons. Some participate due to a desire to be sustainable/green, others are motivated to achieve recognition, and others want a better and more comfortable building. Program staff believe that the standard track projects are usually more motivated by the incentive funding, while owners of custom track projects are typically more interested in constructing a sustainable building. While the actual incentive dollars are relatively small for large projects, the program does validate the energy savings and the technology, and prevents the value engineering out of efficiency measures.

According to program staff, very few participants drop out of the program after initially enrolling; mostly this occurs when a construction project is canceled or suspended. In a few situations, participants did not want to conduct an energy analysis for a Custom track project or they did not purchase equipment that met program efficiency criteria.

5.1.4 Identifying the Appropriate Energy Trust Program

All of the Energy Trust commercial building programs operate under the umbrella 'Business Energy Solutions' brand. Different criteria are used to determine whether a project should participate in the NBE program, the Building Efficiency program (BE) for existing buildings, the Production Efficiency (PE) program, the multifamily homes program, or the ENERGY STAR New Homes program, as discussed below. While PMCs were initially reluctant to pass projects to a different program, this communication has improved over time, especially between the NBE and BE programs.

- *Existing Buildings Program.* All commercial new construction falls under the auspices of the NBE Program, although renovation projects may qualify for the either the BE or NBE program. Renovation projects are allocated between the BE program and the NBE Program using the "two-systems" rule, under which projects that modify two or more systems (i.e., lighting, HVAC, etc.) fall under the NBE Program and those that impact only one system fall under the BE program. There is concern among some staff that participants may phase their projects in order to qualify for the richer incentives available through the BE program, which uses existing equipment levels, rather than Oregon code, as the baseline.
- *Production Efficiency Program.* This program handles projects related to manufacturing processes, equipment, systems, and air compressors in industrial buildings. For joint projects, the NBE Program handles the shell and non-process systems, such as lighting and HVAC, while the PE program covers the industrial processes.
- *ENERGY STAR New Homes Program.* The NBE Program serves multifamily projects 4+ stories high and the ENERGY STAR Homes program serves those less than 4 stories, though the distinction is less clear with mixed-use projects.
- *Solar Energy Program.* Both NBE Standard and Custom track projects may include solar photovoltaic and solar hot water measures; the incentives depend on project type, location, and cost.

5.1.5 Quality Control

As discussed earlier, the PMC staff review all applications for completeness, conduct a technical review of Custom track energy models for reasonableness, review cut sheets and invoices to ensure that equipment meet efficiency ratings, and conduct site inspections at all projects that receive over $10,000 in incentives in order to verify equipment quantities, serial numbers, efficiency ratings, and control set points. For LEED projects, there is less internal review since the USGBC conducts their own review. Before incentive payments are distributed, there are typically four levels of review – three reviews at the PMC and one by the Energy Trust program manager. The PMC submits quarterly quality control reports to the Energy Trust program manager regarding program processes, checklists, and related issues.

By and large, the site inspections do not uncover problems with projects as participants will usually notify the program of any changes in advance. However, occasionally the inspector finds equipment, such as motors or lighting that does not meet program requirements. In these cases, the incentive level is reduced by the appropriate amount.

Baselines. Oregon energy code (or an equivalent) is used as the baseline for all projects, though this may be modified depending on the situation. For example, because residential HVAC units of 5 tons or less are required to meet SEER 13 and the manufacturers use the same platform for producing commercial units, there is greater availability of SEER 13 units for commercial applications. Thus, the program incentives for SEER 13 HVAC units has been discontinued because common practice exceeds code.

In order to adjust for the fact that LEED uses ASHRAE 90.1 as the baseline (which is below Oregon code), the program derates the estimated LEED energy savings by 15% for LEED 2.0 projects (ASHRAE 90.1 2001 is baseline) and by 5% for LEED 2.1 and 2.2 projects (ASHRAE 90.1 2004 is baseline). For ENERGY STAR projects, the program estimates that a target finder rating of 60 is equivalent to Oregon code, and projects must earn a 75 or higher in order to receive incentives. Although SEED projects are required to exceed code by 20%, the baseline is set at code because the SEED projects do not receive other state funding to meet the 20% requirement.

Program staff are not concerned that program incentives are being used to help buildings meet code, as all Standard track measures exceed code and the measures approved within Custom track measures are required to individually pass measure screening tests then, using a rolling baseline, collectively pass cost-effectiveness tests as a group. If the sum of the individual measure savings exceeds the combined measure savings by more than 10% then the estimated program savings is reduced by that amount.

Free riders. Program staff expect that there will be a natural level of free-ridership and spillover and consider it part of the "noise of the market". They expect more free-ridership in the Portland market because the architects, engineers, and developers are savvier regarding energy efficiency than those located elsewhere in Oregon. In addition, they expect less free-ridership in the small/medium market due to less familiarity with energy efficiency. Program staff prefer to encourage projects to be more efficient by offering a consistent, fair program rather than acting as "energy cops" and penalizing them for "doing something good.

However, the program does require a project notice form where the owner affirms their intent to be energy efficient. This form serves to exclude those projects that apply to the program after already purchasing equipment.

5.1.6 Program Strengths and Weaknesses from Perspective of NBE Program Staff

NBE Program staff mentioned a variety of program strengths, including a market-oriented, flexible program that offer multiple program tracks to meet the needs of different types of projects and clients. In addition, others cite the fact that the program works within the existing market structure for building design; an example is aligned program requirements with LEED program and SEED requirements.

Other staff cite the knowledgeable, non-complacent program staff who work together collaboratively to develop new program offerings (such as LEED and ENERGY STAR). Others note the success of the program in reaching out to architects and engineers, and the high visibility of the program in the market.

Program staff mention a variety of areas where they believe the program could be improved. Below is a summary of these issues.

- One staff member cites the absence of small building projects in the program, though this issue has since become the focus of a program outreach campaign. Another staffer also mentions the lack of trade allies as an obstacle to reaching small projects. These small projects may be less cost-effective due to the lower energy savings per project and their location being outside of the Portland metropolitan area.
- One staffer mentions that the "two systems rule", which distinguishes projects between the NBE or BE program, is confusing to the market and not always straightforward to apply.
- Program staff also mention that forecasting is challenging, given the difficulties in predicting the market, especially far into the future.
- Budget constraints force a choice between spending resources on closing out current projects versus conducting outreach to recruit new projects. Staff believe the program could achieve more savings with a greater budget.
- The program is restricted in its ability to integrate market transformation into its efforts, thus the program is limited in sponsoring training and educational events.

While the program has borrowed some hospitality measures from the BE program, some program staff believe that the NBE program should also borrow the BE strategy of targeting market segments, such as restaurant, retail, etc with tailored packages of measures. Energy Trust has reviewed prescriptive measure packages available from the Bonneville Power Authority. In addition, Energy Trust is working with the New Buildings Institute to develop Oregon-specific measure packages that exceed Oregon code by fifteen percent, though there is some concern that this level is not sufficient for the program. Another suggestion is to adopt, from the residential program, new appliance measures and CFL packages for multifamily buildings.

5.2 PARTICIPANTS' PERSPECTIVES ON NBE PROGRAM

This section addresses the following topics.

- A characterization of participation in the program for 2006-7 based on an examination of records received from the Energy Trust of Oregon.
- An examination of program operations based on in-depth interviews with twenty-two participants including owners, trade allies, vendors, and others.

5.2.1 Program Awareness

Participants and non-participating trade allies reported that many of their clients became aware of the program because of their efforts. Among trade allies and vendors, slightly more than half stated that a majority of their clients learned of the program through their sales efforts. This was probably truer of trade allies dealing with smaller customers than design professionals. Design professionals reported that many of their clients came to them with energy efficiency and the Energy Trust already in mind, especially local clients; the out-of-state clients are, not surprisingly, less familiar with the Energy Trust programs. Several respondents commented that energy efficiency (the environment or climate change) was in the air and customers were looking

for ways to respond. One design professional estimated that 20-30 percent of his customers were aware of the Energy Trust programs prior to their contacting his firm. He estimated that in prior years as few as five percent of the customers were aware of the Energy Trust programs.

Nearly all design professionals and vendors say that they recommended upgrades to all of their clients, but several stated that these recommendations had little effect. The design professionals indicated that customers who actually install efficient equipment come to them with the idea that they are going to do energy efficiency. Some design professionals include Energy Trust incentives (along with other efficiency program incentives, if applicable) in their cost proposals, while others say they simply mention the availability of efficiency funding in their proposal or after starting a project. This approach depends on the level of sophistication of the client, as well as how cost-competitive the project is, as the inclusion of efficiency measures typically increases overall costs. One designer who is experienced with the program reports that his organization developed an in-house spreadsheet to estimate Energy Trust incentive amounts based on the type and quantity of measures installed.

The design professionals and some vendors report that customers initiating and successfully completing their first project will return for their next project (replication). One of the trade allies reported that he is able to sell second and third projects more easily.

Some vendors and trade allies, especially those working with the smallest customers, reported that that their customers typically come to them to do simple projects and that they are able to convince them to make the efficiency upgrade.

None of the owners with whom we spoke reported trade allies or design professionals as making them aware of the Energy Trust. Several respondents reported that the Pacific Power and Light (PPL) representative was quite active in promoting the program. Apparently, PP&L representatives involved in design and provisioning of services at commercial sites tell owners about the program and press them to check it out.

One owner said the he learned of the program through information outreach from the Energy Trust of Oregon and another had heard of the program while at a different job. Most of the participants implied or stated that they felt the Energy Trust does a good job in getting the word out even though there is only minimal direct marketing.

When making suggestions about how the program might be improved, one respondent suggested greater use of media, and others suggested working with trade associations or unions to reach the contractors. However, most respondents reported that it was the one-to-one contact that made the difference. At this point, we do not have data on the awareness levels of non-participants.

5.2.2 Program Tracks

As noted above the program includes four tracks: standard, custom, Energy Star, and LEED. A review of the participation data suggested that sixty percent of the projects were standard, twenty-nine percent custom, there were no takers for the Energy Star track, and just six takers for

LEED. As noted above the low level of participation in LEED may be a function of the 12-month occupancy period before certification.

Professionals who work with the program on a regular basis were clearly aware of the tracks and their differences, though one respondent says that "deciding which track [to pursue] was an issue, we had to figure out which track brings the most dollars."

However, when we talked with owners, facility managers, and even some vendors, such as electricians who participated in the program (especially those who have others to do paperwork), we found little awareness of the tracks. With some of the owner participants, we had to describe the tracks before they would hazard a response regarding the track that they were using. Even then, some were not clear about which track their project had used. While the categories are important for incentive administration, it appears that there is less interest and awareness of the tracks beyond the requirements for obtaining incentives among most participants.

Standard Track. Sixty-six percent of Energy Trust's projects were processed through the standard track. In general, the commentary on the Standard track was positive and there were few complaints other than for the paper work involved. Various professionals and vendors repeatedly told us that they elect the Standard track because of the simplicity of administration (see the section concerning paperwork). Because of its simplicity many participants said they would elect the Standard track over other options.

Custom Track. The Custom track was the second most common option. In general, the firms that used this option were architectural or engineering firms that were installing unique technologies that were not covered by the prescriptive program. As noted above, several participants told us that the Standard track is used in preference to the Custom track because of the labor cost involved in developing the required energy modeling. A vendor who deals in infrared systems reported that he sells two types of systems, one that qualifies under the prescriptive track and a second that qualifies under the custom track. He said that they usually file under the standard track because the additional incentives do not justify the additional labor investment.

One respondent lobbied strongly for including LED's in the Standard track. He reported a CFL that uses twice the energy of an LED lamp gets a higher incentive in the Standard track then an LED lamp in the custom track program.

Two respondents complained about the length of time required to review the energy models. One said that there was a lot of back and forth over the appropriate baseline conditions and the other said that the response time was so long that he forgot the details of the model.

One respondent said that the "Custom track is more convoluted [than the Standard track] regarding information requirements and schedule. I learned a lot the first time through [the Custom track], it would be a lot easier the second time." Further, he said that "it's hard to obtain incremental costs for lighting" because we "have to do two different designs, because the change

in the number of fixtures due to different lumens, and the contractor has to price out both options."

Energy Star. Questions about the Energy Star track largely resulted in long pauses. There seems to be little interest in this option in the commercial new buildings program. Only one interviewee participated in the ENERGY STAR track, and he learned about the track after being contacted by program staff regarding a completed building. He reports that the ENERGY STAR track resulted in a few more questions for program staff than the Standard track, but was generally similar to other programs in terms of the level of effort required.

We would recommend that this track be dropped although for political reasons it may be important to retain it. Energy Trust may want to consider making it a subprogram under the Custom track in order to reduce its visibility thereby reducing the confusion among participants regarding the different program tracks.

LEED. While there were just six LEED projects in the evaluation timeframe, LEED was very much at the center of the discussions that we had with several informants. There is a high level of interest in LEED among architectural and some engineering firms. Many firms in the Northwest are promoting green buildings and LEED. This interest of design professionals in LEED clearly appears to stem from the reputation of LEED buildings being high quality buildings and the reputation that a firm gains within the community and with clients and peers from doing LEED projects. This is not lost on the customers and can be both a positive and a negative. One of our owner respondents commented that his "architects, like most architects, are more interested in winning awards for design and aesthetics than in being efficient."

One representative of an engineering firm with whom we spoke said that his firm had worked on six or seven LEED certified buildings over the past year and that the firm was involved in commissioning three of those buildings. One of those was a high gold building, a second was gold, and the remainder was silver. This same respondent reported that they potentially have three additional buildings in the pipeline. Another design firm reported that about 10 to 15 percent of their buildings meet LEED standards and that they have LEED certified professionals within the firm. Note that he says the buildings meet LEED standards. He did not say that they were LEED buildings and that they were LEED certified.

The cache of LEED buildings also appeals to owners. Design professionals report that there has been an increase in inquiries about LEED from prospective clients within the last six months to a year. They attribute this to the high levels of coverage of LEED in the media. One respondent reported that many clients are asking about LEED and that recently many have asked for buildings with LEED performance characteristics but not for the certification. Clients appear to be aware of the cost of LEED and are asking for the attributes without the costs associated with achieving certification.

While there is interest in LEED, implementing LEED is another story. Some design professionals told us that they discourage LEED because of the costs unless the owner feels

strongly that they want and can pay for the label. The costs are incurred in applying for the LEED certification and the costs of the modeling that is required to support the application. There may also be incremental equipment costs but these are viewed as less of an obstacle.

We encountered one owner, who we believe was discouraged from pursuing LEED by his architectural firm, that persisted with the project and who in the end received few incentives and is very embittered about the Energy Trust program.

One professional indicated that the costs for LEED could be above $150,000 for a large and complex building. Some owners said that they considered LEED but were discouraged because the incentives would just barely cover the cost of the certification and little of the incremental cost of the equipment. A very knowledgeable and sophisticated facilities manager at a local school district said that he had decided against LEED because it would cost $50,000 and the money would be better spent on additional measures. He reported that he went through the LEED lists and that they were helpful and gave him ideas when designing his building. His assessment was that all of his new buildings probably come in at a silver or gold level. A facilities manager at another institution reported that if voters approve a pending bond issue, he expects to develop a LEED gold building for his campus. Finally, some of the design professionals told us that they were either asking for or were being asked for buildings that are built to LEED standards.

The one participant we interviewed who had participated in the LEED track says that the project initially applied under the Standard track, then a program staff member contacted him to inform him that the project could earn more incentives through the LEED track, so the project switched tracks. He reports that his clients' peer institutions were constructing LEED certified buildings, and so they were interested in sustainable design. He mentions that the LEED track has fewer documentation requirements than does the Custom track but more than the Standard track, and thus seemed relatively straightforward.

Another respondent who has considered applying for the LEED track says that the track is not clear in terms of how it calculates energy savings, saying, "how occupancy and square footage affect the bottom line in terms of incentive dollars is not transparent." He also says that "combining the Custom & Standard tracks provides more money than the LEED track; it only costs a couple thousand more and can earn much more in rebate dollars."

These findings suggest the following:

- Customers and professionals seem to prefer the standard track because of its simplicity and low cost.
- Energy modeling required for custom projects and especially, LEED and the cost of certification, can be a disincentive to participation in the Custom and LEED tracks. In these cases, some customers default to standard track incentives.
- Owners are interested in LEED because of media coverage and because of the status that it confers.

- Many owners ask for the energy benefits of LEED without the cost.
- The Energy Star option is being rarely used and should perhaps be dropped as an official track. Doing so would help to reduce the confusion regarding the tracks.

The Energy Trust may want to simplify the program by offering just two tracks, standard and custom. The custom track would target three types of customers. Customers with unique applications, such as ammonia based refrigeration that requires special calculations, customers who want to construct buildings with LEED level performance standards but who do not want to pay for LEED certification, and customers who want LEED certification who can submit the documentation from the LEED application in support of custom incentives. The program should perhaps be marketed in just that way.

5.3 DECISION-MAKING

An important aspect of the interviews with participants in the NBE Program was to address the decision-making regarding new construction projects and participation in the NBE program. The results of the discussions regarding decision-making are presented in this section.

5.3.1 Role of Financial Incentives

During the interviews, the role of financial and other types of incentives was a recurring theme across the interviews. Many firms and organizations reported the incentives to be an extremely important aspect of the program.

Financial incentives can influence decisions in different ways. They can serve to call attention to energy efficiency, they can influence a decision by reducing first cost and thus improving the return on investment, or they may play no role at all. The representative of one engineering firm observed, "the incentives have certainly been a catalyst in getting energy efficiency done. Incentives allowed us to enter markets that we might not have entered." Another trade ally stated that incentives are "critical in order to get people to break from doing what they have always done and are comfortable with". In his experience, clients are unwilling spend money on new technology without guarantees and incentives.

Several customers suggested that they would like to see higher incentives. However, it is unclear to what extent higher levels of incentives would drive the market. One designer suggested that most customers want a 12-15 percent return on investment and that the incentives should just cover the gap between the return on investment at those levels and the return without incentives.

When talking to school districts and government entities, incentives seemed to play an important role. All of these respondents want to be green but because of competing investment opportunities and lack of available funds, some projects would not be funded without the incentives. Several individuals talked about value engineering and cutting costs from project. In these cases, respondents indicated that the efficient equipment remained in the project because of the financial incentives. One of the respondents from the public agency (a community college)

talked about a five year return on investment while another (public school) suggested that anything that would return its cost within 12 years would be acceptable.

Some respondents were somewhat emphatic that incentives were not necessarily a panacea. One trade ally stated, "because the Energy Trust profile has risen, customers believe it is important." According to him, approximately 30 percent of customers do not seek rebates for which they are eligible. BETC tax credits are also not always sought because the reward is not worth the effort. A very large warehouse project for a large national retail chain was cited as an example. The trade ally initiated the project with the retailer's corporate office when he heard they were considering building in Oregon and mentioned Energy Trust and BETC. The company eventually decided to apply. There were some difficulties in getting the contractor to install the correct equipment rather than equipment that did not meet Energy Trust requirements. The engineer stepped in and got the contractor to install the correct equipment. After all of that, the vendor reported that it was "like pulling teeth to get corporate headquarters to sign the paperwork to get the $80 - $90,000 incentive. They did not appear to really care about the incentives." This trade ally suggested that this perspective applies to many large retailers (See the section on large retail).

One small business owner had similar feelings about incentives. He was more interested in being green and trying to obtain a LEED certified building. Because public awareness on energy efficiency and green marketing have much higher profiles, the energy efficiency was more important then the small rebate he would receive.

5.3.2 Decision-Making for Smaller Commercial Customers

The vendors who work with small customers talked a lot about how small customers respond and make decisions. They reported that small customers tend not to be interested in efficiency. One vendor suggested that, unlike consumers that are interested in efficiency, small commercial customers have to deal with numerous vendors and the energy efficiency message does not get through or as a result of having to deal with multiple vendors efficiency is not being implemented.

Vendors report that they may talk about energy efficiency with the same customer over the course of several jobs and several years before the customer is willing to undertake an energy efficiency project. According to the respondents, small customers tend to be highly risk averse. As one vendor put it, they tend not to be interested in new technologies whose performance characteristics may be suspect or that they do not understand. Reliability and low maintenance are important to small customers.

Smaller customers also appear to be somewhat wary of offers and programs. One vendor reported that an important function of the Energy Trust website was to allow customers to verify the program and to give credibility to what he tells customers.

The vendors, as opposed to engineers, architects and designers, tend to report that the incentives are essential to getting small customers into the program.

One vendor argued that in order to overcome this risk aversion and to encourage small commercial firms to accept energy efficient equipment and participate in the program, decision-makers need to physically see the effects of the equipment. He then proceeded to suggest how an element of the program might be designed to do this. He suggested vendors be allowed to install a few products, such as lights, so that a customer could get a feel for how they look and feel. More than one vendor indicated small firms tended to want better lighting and were willing to consider something when shown that there were better lighting solutions.

Secondly, and most certainly in reference to BETC, he suggested that the incentives need to be provided at the completion of he project which he believes would increase the level of investment. Tax credits spread over several years do not excite smaller firms.

Thirdly, he suggested that incentives be handled through a single point of contact, especially for small customers. For small firms dealing with multiple vendors, the incentives may come from multiple sources. His point is that small firms are quite sensitive about making sure that the actually get the incentive and they have less interest when there are multiple sources. Perhaps assemblers are needed for small customers with multiple measures.

These points are well taken. Decisions are far more complex than simply finances, although finances may be the excuse for avoiding a decision. It is an established principal of marketing that being able to try something and see its effects is a powerful incentive to adopt a technology or practice. Energy Trust might consider ways to create such demonstrations either at customer sites or in close proximity to the customer's location. A single replacement of a high bay light or temporarily wiring occupancy sensors in one aisle of a warehouse might be enough to convince an owner to adopt. A warehouse operator would be quick to recognize both the savings from the occupancy sensor and the potential for increased security.

A second well established principle of marketing is to reduce complexity and/or increase simplicity. Both the second and third points speak to the issue of complexity.

The important point in this section is that financial incentives are important for small firms but there are other factors that may be equally or more important that may influence adoption as well. Reducing other types of risks are important and allowing the customer to try, observe, and assuring the simplicity with respect to the technology and decision path is important as well.

5.3.3 Decision-Making for National Chains

National retail chains were among the most frequent users of the program. A single firm that specializes in rebate administration represents many of these chains. In the 2006-7 Energy Trust of Oregon program, this firm procured incentives for 24 projects for 10 national chains.

This firm currently serves between 50 and 100 national retail accounts. The firm divides its operations in terms of tracking utility programs, obtaining rebates for its clients, and other activities. This firm maintains data on incentive programs at utilities or public goods charge agencies in 37 states.

A representative of the firm agreed to be interviewed concerning national chains. This was perhaps one of the most significant interviews that we conducted. While this is just one interview, the findings from this interview are very consistent with the findings from interviews of a dozen or so national chains that we have conducted in the last two years for other projects. Thus, we are confidant that what is reported below reflects the situation in the national retail chain market.

Most incentive programs require a pre-application and then a final application. This firm periodically meets with its clients to review projects that are in the pipeline. When a new project is identified, the firm assembles a pre-application two months prior to the project start date. The firm would like six months of lead-time but that is often not possible.

Large retailers base their projects on a corporate prototype. The prototype is usually designed and maintained by an external architectural design firm. Prototypes are typically updated every one to two years. For some retailers the prototype is the "last store that was designed." The prototype typically leads construction by a year. Our respondent pointed out that changes to the prototype are usually well considered and changes, even in response to incentives, are not made on the fly.

The prototype incorporates the aesthetic as well as the equipment specifications. If the specifications exceed the requirements of the utility offerings, then in essence the chains are free riders. The rebate administration firm reports that it makes an effort to review the retail chain prototypes and suggest areas where efficiency improvements can be made. According to the rebate administration firm, they do make recommendations but more often than not the recommendations are not accepted.

In the past, the rebate administration firm has been able to file an application based on the prototype but more recently organizations offering incentives are requiring detailed drawings.

National chains are receiving rebates for HVAC systems, VFD's, and energy management systems. Some rebates have been received for lighting especially when there have been opportunities to change from T-12s to T8's or in re-lamping situations where 28W T8's have replaced 32W T8's. However, many retail stores have already switched to higher efficiency fluorescents.

More could be done. According to the rebate administrator, lighting power densities for retail lighting are consistently at 1.7 or 1.8 watts per square foot. Most efficiency programs start incentives at about 1.5 watts per square foot. The rebate administration firm reported that they are unable take advantage of lighting and advanced design programs for store prototypes because of the limits imposed by merchandizing.

The key to this is decision-making. Facilities engineering in retail chains can propose changes to the prototype but changes have to be approved and merchandising can exercise veto power. It is merchandising that determines the aesthetic. So, while a CFL might replace an MR16 halogen

bulb, merchandising makes the call. From other interviews, we have learned that retail chains are a classic example of diffusion of innovations. The chain becomes aware of a technology, they gather information, they decide on a pilot, they implement the pilot, they evaluate the result, and then they either reject or adopt the practice and incorporate it into the prototype. Merchandising plays a key role in this decision process. Merchandizing trumps efficiency.

Retail chains are increasingly installing and using EMS systems. Third parties are installing many of these systems. These third parties provide the chains with general estimates of the savings but do not have the capability to provide the detailed calculations that would allow the systems to qualify for incentives. Thus, the chains are unable to take advantage of incentive offers for advanced systems.

The rebate administration firm reported that most chains are now monitoring their stores. This report is consistent with the findings from other interviews that we have conducted. The systems are of varying degrees of sophistication even at the chain level with some stores having advanced fully automated systems and others with more rudimentary data collection and communication capabilities. These systems are being used to manage conditions in stores, dispatch maintenance, and control systems at strike prices for demand response. From the vantage of the chain stores, the central systems relieve store managers of a set of responsibilities allowing them to focus on managing the store rather than managing the facility. It also allows merchandizing to control the environment within the store to attain desired ends for customer behavior and comfort.

Thus, the key findings for national retail chains are that:

- The prototype is the key determinant of what can be installed.
- A third party, such as the rebate administration firm, can have some influence (usually somewhat small) by pointing to opportunities for potential improvements in prototypes across a wide program base although the recommendation is vetted by the national chain.
- A financial incentive is unlikely to change the specifications for a given store although a financial incentive broadly offered by many utilities may result in an upgrade to a prototype.
- Chains are increasingly installing and using advanced monitoring capabilities
- Chains are often unable to take advantage of incentives for EMS systems because third party suppliers provide general rather than specific information about savings.
- There is substantial opportunity still to be realized with retail chains especially in the lighting arena.

The respondent at the rebate administration firm indicated in the past that the incentives were largely seen as extra credit or free money. With the recent increase in energy costs, tighter capital markets, greater attention to the bottom line, and customer interest in green, retail chains are beginning to take a closer look at their prototypes and to incorporate green and/or energy efficiency and to reference it in their marketing and merchandising efforts.

From a program standpoint, these findings suggest three important points:

- National retail chains need to be engaged at the national level. This is needed both from the standpoint of efficiency and monitoring. This will require collaboration with utilities, other state and regional efficiency organizations, organizations such as CEE, ACEEE, and government agencies such as DOE and EPA.
- Secondly, engagement needs to be with facilities engineering, but more importantly, it must include merchandizing. Examples of strategies that might work would be to engage merchandizing and the house architects in advanced retail lighting design projects. The timing for this may be fortuitous because of the emergence of LEDs and the opportunities to create new aesthetics and significantly reduce maintenance. Another strategy may be to work with most of the large retailers to do a pilot program in one of their stores. A third strategy is to conduct a needs assessment and train merchandisers.
- Finally, incentives in retail chain stores do not appear to have been "buying efficiency" but their availability serves as a reminder about efficiency and may stimulate efforts to make prototypes more efficient.

5.3.4 Vendors Who Are Not Trade Allies.

The vendors who are not listed as program trade allies either were unfamiliar with the trade ally program, thought there was no reason to pursue becoming a trade ally since they are already working with the program, or they were a design professional who believed the trade ally program was intended for contractors. All would become trade allies if required as a precursor to participating in the program.

5.4 PAPERWORK REQUIREMENTS

By far the most common concern that surfaced during the interviews was that of paperwork. The most common suggestion for improving the program was that paperwork should be simplified. Some caution is needed because the paperwork requirements have changed since beginning of the evaluation period and changes to requirements were also made prior to that. Respondents tend to have long memories for the anguish of paperwork and will typically report issues with paperwork in the early stages of a program even though changes have been made to the filing requirements.

One of the vendors we interviewed indicated that he had dropped out of the program because of the paperwork requirements and only just recently rejoined after the requirements were simplified. Contractors observed that it was not only the cost to them of doing the paperwork but also to the cost to the customer for what is sometimes a relatively small incentive. One interviewee suggests that Energy Trust "should review the costs of participating versus the incentives obtained, as consulting firms charge hourly rates and additional labor hours cost the owners more; the incentives need to justify the expense." Another respondent reports that it is more difficult to collect invoices and receipts from subcontractors in large projects.

Respondents indicate that small customers do not have a lot of time and are not particularly interested in reporting information about their business to others. Also, vendors may not do applications frequently so that they have difficulty remembering from one time to the next how to complete the application.

This contractor and two other contractors reported that paperwork was now being handled through third parties, in two cases through what appears to be a distributor who supplies them with equipment, and in a third case by a vendor operating on behalf of the Energy Trust. All three of the respondents indicated that this was working well. They are able to do the installations and the larger entity with more resources is able to handle the applications more easily. However, one design professional sees a business advantage in the program application process, he says that the "additional revenue from clients for coordinating with programs is worth maybe $5,000 to $10,000."

Also, customers do not tend to distinguish between paperwork required by the Energy Trust of Oregon and the Building Energy Tax Credit Program. When we asked about paperwork, some respondents immediately began to discuss the paper work associated with BETC. Those who did make the distinction between BETC and Energy Trust indicated that the Energy Trust paperwork had become much simpler and basically thought that the paperwork for the prescriptive program was reasonable.

Three different respondents discussed the BETC paperwork in some detail. They reported that their accountants did not understand the paperwork and that the respondents were called upon periodically to recall details of the implementation, for instance, why a motor had been changed from one model to another. They were seeking the tax credit because the amounts were substantial but they clearly were not happy. One respondent claimed to have spent 100 hours internally tracking information and then hiring a consultant for $2,000 to complete the filing.

We have not fully investigated the nature of the BETC paperwork and BETC requirements. However, it does seem that the Energy Trust and the State of Oregon might work together to significantly reduce the paperwork for the BETC program. We recognize that this might require legislative action and might be a slow process.

The Energy Trust got high marks for customer assistance with applications. More than one customer mentioned both the technical and administrative assistance they received from SAIC and RHT. Several customers specifically singled out Anne Wagner for her assistance. In general, respondents reported that the Energy Trust was responsive to inquiries although at least one respondent noted that the telephones might go unanswered for days.

We believe that the Energy Trust is making good progress on paper work requirements and should continue to examine its paperwork requirements and alternative ways that it can meet its fiduciary responsibilities.

5.5 TRAINING, WEBINARS, AND MANUALS.

One of the purposes of the interviews was to get an understanding of customers' receptiveness to Energy Trust training sessions and webinars. Roughly half of the respondents stated that they had attended either a live training session or participated in a webinar. Those attending Energy Trust's live sessions found the information to be very useful particularly with respect to addressing paperwork issues. One respondent stated that going into the training session he was under the impression that the paperwork for program participation was overwhelming. He was pleasantly surprised to learn that the paperwork load had decreased and was much more manageable. Several found even more value in the networking opportunities with other professionals. The on-site training sessions may serve as a breeding ground to help create alliances among vendors.

Those that participated in the webinars also found them useful but were less enthusiastic. This may be due to the lack of a social component. One trade ally suggested expanding the length of the webinars. He did not feel that enough information could be relayed in the hour that the webinar lasted.

Only a few respondents indicated that they used or were even aware of the participant manual; they reported that they referenced it when the first participated in the program, but now simply call program staff to answer their more detailed questions. Many of the respondents had others filling out the paperwork, so there may have been little need for them to know about the manual. It appears that many trade allies and owners are deferring paperwork and Energy Trust interactions to program contractors or other firms such as distributors who may have more involvement with Energy Trust.

5.6 MARKET EFFECTS

A number of respondents, particularly the owners, reported market effects. For example, the representative for a food processing company that participated in the program reported that management has now agreed that energy efficiency is the policy of the company. She said this is consistent with their mission statement that includes statements about being a low carbon company. She said that she was not aware of a formal policy but it was reported that the company now intends to install efficient equipment. As evidence that it has made a difference, the respondent indicated that she has a wish list of projects and that the company is now exploring similar projects in California, both for the energy and the non-energy benefits.

In an earlier section, we reported that a national retailer was not aggressive in seeking the rebate and that the vendor had to work with the company to get to it file an application. The rest of that story is that the infrared heating system that was installed was the first of a kind for this company in its warehouses. The vendor now reports that infrared heating is the company standard in warehouses (replication).

In a third example, a community college that participated in the program is now planning future construction to be energy efficient and may pursue a LEED gold building.

As reported in a previous section, more and more customers and clients are asking about Energy Trust programs. Finally, the vendors working with small commercial customers report that these customers are returning for repeat projects (replication).

5.7 FINDINGS AND CONCLUSIONS

1. The program has evolved nicely over the last five years. The program managers have exhibited a pattern of observing customer response to the program and adapting the program to make it more effective. Customers have noted and commented positively on the changes to the program.
2. The program has communicated effectively with potential customers. One-to-one communication and word-of-mouth communication by participants has been an effective marketing strategy.
3. With the exception of one customer that had a bad experience, the customers with whom we spoke indicated that overall they were satisfied or very satisfied with the program.
4. The major complaint with the program has to do with the paperwork. While the paperwork is consistent with the Energy Trust's fiduciary responsibilities, many customers find it difficult. This is particularly true of the smaller trade allies. The Energy Trust has made some adjustments in the paperwork that have been noticed by the participants. In addition, some of the smaller trade allies have been adaptive and work with their distributors or others to complete the paperwork.
5. The program has four tracks: standard, custom, LEED and Energy Star. The standard track is the most used followed by the custom track. The LEED track has been used six times and the Energy Star track not at all based on the records we reviewed; although, one participant said that he had been switched to the Energy Star track. There may be more LEED projects as LEED projects complete the required year of operation for LEED certification.
6. The system of tracks may be important for administration but there is neither interest nor widespread awareness of the tracks among clients.
7. The track system could probably be simplified and reduced to a two-track system of standard and custom and the LEED and Energy Star tracks incorporated into the custom track.
8. Several respondents indicated that they preferred the standard as opposed to the custom track because of the simplicity and the cost of documentation for the custom or LEED tracks.
9. There is widespread interest in LEED but because of the costs of LEED certification may customers are asking and many design professionals are suggesting that projects build to LEED standards or to the most efficient standard that the customer can afford.
10. Financial incentives played different roles. Several participants suggested higher incentives. For some participants, especially large customers and national chains, there were indications that incentives may not have made much difference. For public entities, there were instances

where incentives appeared to be the difference between installing the measure and having a measure value engineered out of a project. The relationship between incentives and participation is not a linear function but rather more like a step function.

11. For smaller participants there was a lot of discussion of risk. Smaller customers are particularly anxious about trying technologies that might fail. It was suggested the program might install samples at smaller locations to demonstrate the value of the equipment. This is consistent with good marketing practice.
12. For national retail chains:
    - The prototype is the key determinant of what can be installed.
    - A third party, such as the rebate administration firm, can have some influence (usually somewhat small) by pointing to opportunities for potential improvements in prototypes across a wide program base although the recommendation is vetted by the national chain.
    - A financial incentive is unlikely to change the specifications for a given store although a financial incentive broadly offered by many utilities may result in an upgrade to a prototype.
    - Chains are increasingly installing and using advanced monitoring capabilities
    - Chains are often unable to take advantage of incentives for EMS systems because third party suppliers provide general rather than specific information about savings.
    - There is substantial opportunity still to be realized with retail chains especially in the lighting arena.
13. The Energy Trust needs to work with others to engage chains at the national level.
14. Such national engagement of chains needs to focus on both engineering and merchandising.
15. Training and webinars were positively received. The manuals were largely unused.
16. There were some dramatic examples of market transformation, mostly replication effects. The Energy Trust may want to examine these effects in future studies. These studies should focus on replications, emulation, incidental efficiency, sustained behavior, and cultural change rather than spillover of which the preceding are a subset.

6. COMMERCIAL NEW BUILDING MARKET IN OREGON 2004 TO 2007

This chapter discusses the commercial new building market in Oregon during 2004 to 2007 and provides a characterization of the NBE program's participation in that market.

6.1 OVERVIEW OF NEW CONSTRUCTION IN OREGON

In order to gain an overview of new construction in the State of Oregon, we obtained FW Dodge Players Data for the years of 2004 through 2007. This data allows us to examine all construction projects exceeding a value of $100,000 for which a building permit was filed. The providers of the data claim that they capture 97 percent of all construction projects including many blow the $100,000 limit. The data do not capture replacement projects where a permit was not required. The data capture data when a permit is filed. The data do not capture project completions well. Therefore, it is difficult to determine what projects are in process at any given time. Thus the analysis is an analysis of the composite data form 2004 through 2007.

For most projects the following information is collected:

- Location and name of the project
- Sector (manufacturing, health, schools, etc.)
- Size in square feet
- Value
- Type (new construction, additions, etc.)
- Stage of construction when last updated
- Type of owner (private, municipal, federal, etc.)
- Information on all of the players involved (name, address, job function, etc.)

During the four years of data collection, 3,345 nonresidential projects consisting of new construction and/or additions were recorded. Another 1,435 nonresidential projects consisting of alternations or renovations were also documented. The total value of all nonresidential projects was $8.8 billion and included a little over 60 million square feet. However, the cost field and the field for square footage have significant amounts of missing data. Thus, these estimate are likely an underestimates

New construction projects occurred in all 36 of Oregon's counties. Most of the projects occurred in Multnomah County (951), followed by Washington County (483), Lane County (435), Marion County (388), and Clackamas County (279). The number of projects in all 36 counties along with project value can be seen in Table 6-1. Many projects did not have square footage associated with the project so that data is not included in the totals.

Table 6-1. Value of New Construction / Addition and Alternations / Renovations in 36 Oregon Counties 2004 – 2007

County	***New Construction / Additions***				***Alterations / Renovations***			
	#	***Median Value (000s)***	***Max Value (000s)***	***Total Value (000s)***	***#***	***Median Value (000s)***	***Max Value (000s)***	***Total Value (000s)***
Multnomah	951	150	184,000	1,702,210	504	380	37,500	509,444
Washington	483	350	45,000	1,132.902	217	350	7500	148,467
Lane	435	227	280,160	965,180	185	325	10,000	125,407
Marion	388	238	120,000	570,352	116	328	11,000	101,891
Clackamas	263	480	90,000	774,883	111	417	14,000	110,774
Deschutes	205	1,230	37,500	506,194	56	500	7,500	51,328
Jackson	138	610	28,656	250,886	41	350	2,575	26,837
Umatilla	57	320	4,500	41,904	7	593	1,600	4,522
Yamhill	55	1,489	50,000	212,374	11	500	7,500	15,076
Coos	35	1,000	22,000	95,836	9	350	2,000	4,897
Benton	34	1,387	40,000	170,922	45	400	8,500	36,895
Union	31	179	8,500	29,082	3	535	913	1.798
Polk	28	818	20,000	54,763	13	1,000	10,900	25,508
Douglas	26	1,084	12500	60,227	17	450	4,000	13,955
Linn	25	1,900	50,000	121,685	18	584	6,051	19,070
Klamath	22	2,000	32,606	90,967	11	625	5,000	11,605
Lincoln	20	1,132	16,640	46,968	5	332	2,000	3,348
Clatsop	18	2,444	14,050	70,441	9	175	4,000	5,993
Morrow	17	715	50,000	111,704	2	1714	3,200	3,427
Josephine	16	1,022	7,500	29,701	3	314	450	864
Crook	13	640	2,000	14,977	2	328	555	655
Jefferson	13	2,000	95,000	145,373	4	250	996	1,697
Malheur	12	1,063	4,000	20,532	3	300	4,000	4,453
Tillamook	11	2,000	9,175	36,827	5	285	7,500	10,649
Grant	10	210	1,490	3,463	4	204	448	945
Wallowa	10	218	13,000	15,641	0	0	0	0
Columbia	9	731	190,000	197,795	7	350	7,500	10,900
Wasco	7	2,000	8,800	23,175	3	600	625	1,375
Baker	6	368	1,100	3,085	5	700	1,600	3,725
Hood River	5	2,000	29,000	40,573	5	335	2,000	3,037
Harney	4	1,047	10,000	12,162	4	188	250	737
Lake	3	928	16,826	17,967	1	190	190	190
Curry	2	975	1.449	1,949	8	1040	2,000	6,007
Gilliam	2	2,377	4,000	4,754	1	156	156	156
Sherman	2	1,251	2,000	2,501	0	0	0	0
Wheeler	1	393	393	393	0	0	0	0

Multnomah County had about twice as many projects as Washington County, the second most populated county. As the median value of 150 shows, many of the projects in Multnomah County were smaller when compared to the size of projects in Washington County and the value of projects in Deschutes County and Yamhill County. Roughly 65 percent of commercial projects in Multnomah County were new construction and 70 percent were in Washington County. Among counties with more then 50 total commercial projects, Umatilla County had the highest percentage of new construction projects at 89 percent and Benton County had the lowest at 43 percent

The nonresidential new construction projects can also be broken down by sector. Most of the projects were office and bank buildings (1,246) followed by stores and restaurants (629), warehouses (314), hospitals and other health treatment facilities (259) and schools and colleges (162). Several of these categories could be further broken down as seen in Table 6-2. Also included in the table is value and area data for new construction projects and renovation. This table includes the median and maxim square footages of the structures. Because there are so many projects with the square footage missing, these square footage values should be considered illustrative only.

Table 6-2. Value of New Construction/Addition & Alternations/Renovations by Sector: 2004–2007

	New Construction / Additions						***Alterations / Renovations***			
	#	***Median Value (000)***	***Max Value (000)***	***Total Value (000s)***	***Median Area (000)***	***Max Area (000)***	***#***	***Median Value (000)***	***Max Value (000)***	***Total Value (000s)***
Office / Bank Buildings	1.246	154	90,000	1.021,354	9	435	412	312	10,900	230.973
Office Buildings	1.183	150	90,000	984,635	12	435	370	316	10.900	216.018
Bank Buildings	63	450	3,658	36,719	4	29	42	295	625	14.955
Stores and Restaurants	629	350	96,000	1,010,870	12	653	394	400	12,500	348.615
Retail Stores	402	420	96,000	659,781	14	653	214	350	12,500	166,920
Restaurants	170	173	4,510	53,333	4	24	88	300	5,000	39,363
Mall / Shopping Centers	30	2,000	90,000	218,469	25	287	20	625	7,500	30,990
Grocery / Drug Stores	27	2,000	20,000	79,287	26	114	72	1019	7,500	111,342
Warehouses	314	375	50,000	498,958	14	1,400	37	300	1,989	19,510
Hospitals and Other Health Treatment	259	750	280,160	1,427,942	14	1,439	117	450	37,500	178,359
Hospitals	147	625	35,000	332,562	10	214	67	350	10,000	68,312
Medical Buildings	62	178	280,160	857,683	26	490	45	725	37,500	104,622
Other Health Treatment	50	3,394	35,000	237,697	32	1,439	5	875	2,000	5,425
Schools and Colleges	162	2,000	47,500	1,008,944	20	225	145	495	25,000	173,497
School Buildings (K – 12)	101	2,000	39,500	591,826	23	225	89	495	7,500	89,089
College Buildings	34	6,520	45,000	347,533	34	177	37	359	25,000	69,203
Other Education Buildings	27	450	47,500	69,585	7	35	19	500	3,206	15,205
Amusement, Social and Recreational Buildings	147	625	50,000	352,625	11	148	85	300	10,000	58,149
Parking Garages and Automotive Services	126	437	184,000	518,720	10	362	25	323	2,000	11,164
Manufacturing and Processing Plants	121	714	190,000	544,131	20	308	19	625	7,500	29,841
Houses of Worship	100	900	37,500	189,694	10	135	38	383	4,000	23,612
Misc. Nonresidential Bldgs	66	368	40,000	173,684	9	156	45	461	20,000	75,762
Hotels and Motels	51	3,000	20,000	187,859	48	150	16	2000	11,000	33,384
Other Gov't Service Bldgs	44	1,283	95,000	243,839	6	116	28	389	2,350	18,010
Libraries and Museums	32	1,073	7,500	57,415	7	120	26	458	2,586	21,734
Dormitories	27	2,000	20,190	113,815	15	120	13	875	5,500	16,874
Capitols/Court Houses/City Halls	15	1,633	70,400	107,088	10	278	20	222	11,000	20,565
Labs(manufacturer owned)	15	950	50,000	113,971	12	507	14	305	971	5,378
Other Religious Buildings	3	2,000	7,340	9,429	9	9	1	205	205	205

6.1.1 Major Players

The top 20 entities (owners) in terms of the number of all projects are listed in Table 6-3. Overall, the Port of Portland completed the most projects (58) followed by Safeway (44), University of Oregon (36), and the city of Eugene (33). Not shown here are two very large projects Terwilliger Plaza Inc and Lowe's Companies Inc that completed one new construction project each more than 1.4 billion square feet. Wal-Mart, which is in the table that follows, had a combined total 1.2 million square feet for fifteen projects that was the third largest amount in terms of square feet. Some projects did not report the area covered by the new construction.

Table 6-3 Top 20 owners by number of projects with values

Primary Sector	*Company*	*All Projects*	*New Projects*	*Median Value (000s)*	*Max Value (000s)*	*Total Value (000)*
Office	Port of Portland	58	30	214	184,000	221,633
Stores	Safeway	44	6	840	7,500	59,580
School	University of Oregon	36	14	419	33,000	127,205
Office	City of Eugene	33	15	145	2,709	10,964
Office	OR Dept of Admin Services	31	8	430	47,500	124,152
School	Beaverton School District	31	14	350	14,750	76,856
Worship	Church of Jesus Christ of Latter-Day Saints	29	13	686	5,400	35,570
Government	City of Portland	26	4	385	3,299	20,056
School	Oregon State University	26	5	242	37,500	72,830
Office	PacTrust Pacific Realty Associates LLP	26	22	165	2,002	9,188
Stores	General Growth Properties	24	18	225	90,000	111,567
Office	State Of Oregon	23	18	150	2,402	6,370
School	Eugene School District	21	7	343	13,393	24,808
Stores	Harsch Investment Prop.	18	12	586	7,500	31,502
Office	City of Salem	17		337	9,007	18,995
Office	McKay Investment Co.	17	11	250	20,000	26,725
Stores	Wal-mart	15	9	4,000	7,500	62,385
Stores	Fred Meyer Stores Inc	15	5	2,500	7,500	49,955
Health	Providence Portland Med.	15	6	2,500	128,000	214,570
Stores	Washington Square LLC	15	9	200	541	3,356

We also examined the square footage of projects more closely for those projects for which square footage was available. Figure 6-1 shows the accumulative square feet and percent of percent of cumulative area grouped by the size of projects of projects. The figure shows that less then 20 percent of total square feet constructed in Oregon are in projects smaller then 25,000 square feet. The increase in cumulative square footage is greatest between 50,000 and 500,000 square feet suggesting that is medium large to large buildings that account for most of the square footage. Approximately half of the total square footage that is constructed occurs in projects of less then 100,000 square feet and half occurs in projects larger then 100,000 square feet. As stated earlier,

the largest project, an assisted living health center (Terwilliger Plaza Assisted Living), covered nearly 1.44 million square feet.

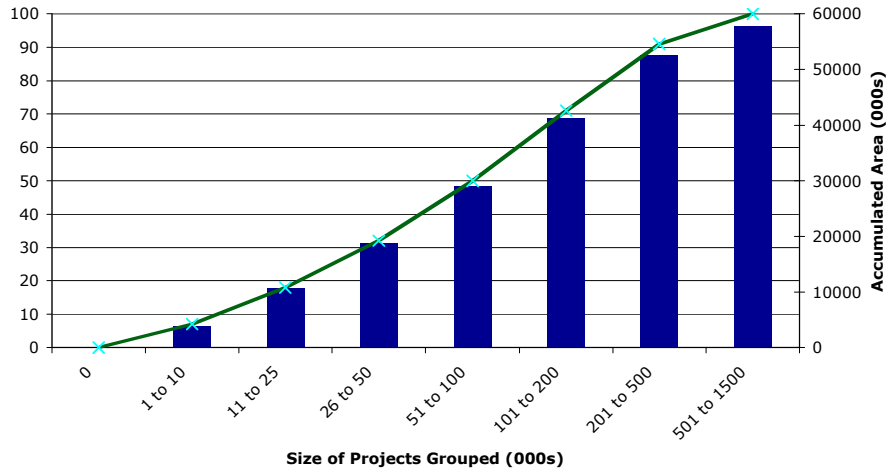

Figure 6-1. Cumulative square footage and percent of cumulative square footage by size of projects.

In order to get a better idea of whom some of the major players are in four key sectors, stores, offices, schools and health, we sorted the top 10 players by the number and value of the projects.

Figure 6-2 shows the top players in the retail sector. These players completed between 4 and 15 projects. There were two or three large national retail chains, Wal-mart, Walgreens, and Home Depot, in this submarket but there were also more local developers.

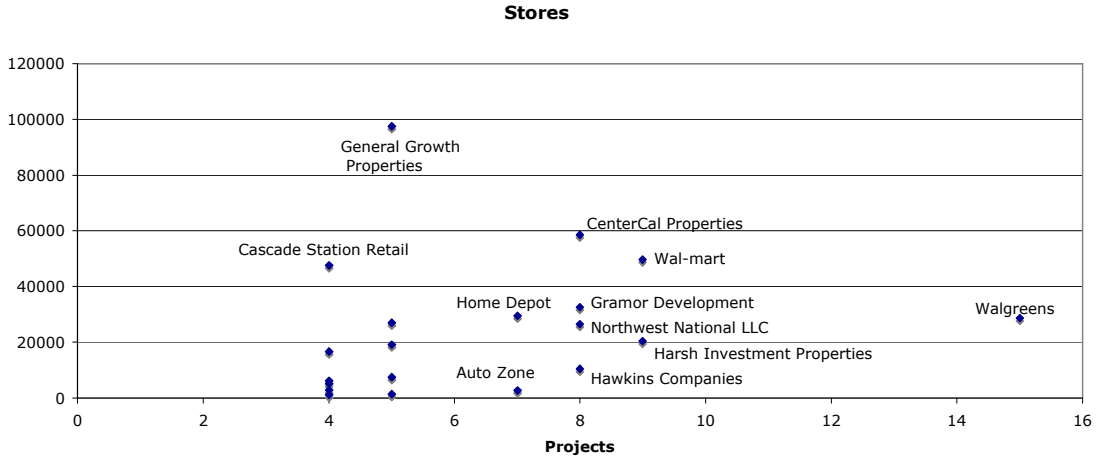

Figure 6-2 Top Retail Developers and Chains by Number of Projects and Value ($1000s)

Figure 6-3 shows the top developers of office space. The number of projects was between four and ten. This group was split between private developers such as Dorm and Platz, Pacific New

Properties, and Pacific Reality Associates LP and governmental or quasi-governmental institutions such as the Port of Portland and the City of Portland.

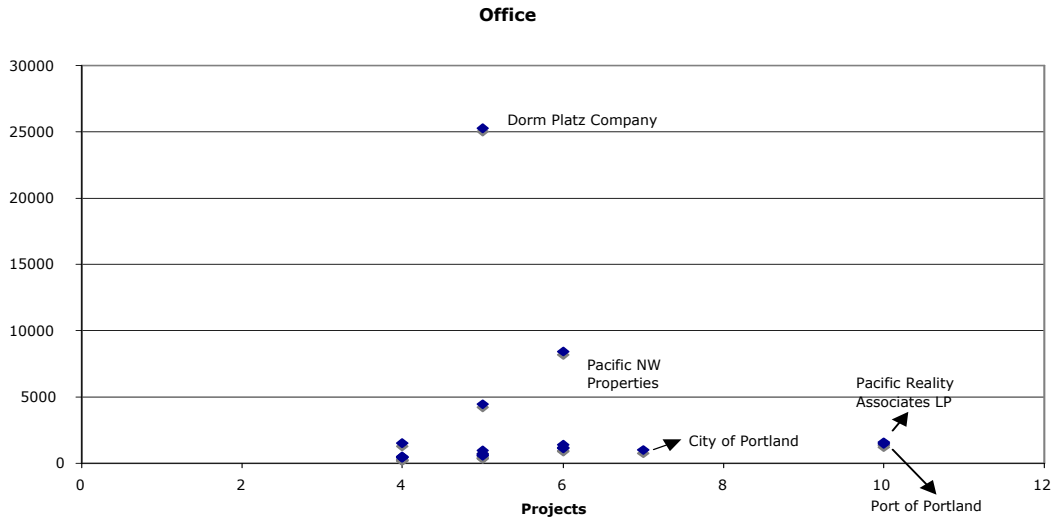

Figure 6-3 Top Office Developers by Number of Projects and Value ($1000s)

Top players in school construction are shown in Figure 6-4. Several school districts completed three or more projects. Beaverton had the most projects (7) with the highest total value. Portland Community College had five projects. It is our understanding that the Portland Community College may be looking ahead to additional projects. Overall, schools and colleges engaged in substantial construction.

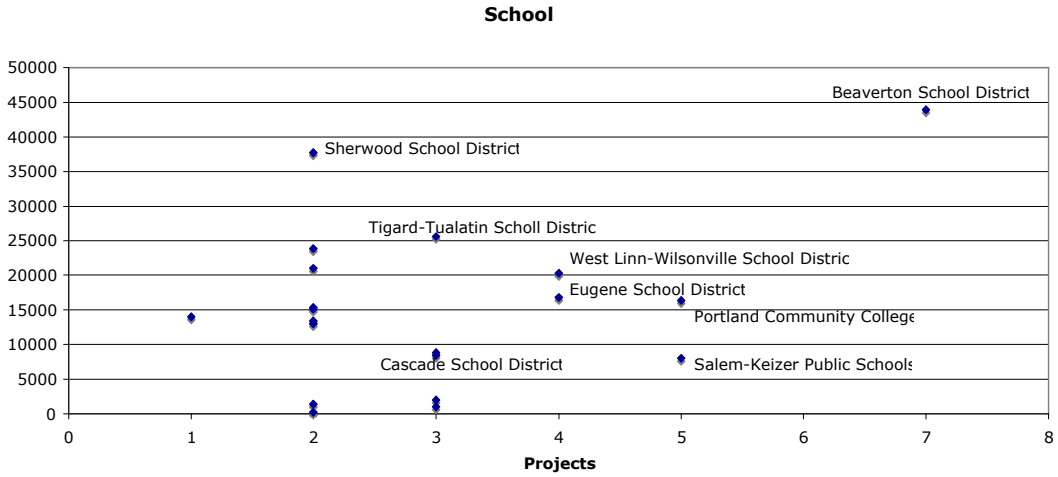

Figure 6-4. Top Players in School Construction.

Finally, there are health sector projects as well. As shown in Figure 6-5, there are three organizations that completed substantial high dollar projects during the period of interest. These are the Peace Health Medical Group, the Providence Portland Medical Center and Kaiser Permanente. The projects for these three groups totaled $100 million or more.

It is important to be cognizant of the fact that the general trend in the medical market is away from hospitals toward medical office suites and care for elders. One of the largest projects in Oregon was a 1.4 million square feet facility for seniors.

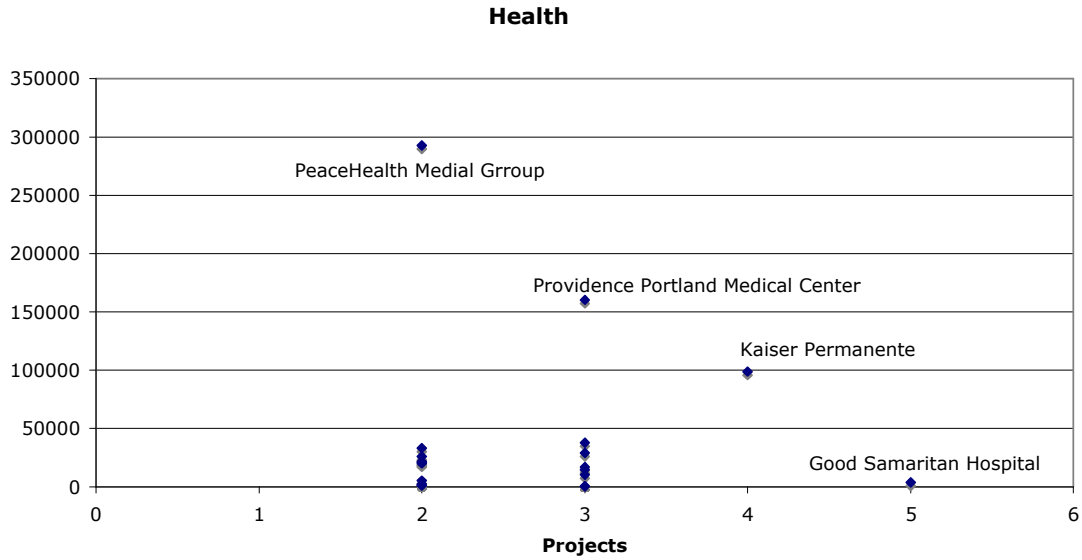

Figure 6-5 Top players in the health care submarket.

Finally, we examined where various factotum types were located. The results of this examination are reported in Table 6-4. Seventy eight percent of factotums are located in Oregon while 22 percent are located outside of the state. Owners, owners' agents, civil engineers and general contractors are likely to be located in the state (80 percent plus). A majority of architects, consultants, and structural engineers are located in Oregon but are less likely than owners, owner agents and others to be there. Structural, electrical and mechanical engineers are least likely to be resident in Oregon. Electrical and mechanical engineers are very important to energy efficiency efforts, perhaps more important than other disciplines. Because they are least likely to be resident electrical and mechanical engineers they may be less aware of the efficiency environment in Oregon.

When we examine the linkages of owners inside and outside of Oregon we find that the average size of projects from owners in Oregon is 37,000 sq ft (median 14,000) while those from outside Oregon average 58,000 sq. ft. (median 24,000). Projects from owners inside of Oregon subcontract to contractors located in Oregon 93 percent of the time, whereas owners outside of Oregon subcontract to contractors located in Oregon sixty percent of the time. This suggests that the developers of larger projects may be less aware and tuned into the energy efficiency efforts in Oregon.

Table 6-4 Factotum Type by Location Inside or Outside of Oregon

Factotum Type	*OR (Percent)*	*Not OR (Percent)*	*Total (Percent)*	*N*
Owner's Agent	90	10	100	185
Construction Manager	88	12	100	58
Engineer (no specialty)	88	12	100	105
Owner	85	15	100	2,249
Civil Engineer	82	18	100	140
General Contractor	80	20	100	1,345
Interior Designer	79	21	100	29
Landscape Architect	78	23	100	80
Architect (not Landscape)	63	37	100	619
Consultant	63	38	100	8
Structural Engineer	59	41	100	207
Electrical Engineer	44	56	100	142
Mechanical Engineer	44	56	100	140
Total	78	22	100	5,307

6.2 CHARACTERIZATION OF PARTICIPATION BY 2006/2007 NBE PROGRAM IN COMMERCIAL BUILDING MARKET

Records on participation in the NBE Program in 2006 and 2007 were used to characterize the participation of the program in the commercial building market in Oregon.

6.2.1 Tracks

Based on the available records, the New Building Efficiency Program funded 291 projects in 2006 and 2007. Fifty-four percent were initiated in 2006 and 46 percent were started in 2007. The projects fell into five tracks: Standard, Custom, High Performance Building, USGBC LEED NC, and Energy Star. The Standard Track provides incentives for purchasing and installing specific types of energy efficient equipment. The Custom Track provides incentives for building systems that result in energy savings as compared to a code minimum building of the same type and occupancy. This track provides incentives for unique situations not covered by the Standard Track. The High Performance track was not a part of the 2006 and 2007 program. These projects were initiated in a prior year and completed in 2006. An Energy Star Track offers incentives to eligible new building projects that use the Environmental Protection Agency's national energy performance rating system to achieve the Energy Star building performance certification. There were no Energy Star projects in 2006 or 2007. The USGBC LEED® NC Track provides incentives for projects registering for certification with the US Green Building Council (USGBC) LEED® NC program. The New Building Program breakdown among tracks for 2006-2007 is shown in Table 6-5.

Table 6-5. Projects by Track

Track	*Percent*	*Avg. Area (square feet)*	*Avg. Value ($)*	*Median Area*	*Median Value*
Standard Track	66	34,885	122,378	17,691	0
Custom Track	29	90,021	93,409	43,130	29,400
High Performance Track*	3	132,562	403,922	86,513	381,875
USGBC LEED NC Track	2	53,758	0	48,663	0
Total	100	54,021	40,817	25,500	0
N	291				

The high performance track was not a part of the 2006/7 program. These projects were initiated in a prior year and completed in 2006.

The majority of projects followed the Standard Track (66 percent). These projects tended to cover a smaller area then projects in other tracks. Only four of the 193 projects listed an installation cost, so the value in the table (represents just those four projects) may be misleading. The Custom Track was used for larger projects in both size and cost and was used by 29 percent of participants.

When comparing the type of projects within each track, few distinctions stood out and most followed the same proportion as shown in the table above. However, it was apparent that most office building projects followed the standard track (80 percent). The High Performance Building Track was generally used for school or health projects. Four of the nine projects were with school or health projects and the other 5 were unknown types.

6.2.2 Type of Projects

The type of project was also analyzed separately, as shown in Table 6-6.. Forty percent of projects were for stores, 16 percent were for warehouses, 13 percent were for office and bank buildings, and 13 percent were for manufacturing buildings. Among stores, 71 percent were retail, 20 percent were grocery stores, and 9 percent were restaurants.

Table 6-6. Projects by Type

Type	*Projects*	*Percent*	*Avg. Area*	*Avg. Value*
Stores	91	40	38,627	11,274
Warehouse	36	16	90,595	14,652
Office	30	13	18,228	8,767
Manufacturing	30	13	25,422	11,552
School	16	7	50,733	95,460
Health	15	7	138,330	280,255
Apartment	8	3	176,398	87,746
Hotel	4	2	78,300	237,737
Other	61		49,558	38,208
Total	291	100	54,021	40,817

6.2.2.1 Location of Projects

The New Building Efficiency Program is available statewide in Oregon. In order to examine where most of the projects were taking place, county participation data was analyzed. As expected the most urban county, Multnomah, had the most participants with 26 percent of the total. Washington, Clackamas and Marion followed with 17 percent, 13 percent, and 11 percent respectively. The remaining counties along with the average size and cost of projects are shown in the table below. Fifteen or 42 percent of counties did not have a participant and 7 more counties had only three or fewer participants. However, when looking at overall construction data, most of these counties had little construction activity. According to FW Dodge Data, counties with no participants had between 1 and 19 new construction or addition projects between 2004 and 2007.

Table 6-7. Projects by County

County	*Projects*	*Percent*	*Avg. Area*	*Avg. Value*
Multnomah	73	26	72,773	72,606
Washington	49	17	38,008	17,794
Clackamas	36	13	39,579	22,720
Marion	30	11	46,925	40,216
Deschutes	18	6	88,084	12,922
Jackson	13	5	45,167	19,404
Douglas	12	4	32,006	5,139
Lane	11	4	65,344	69,809
Klamath	7	2	84,435	113,673
Linn	7	2	76,100	0
Josephine	6	2	10,287	2,187
Benton	4	1	104,843	103,448
Hood River	4	1	7,978	19,544
Yamhill	4	1	64,583	138,998
Clatsop	3	1	40,872	2,833
Polk	2	1	14,760	0
Umatilla	2	1	18,500	0
Coos	1	0	32,500	0
Jefferson	1	0	0	0
Lincoln	1	0	5,600	0
Wallowa	1	0	51,093	321,253
Tillamook	0	0	0	0
Columbia	0	0	0	0
Union	0	0	0	0
Morrow	0	0	0	0
Crook	0	0	0	0
Malheur	0	0	0	0
Wasco	0	0	0	0
Baker	0	0	0	0
Curry	0	0	0	0
Grant	0	0	0	0
Harney	0	0	0	0
Lake	0	0	0	0
Gilliam	0	0	0	0
Sherman	0	0	0	0
Wheeler	0	0	0	0
Unknown	6		43,958	30,045

6.2.3 Electric Provider

The data also recorded the electric providers of participants. As shown in Table 6-8, most of the projects took place in Portland General Electric's (PGE) territory (59 percent) followed by Pacific Power (PAC) territory (37 percent), NENEWEB (1 percent), and NWNFGLP (less then 1 percent).

Table 6-8. Projects by Electric Provider

Electric Provider	***Count***	***Percent***
PGE	172	59
PAC	108	37
NWNEWEB	4	1
NWNFGLP	1	0
None Recorded	6	2
Total	291	100

6.2.4 Participants

The data available allowed little insight into the participants of the program. Only site and measure information was given. Multiple participation can be determined for buildings that are chains within the store category, but multiple participation among owner and decision makers in office buildings and other types, cannot be determined from the data given by the Energy Trust. By cross referencing Energy Trust data with new construction data based on the address from FW Dodge (a database that compiles all building permits filed), we were able to match on roughly one third of the participants. We have owner data on these projects, and because of limited data and multiple projects at the same address, is possible inaccurate.

We conclude from the available data that 235 different participants completed the 291 projects in the New Building Program. The table below lists those participants that completed multiple projects as well as the type, average size and cost, and the source of the information.

Albertsons completed the most projects with 14, followed by Walgreens and the Olive Garden at eight and five respectively. ProLogis Development Services, Ross, Tri Star Building, Red Lobster and Office Depot all completed four projects. The ProLogis Development Services built a PetCo warehouse, a Cardinal Logistics building, a LaCrosse Footwear warehouse, and another undefined building. The FW Dodge data lists ProLogis as the owner of these projects but it could also be the developer and not the owner. From the FW Dodge data, Dale Poppe and the Oregon Department of Administration were also listed as owners of their respective projects.

Table 6-9. Multi-Project Participants

Participant	*Count*	*Type*	*Avg. Area*	*Avg. Cost*	*Source*
Albertsons	14	Stores	46,170	31,962	Energy Trust
Walgreens	8	Stores	14,711	0	Energy Trust
Olive Garden	5	Stores	4,800	0	Energy Trust
ProLogis Development Services	4	Store/ Warehouse	59,508	0	FW Dodge
Ross	4	Stores	29,414	0	Energy Trust
Tri Star Building	4	Unknown	12,693	0	Energy Trust
Red Lobster	4	Stores	4,500	0	Energy Trust
Office Depot	4	Stores	16,085	0	Energy Trust
Blockbuster	3	Stores	2,300	0	Energy Trust
Dale Poppe	3	Office	11,883	0	FW Dodge
Fred Meyer	3	Stores	93,358	133,589	Energy Trust
Home Depot	3	Stores	102,822	0	Energy Trust
Jo-Ann Store	3	Stores	34,407	0	Energy Trust
New Seasons	3	Stores	30,070	51,214	Energy Trust
Wal-Mart	3	Stores	231,533	0	Energy Trust
Columbia Knoll	2	Apartment	296,210	0	Energy Trust
Corporate Express	2	Office	48,592	0	Energy Trust
East Empire	2	Office	4,500	0	Energy Trust
Health Wright	2	Warehouse	55,910	13,328	Energy Trust
Lowe's	2	Store/ Warehouse	760,808	116,300	Energy Trust
Office Max	2	Stores	10,636	0	Energy Trust
Oregon Dept of Admin Services	2	Office/ School	186,350	286,187	FW Dodge
Rite Aid	2	Stores	14,900	0	Energy Trust

6.2.5 Savings

The New Building Efficiency Program produces electrical energy savings (kWh) or gas energy savings (therms). Ninety-three percent of the projects produced electrical savings while 30 percent produced gas savings. Twenty-four percent of the projects saved both. Two projects actually increased gas usage but reduced electrical usage. For those projects that saved electricity, the range was from 294 kWh to more then 3.7 million kWh. A distribution can be seen in Figure 6-6.

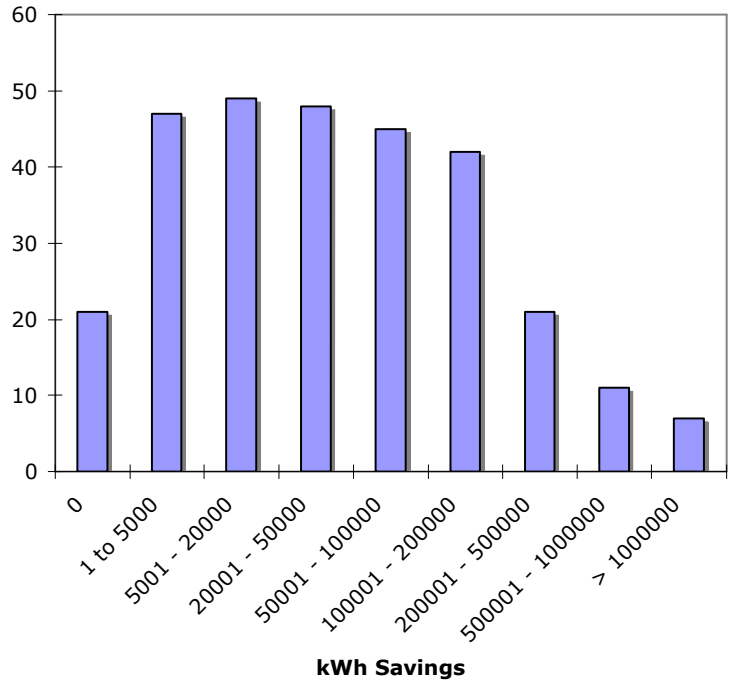

Figure 6-6. Projects by kWh Savings

Eighty-six projects increased the gas efficiency of new buildings. The range was from 60 therms to more then 202,000 therms. Forty-three percent saved less than 2,500 therms. The distribution can be seen in Figure 6-7.

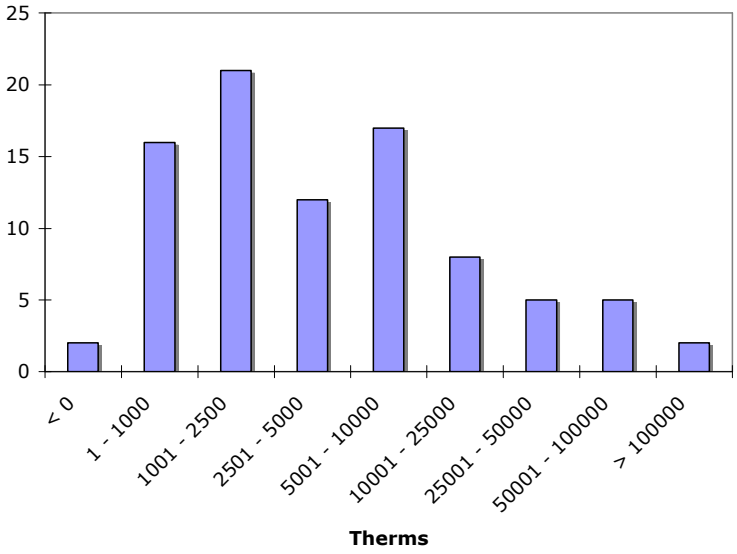

Figure 6-7 Projects by Therms of Savings

6.3 FINDINGS AND CONCLUSIONS

The findings and conclusions from the examination of Oregon's commercial building market were as follows.

1. At the present time new construction projects out weigh alterations and renovations in Oregon.
2. There are seven Oregon counties with several hundred new construction projects between 2004 and 2007. There are another 10 counties with 30 to 100 projects with most of these in the 30 to 50 range. The remaining 22 counties had less than 30 projects during the 2004 – 2007 timeframe. In relative terms, participation in the New Commercial Buildings program largely mirrored construction activity in the 17 counties with the most construction between 2004 and 2007. While many of the remaining counties had only a few new construction projects most had no Energy Trust projects or perhaps one.
3. Between 2004 and 2007, the most projects and the largest dollar volume of projects occurred in the office and bank buildings, stores and restaurants, hospital and other health treatment, and schools and colleges. The next largest submarkets were parking garages and automotive services, and manufacturing and processing plants.
4. The largest cumulative amount of construction measured in square feet occurred between 50,000 and 500,000 square feet.

7. FINDINGS AND RECOMMENDATIONS

The major findings and recommendations from the study of the projects participating in the New Building Efficiency Program in 2006 and 2007 were as follows.

Gross savings were estimated using proven techniques, including engineering calculations using industry standards and verification of computer simulations developed by program contractors to determine energy savings. In general, the evaluation performed for the 2006-2007 projects resulted in confirmation of the expected energy savings.

- The monitored data for lighting projects revealed that on average, the monitored data is consistent with the claimed hours.
- The monitored data for Building, HVAC and VFD projects confirmed the variation in operating loads introduced by the addition of the energy efficient hardware and/or improved control system.
- Although the monitored data were not used in the savings calculations, which rely more on DOE-2 modeling, they provided confirmation of whether a system was operating as intended.

Survey-based techniques for estimating free-ridership in a program were applied to the data collected through a telephone survey of decision-makers. Data collected through this survey were also used to assess qualitatively the extent of program spillover effects. Participants representing about a fifth of realized kWh savings provided answers that indicated some spillover was occurring.

Findings and conclusions from the process evaluation of the NBE Program were as follows.

- The program has evolved nicely over the last five years. The program managers have exhibited a pattern of observing customer response to the program and adapting the program to make it more effective. Customers have noted and commented positively on the changes to the program.
- The program has communicated effectively with potential customers. One-to-one communication and word-of-mouth communication by participants has been an effective marketing strategy.
- Customers with whom we spoke indicated that overall they were satisfied or very satisfied with the program.
- The major complaint with the program has to do with the paperwork. While the paperwork is consistent with Energy Trust's fiduciary responsibilities, many customers find it difficult. This is particularly true of the smaller trade allies. Energy Trust has made some adjustments in the paperwork that have been noticed by the participants. In addition, some of the smaller trade allies have been adaptive and work with their distributors or others to complete the paperwork.

- The program has four tracks: standard, custom, LEED and Energy Star. The system of tracks may be important for administration, but there is neither interest nor widespread awareness of the tracks among clients. The track system could probably be simplified and reduced to a two-track system of standard and custom and the LEED and Energy Star tracks incorporated into the custom track. Several participants interviewed indicated that they preferred the standard as opposed to the custom track because of the simplicity of that track and the cost of documentation for the custom or LEED tracks.
- There is widespread interest in LEED but because of the costs of LEED certification many customers are asking and many design professionals are suggesting that projects build to LEED standards or to the most efficient standard that the customer can afford.
- Financial incentives played different roles. Several participants suggested higher incentives. For some participants, especially large customers and national chains, there were indications that incentives may not have made much difference. For public entities, there were instances where incentives appeared to be the difference between installing the measure and having a measure value engineered out of a project. The relationship between incentives and participation is not a linear function but rather more like a step function.
- For smaller participants there was a lot of discussion of risk. Smaller customers are particularly anxious about trying technologies that might fail. It was suggested the program might install samples at smaller locations to demonstrate the value of the equipment. This is consistent with good marketing practice.
- For national retail chains:
  - The prototype is the key determinant of what can be installed.
  - A third party, such as the rebate administration firm, can have some influence (usually somewhat small) by pointing to opportunities for potential improvements in prototypes across a wide program base although the recommendation is vetted by the national chain.
  - A financial incentive is unlikely to change the specifications for a given store although a financial incentive broadly offered by many utilities may result in an upgrade to a prototype.
  - Chains are increasingly installing and using advanced monitoring capabilities
  - Chains are often unable to take advantage of incentives for EMS systems because third party suppliers provide general rather than specific information about savings.
  - There is substantial opportunity still to be realized with retail chains especially in the lighting arena.

  Energy Trust needs to work with others to engage chains at the national level. Such national engagement of chains needs to focus on both engineering and merchandising.
- Training and webinars were positively received. The manuals were largely unused.

There were some dramatic examples of market transformation, mostly replication effects. Energy Trust may want to examine these effects in future studies. These studies should focus on

replications, emulation, incidental efficiency, sustained behavior, and cultural change rather than spillover, of which the preceding are a subset.

APPENDIX A
DISCUSSION OF REALIZATION RATES

This appendix discusses the reasons for large variance in realization rates for selected sites and issues.

Before discussing specific projects and issues, we make a recommendation concerning project data received from Energy Trust. For projects that have had SEED energy simulations performed as part of compliance with the Oregon energy code, we recommend that the set of SEED simulation input-out files be provided to the impact evaluators. This will improve the quality of the analysis.

The remainder of this Appendix discusses issues and examples that contribute to larger variance in realization rates.

A-1 Small Commercial Buildings with Package Rooftop Air Conditioning Units

All such sites were simulated using the DOE-2 simulation program using Oregon energy code minimum requirements to establish HVAC baseline conditions. As-built conditions were determined from the ADM survey of conditions at each site. The savings were calculated as the difference in cooling energy between these two simulation runs.

We normally expect a reasonably close comparison to the Tracking system savings. However, upon checking the simulation results with Tracking system savings, it was noted that something is amiss here because of the strong correlation was not found in a number of cases. This caused us to study why a consistent discrepancy was appearing between these two savings numbers.

Since ADM ‘s evaluation is based on the actual unit’s model number at the site (and the performance data) compared to the State of Oregon energy code, the focus was on the tracking system savings. Specific documentation is apparently not available on the calculation of the incentives. We thus selected and compared package units across different sites and facility types (i.e., type of building function and typical operation hours).

We observed that larger units with larger EER difference (between baseline EER and as-built EER) have larger energy savings. For example, a 10-ton with 10.5 EER will only have about half the savings of a similar 10-ton with 11.5 EER. Therefore, the tracking system savings does not necessarily reflect the energy savings that will be produced in response to the actual building schedule, set points and facility type. Therefore, we suspect that ADM reported savings are more likely to represent actual energy savings occurring at the various sample facilities.

A-2 Site 2003017 (Sample ID C-02)

A set of energy simulations for this site had been performed under the applicable state building energy compliance method - SEED. The sets of SEED input-output files form an excellent resource for the independent evaluation being conducted by ADM. However, documents from the SEED analysis were not included as part of the supporting documents received by ADM from the Energy Trust. Only two pages were provided, which included only the most general summary baseline and post case simulation data about the SEED energy analysis.

Also provided in the package that ADM received from the Energy Trust was an "EZ Sim" analysis simulation output (based on EUI data from Energy Trust's internal database). This output was the only source of data about activity areas within the facility, and grouped the floor space into three functional areas (offices, classrooms, and laboratory spaces). The "EZ Sim" analysis also provided a generic glimpse of building operation as 24-hours per day, 7-days a week, year round operation.

Both third party post-inspection and ADM staff verified the use of ground source heat pump (GSHP) for cooling and heating of the facility with supplementing the mechanical cooling from one of two chillers (one 400 ton and one 200 ton).

Baseline: The following important parameters that determine the buildings baseline energy use were not provided:

- Building floor layout by functional areas
- Internal loads in these areas,
- Occupancy and equipment schedules for these areas,
- Building systems that keep the space within comfort conditions,
- Required outdoor air intake for spaces,
- Economizer operational parameters,
- Cooling and heating set-points and
- Supply fan operating criteria.

As-Built: Important parameters for the as-built case were also not provided. Missing data included:

- Both atrium impact areas, systems, and schedules are not available to create a viable as-built energy simulation.
- Information on window areas or placement to aid the ventilation in order to assess the passive solar load impact on building cooling energy use.
- In the post case chillers are expected to supplement the GSHP operation. Missing the control points for the given operating conditions severely hampered the simulation capabilities.

Given the very general information provided, ADM used typical multi-use building profiles for this type of educational facility, but the ADM the DOE-2 baseline simulation was able to account for about 72% of baseline energy use levels and provided about 51% of the tracking system savings.

Further adjustments and changes were made to the schedules, set points, internal loads, operating and occupancy schedules, economizer operation (percentage outdoor air intake) and atrium influence was assumed for the top two floors spaces. Fans were made to run 24-hours with the exception of when the outside temperature falls below 70F, creating automatic window openings and natural ventilation for the top two floors and any lobby areas (assumed about 10% of the total area). Varying these parameters provided the simulation to increase the baseline case usage to match the reported baseline energy use in the SEED study.

However, even with the maximum impact assessed for the given measures the energy savings were only realizable to the 83% of the reported savings in this study.

In summary, the absence of important building parameters for as-built and baseline operation severely limited the analysis that ADM could perform. The capabilities of performing engineering simulations are as good as the assumptions that were made to establish an as-built benchmarking. In the case of the analysis of this building, by using the highest reasonable values for key parameters, the energy savings were only established for 83% of the reported savings:

- Tracking system reported savings from the SEED study of 2,406,400 kWh.
- ADM simulations identified maximum savings impact of 1, 998,856 kWh (83%).

A-3 Site 2003029 (Sample ID C-04)

For this site, the building occupancy profile appears to have a strong impact on the magnitude of the HVAC equipment energy savings for this large apartment building site. Since most of the interior space (about 85%) is used as high-rise apartments, the facility was surveyed by sampling 3 different type/sized apartments along with the entire non-residential area and retail spaces. Both retail spaces and non-residential areas were small and have a reasonably sound operational schedule. We evaluated the magnitude of the influence the assigned apartment area schedule has for the HVAC energy savings.

We began our analysis by assuming that a typical occupancy schedule for weekday apartment usage was:

- About 50% of the apartments are occupied 24-hours
- The remaining 50% are occupied only from after work hours till the next morning.

We also assessed the impact of setback versus shut-off with the air-conditioning equipment.

Finally, after evaluating the impact of occupancy schedules on the WSHP energy usage, we have decided to reduce the 24-hour occupancy from 50% of units to 35% of units, and to increase the overnight only schedule from 50% to 65% of units. This set of schedules provides a good fit with the tracking system savings. However, by having assessed the impact of schedule we see the increase of 24-hour occupancy to 50% of all the units would raise the savings estimates as high as 135% of the tracking system savings.

A-4 Site 2005397 (Sample ID C-18)

The HVAC equipment energy savings for this bookstore site from the DOE-2 simulations appears to be about 178% of the tracking system estimates.

The energy savings calculation in the Energy Trust supporting documents, when compared across similar sized Air-conditioning units, indicates that the incentives are fixed by the capacity of the unit. For example:

- A 3-ton with 13 SEER always given a energy savings of 498 kWh/yr,
- A 4-ton yields 665 kWh/yr,
- A 10-ton with EER of 11 or better was given an energy savings of 445 kWh/yr.

In essence, the tracking system savings do not take into account that higher EER or SEER levels on specific units would result into higher energy savings.

Our analysis is based on engineering simulations with building schedule, occupancy and operational parameters for baseline and as-built scenarios. The energy usage between the baseline (with code minimum as EER or SEER for the capacity) and the as-built (with surveyor reported EER or SEER) simulations would be reported as energy savings. Consequently our analysis reflects three factors:

- The impact of as-built EER,
- Building operational parameters, and
- How much the as-built EER is above the code-minimum EER.

Therefore, despite the disparity, our savings estimates are more in keeping with actual energy savings to be expected for this type of installation.

A-5 Site 2006428 (Sample ID P-09)

The ADM surveyor for this site found 290 fixtures with 4-lamp 32-watt 4-foot fixtures and 18 fixtures with 3-lamp 4-foot fixtures in the sales area of this store. Using only the 4-lamp fixtures, the wattage is about 35.09 kW. If half of these were turned off between midnight and 6-am, the resulting savings along from these fixtures are 0.5*35.09*6 hrs/day*7days/wk*52weeks/yr = 38,318 kWh/yr. This is about 143% of the tracking system savings.

The refrigeration system has 133 total hp of rack system in 14 individual and one 3-group. These are serving 2,729 sq.ft. walk-cooler and 468 sq.ft. walk-in freezer along with display cases (284 Linear ft.-L-Ft multi-deck open, 244 L-ft. multi-deck closed with 94 doors, 69 L-ft. reach ins and 96 L-ft open).

Based on these parameters the refrigeration system energy usage and the impact of installed refrigeration controls were assessed. Our assessment indicates that a savings of 126,457 kWh/year is possible for this size of refrigeration system under the given control measures. These energy savings estimates have to be normalized against similar sized stores for capacity and annual energy usage of the store along with direct impact of the interactive effects of the individual controls options that are part of the EEM#3-Refrigeration Controls. Once the corrections are applied, the savings are about 89,972 kWh or 133% of the tracking system savings. Annual energy usage was benchmarked to 96% of annual usage or 1,793,297 kWh.

The HVAC system (i.e., main air handler) was set to operate by cycling (instead of ON mode) and set-points were reduced or increased by 5F (cooling by 5F up, heating 5F down) at mid-night to 6 am hours when store is not occupied.

Since the control is set to change the set-point at midnight the call for cooling and heating year round will be reduced along with fan operating only when needed. This boosted the savings higher than what was reported. Due to this combined control with setback impacting the run time of the HVAC unit, savings are higher than the normally expected savings. Our savings are based on DOE-2 simulation. The tracking system savings, if calculated as noted in the supporting document, used a simple bin method without the changed set-point impact; hence, supporting document would have underestimated savings.

APPENDIX B
ON-SITE DATA COLLECTION FORM

APPENDIX C
DECISION MAKERS AND NET-TO-GROSS SURVEY QUESTIONNAIRE